# 1

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# Electric Vehicle Innovation Challenge

Race to the Future!

Unit 1, lesson 1

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 1 "**Powering the Future: Understanding Electric Vehicle Research and Development**" from unit 1 "**Research and Development in Electric Vehicles .**"*

**- What is the goal of this activity?**
*The goal of this activity is to engage students in a hands-on exploration of electric vehicle design principles, fostering creativity, critical thinking, and teamwork skills.*

**- What are students going to learn and why is it important?**
*Students will learn about electric vehicle design principles through hands-on brainstorming and sketching activities.*

*Understanding electric vehicle design is vital for addressing sustainability and technological advancement challenges. This is why*

- *This fosters creativity, critical thinking, and teamwork skills crucial for future innovation.*
- *Understanding electric vehicle design is vital for addressing sustainability and technological advancement challenges.*

**- What are the things that students need to have covered as material to perform the exercise successfully?**
*To ensure student success, make sure that they are already acquainted with **Unit 1 of Lesson 1: Powering the Future: Understanding Electric Vehicle Research and Development.***

# Requirements

**Duration:** 60-90 minutes broken down as follows:

- Introduction and Explanation of the Activity (10 minutes)
- Brainstorming (20-30 minutes)
- Sketching and Concept Development (20 minutes)
- Group Discussion and Refinement (10 minutes)
- Presentation Preparation (10 minutes)
- Design Showcase and Reflection (20 minutes)

**Format:** Team (3-4 students per group)

**Resources:**

- Large, flip chart sheets of paper or whiteboards
- Markers or drawing implements
- Access to relevant electric vehicle concepts and information (access to internet)
- A supportive classroom environment with open discussion encouraged
- Clear instructions and guidance from the educator

# Activity Description

Here you want to describe how the activity proceeds – consider how you can break down and describe the activity in steps and present it as follows.

## STEP 1: Introduction and Objective Setting (10 minutes)

- Start by introducing the activity to the class, explaining its purpose and objectives. Highlight that the **goal** is to **explore electric vehicle design principles** while fostering creativity and critical thinking.
- Provide a clear overview of the steps students will follow during the exercise. This helps set expectations and gives students a roadmap for the activity

## STEP 2: Brainstorming (20-30 minutes)

- Divide the class into small groups and allocate time for students to **brainstorm ideas for their electric vehicle designs**. Encourage them to think creatively and explore innovative concepts.
- Offer prompts or guiding questions to spark ideas, such as asking about potential features, energy sources, or design aesthetics.
- Circulate among the groups to provide support and guidance as needed, fostering an environment of collaboration and idea-sharing.

## STEP 3: Sketching and Concept Development (20-30 minutes)

- After the brainstorming session, instruct students to translate their ideas into **sketches of their electric vehicle designs**. Encourage them to include key design features and annotate their sketches to provide clarity.
- Remind students to consider factors such as vehicle size, shape, features, energy efficiency, and sustainability in their designs.
- Provide access to drawing materials and ensure students have ample space to work on their sketches

## STEP 4: Group Discussion and Refinement (10-15 minutes)

- Bring the class back together for a group discussion where each group shares their sketches with the rest of the class.
- Encourage constructive feedback and discussion among students, focusing on strengths, weaknesses, and areas for improvement in each design.
- Guide students in refining their designs based on the feedback received, emphasizing the importance of iteration and continuous improvement.

## STEP 5: Presentation Preparation (15-20 minutes)

- Instruct students to prepare a brief presentation to **showcase their** electric vehicle **designs** to the class. Remind them to organize their presentations effectively and practice their delivery.

## STEP 6: Design Showcase and Reflection (20 minutes)

- Invite each group to present their electric vehicle designs to the class. Allocate time for questions and feedback from classmates, fostering a supportive and collaborative atmosphere.
- Facilitate a brief reflection session where students share their thoughts and insights from the activity. Encourage them to reflect on what they learned, challenges they faced, and ideas they found most promising.

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# Exploring Electric Vehicle Debates

Navigating the Electric Vehicle Revolution: Strategic Decision-Making in a Dynamic Market Environment!

Unit 1, lesson 3

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity related to the material covered in lesson Lesson 3 "**Navigating Innovation: Current Trends in Electric Vehicle Development"** from unit 1 "**Research and Development in Electric Vehicles ."***

**- What is the goal of this activity?**
*The goal of this activity is to engage students in structured debates to explore various perspectives on key issues related to electric vehicles. By participating in debates focused on policy, infrastructure, environment, and economy, students will develop critical thinking skills, enhance their communication abilities, and learn to consider multiple viewpoints on complex topics.*

**- What are students going to learn and why is it important?**
*Through this activity, students will learn to:*

*- Analyze arguments by researching and presenting diverse viewpoints.*
*- Communicate effectively through engaging in debates.*
*- Consider diverse perspectives on electric vehicle development.*
*- Develop teamwork skills by working collaboratively.*
*- Enhance knowledge of electric vehicle issues.*
*This encourages **critical thinking** and prepares students for future **leadership roles.***

**- What are the things that students need to have covered as material to perform the exercise successfully?**
*"To ensure student success, make sure that they are already acquainted with Unit 1 of Lesson 3: Navigating Innovation: Current Trends in Electric Vehicle Development*

# Requirements

**Duration:** 60-90 minutes broken down as follows:

**Format:** Team (3-4 students per group)

**Resources:**

- Classroom with seating arrangements conducive to group discussions
- Whiteboard or flipchart
- Debate topics handouts (prepared in advance)
- Timer or stopwatch
- Writing materials for note-taking

# Activity Description

## STEP 1: Introduction and Objective Setting (10 minutes)

- Welcome students to the lesson and introduce the topic of electric vehicle debates.
- Explain the objectives of the lesson, emphasizing **critical thinking, communication skills, and the ability to consider multiple perspectives.**
- Briefly review the debate contexts (policy, infrastructure, environment, economy) to provide context for the upcoming activities.

## STEP 2: Team Formation (5 minutes)

Annex 1

- Divide the class into four teams, assigning each team to one of the debate contexts: Policy, Infrastructure, Environment, and Economy.
- Ensure that each team has four members, with two members designated as speakers and two as researchers/note-takers.

## STEP 3: Debate Preparation (20 minutes)

- Conduct four debate rounds, each focusing on a specific context (Policy, Infrastructure, Environment, Economy).
- In each round, one team presents their arguments while the opposing team offers rebuttals and counter arguments.
- Speakers should adhere to time limits (e.g., 5 minutes for initial arguments, 3 minutes for rebuttals), with the timer enforced by the teacher or designated timekeeper.
- Encourage active participation from all team members, both speakers and researchers, during the debate rounds.

# STEP 4: Reflection and Discussion (15 minutes)

- Facilitate a class discussion to reflect on the debate experience and key insights gained.
- Ask students to share their observations, including strengths and weaknesses of arguments presented, effective communication strategies, and areas for improvement.
- Emphasize the importance of considering diverse perspectives and evidence-based reasoning in debates and decision-making processes.

TO DO SO, YOU MAY ASK THE FOLLOWING QUESTIONS:

- What were some of the most compelling arguments presented during the debates, and why did they resonate with you?
- Were there any weaknesses or gaps in the arguments that you noticed? How could those weaknesses have been addressed or strengthened?
- Did any teams use particularly effective communication strategies, such as clear organization, persuasive language, or compelling visuals? How did these strategies contribute to their overall effectiveness?
- How did your team approach the task of researching and preparing arguments? What strategies did you find most helpful in gathering and presenting evidence to support your position?
- Did you encounter any challenges during the debate, such as conflicting viewpoints within your team or opposition from the opposing team? How did you address these challenges, and what did you learn from the experience?
- In what ways did participating in the debate deepen your understanding of the issues surrounding electric vehicles, including policy, infrastructure, environment, and economy?
- How did considering diverse perspectives during the debate influence your thinking on the topic? Did you encounter viewpoints that differed significantly from your own, and if so, how did you respond?
- Reflecting on the debate experience, what are some key takeaways or lessons learned that you will carry forward into future discussions or decision-making processes?
- How do you think debates contribute to developing critical thinking skills, effective communication, and collaborative teamwork? How might these skills be valuable in your future academic or professional endeavors?
- Looking back on the entire activity, what aspects did you find most engaging or valuable, and are there any areas you would suggest improving for future debate sessions?

## STEP 5: ScoreBoard explanation (15 minutes)

Annex 2

- Explain that during the debates, each team will observe each other's performance and score them based on these criteria found in Annex 2.
- Afterward, provide constructive feedback to highlight their strengths and areas for improvement.
- Finally, share the scores and feedback with the teams, encouraging reflection and discussion to enhance their debating skills.

## STEP 6: Conclusion (5 minutes)

- Summarize the main takeaways from the lesson and reinforce the value of engaging in constructive debates to explore complex issues.
- Thank students for their participation and encourage them to continue exploring electric vehicle-related topics both inside and outside the classroom.

# Annex 1:

Use the annex below to set the tone for the debate team:

## TEAM A

POWER UP

### POLICY DEBATE ON ELECTRIC VEHICLE INCENTIVES:

- Team A: Advocates for government incentives to promote electric vehicle adoption, such as tax credits, rebates, and subsidies.

Context: The debate centers around the effectiveness of government incentives in accelerating the transition to electric vehicles, addressing climate change, and reducing air pollution.

## TEAM B

POWER UP

### POLICY DEBATE ON ELECTRIC VEHICLE INCENTIVES:

- Team B: Opposes government incentives for electric vehicles, arguing that they distort market forces and unfairly benefit a specific industry.

Context: The debate centers around the effectiveness of government incentives in accelerating the transition to electric vehicles, addressing climate change, and reducing air pollution.

# Annex 1:

Use the annex below to set the tone for the debate team:

## TEAM A

### INFRASTRUCTURE DEBATE ON CHARGING NETWORK EXPANSION:

- Team A: Supports government investment in expanding electric vehicle charging infrastructure, including public charging stations, fast chargers, and smart grid integration.

Context: The debate focuses on the role of government in facilitating the widespread adoption of electric vehicles by ensuring adequate charging infrastructure availability and accessibility.

## TEAM B

### INFRASTRUCTURE DEBATE ON CHARGING NETWORK EXPANSION:

- Team B: Argues against government intervention in charging network expansion, advocating for a market-driven approach and private sector investment.

Context: The debate focuses on the role of government in facilitating the widespread adoption of electric vehicles by ensuring adequate charging infrastructure availability and accessibility.

# Annex 1:

Use the annex below to set the tone for the debate team:

## TEAM A

### ENVIRONMENTAL DEBATE ON ELECTRIC VEHICLE IMPACT:

- Team A: Asserts that electric vehicles significantly reduce greenhouse gas emissions, improve air quality, and mitigate climate change compared to traditional internal combustion engine vehicles.

Context: The debate examines the overall environmental impact of electric vehicles, including their carbon footprint, energy efficiency, and potential ecological consequences.

## TEAM B

### ENVIRONMENTAL DEBATE ON ELECTRIC VEHICLE IMPACT:

- Team B: Challenges the environmental benefits of electric vehicles, citing concerns about resource extraction for battery production, electricity generation emissions, and vehicle lifecycle impacts.

Context: The debate examines the overall environmental impact of electric vehicles, including their carbon footprint, energy efficiency, and potential ecological consequences.

# Annex 2:

Distribute the score cards below to each team, as they will need to score their classmates debating strategies.
You can choose to print them out, or to use them on a projector.

POWER UP

## SCORE BOARD

**Knowledge of Electric Vehicles (10 points):** ☐

1. *How well did the team demonstrate understanding of electric vehicle concepts?*
2. *Did they use accurate information and examples?*

**Argument Clarity (5 points):** ☐

3. *Were the arguments easy to follow and understand?*
4. *Did the team present their points clearly and logically?*

**Team Collaboration (5 points):** ☐

5. *How well did the team work together?*
6. *Did each member contribute to the debate?*

**Persuasiveness (5 points):** ☐

7. *Were the arguments convincing?*
8. *Did the team provide strong reasons to support their views?*

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# Annex 2:

Distribute the score cards below to each team, as they will need to score their classmates debating strategies.
You can choose to print them out, or to use them on a projector.

POWER UP

## SCORE BOARD

**Engagement (5 points):** ☐

1. *Did the team engage the audience?*
2. *Were they able to keep the audience interested in the debate?*

**Critical Thinking (5 points):** ☐

3. *Did the team demonstrate critical thinking skills?*
4. *Were they able to analyze different aspects of electric vehicles?*

**Overall Presentation (5 points):** ☐

5. *How effective was the overall presentation?*
6. *Did the team deliver their arguments in a compelling way?*

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# Electric Vehicle Evolution Simualtion

Unit 1, lesson 3

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity related to the material covered in lesson Lesson 3 "**Navigating Innovation: Current Trends in Electric Vehicle Development"** from unit 1 "**Research and Development in Electric Vehicles"***

**- What is the goal of this activity?**

*The goal is to immerse students in the historical evolution and stakeholder perspectives of electric vehicles (EVs), fostering critical thinking, problem-solving, and collaboration.*

- ***What are students going to learn and why is it important?***

*Through this activity, students will learn to:*

- *Understanding EV history to grasp their current and future role in the automotive industry.*
- *Exploring stakeholder perspectives to foster empathy and awareness of EV development challenges.*
- *Problem-solving to cultivate creativity for real-world challenges.*
- *Collaborating in groups to hone vital communication skills.*
- *Examining environmental impacts to encourage responsible decision-making.*

**- What are the things that students need to have covered as material to perform the exercise successfully?**
*"To ensure student success, make sure that they are already acquainted with Unit 1 of Lesson 3: Navigating Innovation: Current Trends in Electric Vehicle Development*

# Requirements

**Duration:** 60-75 minutes broken down as follows:

- Group Formation: 5 minutes
- Challenge Selection: 10 minutes
- Idea Generation: 15-20 minutes
- Idea Development: 15-20 minutes
- Presentation: 5 minutes per group

**Format:** Team (3-4 students per group)

**Resources:**

- Flashcards with scenarios for each group representing different eras in the evolution of electric vehicles (Annex 2)
- Assigned roles representing stakeholders in the electric vehicle industry.
- Set of current challenges and trends related to EV development.
- Access to internet or resources for research during brainstorming sessions.

# Activity Description

## STEP 1: Introduction and Objective Setting (10 minutes)

- Welcome students to the lesson and introduce the topic of electric vehicle debates.
- Explain the objectives of the lesson, emphasizing the importance of ***collaborating in groups to hone vital communication skills and together*** *examining environmental impacts to encourage responsible decision-making*.

## STEP 2: Team Formation (15 minutes)

- Divide the class into teams, assigning each team one scenario. Go through the scenarios together with the whole class as well as through the role that each group has. Be ready to answer questions and make sure you are familiar with the time frames.

## STEP 3: Idea Generation (20 minutes)

- Allocate 15-20 minutes for brainstorming.
- Encourage groups to use the internet or other resources to research and gather ideas related to their assigned era or stakeholder role.
- Focus on exploring societal, economic, and technological factors influencing electric vehicle adoption and development.

# Activity Description

## STEP 4: Idea development (15/20 minutes)

- Dedicate another 15-20 minutes for groups to develop their chosen idea further.
- Discuss potential solutions to the challenges presented in their scenario.
- Encourage creativity and critical thinking to address the issues specific to their era or stakeholder role.

## STEP 4: Presentation (15 minutes)

- Designate one or two spokespersons from each group to present the solution to the challenge.
- Each group has 5 minutes to deliver their presentation, summarizing their idea and addressing key points related to their assigned era or stakeholder role.
- Encourage interaction and questions from other groups or participants.

## STEP 5: Wrap up (10 minutes)

- Facilitate a brief discussion to reflect on key insights, lessons learned, and any challenges encountered during the activity.
- Encourage students to share their thoughts on the significance of understanding electric vehicle development and the importance of considering diverse perspectives.
- This session helps reinforce learning outcomes and provides closure to the activity.

# Annex 2:

Use the annex below to set the tone for the groups:

## Scenario

SCENARIO 1

### ELECTRIC VEHICLE EVOLUTION SIMULATION

Participants are divided into groups, and each group represents a different era in the evolution of electric vehicles. They are tasked with exploring the societal, economic, and technological factors influencing the adoption and development of electric vehicles during their assigned era.

## Groups

SCENARIO 1

### ELECTRIC VEHICLE EVOLUTION SIMULATION

**GROUP 1**

*Early Adoption Era (Late 19th to Early 20th Century):*
*Participants discuss the emergence of electric vehicles as a viable alternative to horse-drawn carriages, considering factors such as urbanization, early automotive technology, and social perceptions of transportation.*

**GROUP 2**

*Decline and Revival Era (Mid-20th Century):*
*Groups examine the decline of electric vehicles due to advancements in internal combustion engines and the subsequent revival driven by environmental concerns, oil crises, and technological innovations.*

**GROUP 3**

*Modernization Era (Late 20th to Early 21st Century):*
*Participants explore the modernization of electric vehicles with advancements in battery technology, government incentives, and growing environmental awareness, leading to the emergence of hybrid and electric vehicles in mainstream markets.*

**GROUP 4**

*Consumer Experience Group:*
*Participants consider the evolving needs and preferences of consumers, envisioning user-friendly electric vehicles, seamless charging experiences, and personalized mobility services tailored to individual lifestyles.*

# Annex 2:

Use the annex below to set the tone for the groups:

## Scenario

POWER UP

SCENARIO 2

### ELECTRIC VEHICLE INDUSTRY FORECAST

Participants are assigned roles representing different stakeholders in the electric vehicle industry, such as automotive manufacturers, government regulators, environmental organizations, and consumers. Each group is given a set of current challenges and trends related to EV development, along with future projections.

## Groups

POWER UP

SCENARIO 2

### ELECTRIC VEHICLE INDUSTRY FORECAST

**GROUP 1**

*Automotive Manufacturers Group:*
Discusses challenges and innovations in electric vehicle design, production, and market strategies, considering factors such as cost efficiency, performance, safety, and sustainability.

**GROUP 2**

*Government Regulators Group:*
Examines policies, incentives, and regulations influencing EV adoption, including emissions standards, infrastructure investments, and incentives for consumers and manufacturers.

**GROUP 3**

*Environmental Organizations Group:*
Addresses the environmental benefits and challenges associated with electric vehicles, including the reduction of greenhouse gas emissions, air pollution, and resource sustainability.

**GROUP 4**

*Consumers Group:* Represents the perspectives and preferences of consumers regarding electric vehicles, discussing factors such as affordability, range, charging infrastructure, and brand reputation.

# 2

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# The future is electric/the electric car

*The ecological transaction and the transition to electric mobility, advantages and disadvantages*

POWER UP

# Introduction

**Which lesson and unit is this activity connected to?**
*This activity related to the material covered in lesson 3 from unit 2.*

**What is the goal of this activity?**
*The goal of this activity is for students to practice/explore/connect/create/present, etc. topics on electric cars but especially on charging systems*

**What are students going to learn and why is it important?**
*From this activity, students will learn more about the topic of changing automotive mobility, and at the same time they will learn about the electric transmission system and recharging them*

**What are students going to learn and why is important?**
*The importance of these two lessons lies in the fact that students learn and reflect on the importance of the ecological transition, a radical change necessary for the future. They will also have to think about and start to get into the perspective of electric mobility and how an electrically powered car works.*

**What are the things that students need to have covered as material to perform the exercise successfully?**

*First of all, they must be aware of how the change is happening, why and the time it takes*

# Requirements

**Duration:** 60 minutes

**Format:** Individual or team (max 4 persons)

**Resources:**

- Paper
- Pen
- Materials for online searches

# Activity Description

The activity of the lesson in question should be set up in such a way as to sensitize the student to understand above all the ecological transaction, i.e., the importance and why of switching from endothermic engine to electric mobility. At first, the importance and necessity of this transition will be explained through the slides (lesson 1) “The future electric”. It will then continue with lesson 2 (The electric car) to make the student understand how an electric car works, (Features, safety, etc.). Finally with lesson 3 (Charging infrastructure) to understand how charging stations work.

## STEP 1: Introduction and Objective Setting (10Min)

Start by presenting the activity to the class, explaining the importance of the ecological transition, why electric mobility was thought of and the future purpose. It encourages students to believe in a future where emissions can be zero and in silent and clean mobility.

## STEP 2: Brainstorming (10 min)

Now create small groups in class and open a discussion for each group on what the advantages and disadvantages of switching to electric mobility could be. At the same time go around the various groups and involve them in expressing themselves on the concept of electric mobility and trying to better understand that the advantages are more than the disadvantages.

## STEP 3: Development concept (10 min)

At this point, after having discussed the advantages and disadvantages, discuss and file a report on the results obtained by each group and make a sheet with the results obtained. On one side indicate the advantages and on the other the disadvantages

## STEP 4: Question and answer (20 Min)

After having developed a report with a written table with the advantages and disadvantages of electric mobility you can ask targeted questions to the students:

1. Do electric cars really emit less $CO_2$ than traditional ones? and why?
2. Do electric cars really improve air quality? as?
3. How is the energy with which we charge electric cars produced?
4. What impact will battery-powered vehicles have on the Italian electricity grid?
5. In your opinion, are electric cars safe?

## STEP 5: Argumentation of the answers (15 min)

After having students answer the questions above, open a discussion on each answer in order to resume the discussion of electric mobility and raise students' awareness of the change

## STEP 6: Conclusion (5 min)

Summarize the main takeaways from the lesson and reinforce the value of engaging in constructive debates to explore complex issues.
Thank students for their participation and encourage them to continue exploring electric vehicle-related topics both inside and outside the classroom.

# Annex 1:

Use the annex below to set the tone for the debate team

Giunti alla fine di queste lezioni, per verificare che gli student abbiano effettivamnete appreso queste nozioni fai realizzare una relazione dividend in due la classe su questi argomenti:

| **Argomento 1** |
| --- |
| Fate un rapporto sull'andamento delle vendite in Europa delle auto elettriche |

| **Argomento 2** |
| --- |
| Fate un rapporto approfondito sulla riduzione delle emissioni nocive nell'ultimo anno grazie alle auto elettriche |

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# Charging infrastructure

## Charging stations and their operation

POWER UP

# Introduction

**Which lesson and unit is this activity connected to?**
*“This activity related to the material covered in lesson 3 from unit 2.”*

**What is the goal of this activity?**
*"The goal of this activity is for students to practice/explore/connect/create/present, etc. topics about charging stations and how they work”*

**What are students going to learn and why is it important?**
"From this activity, students will learn more about the topic of changing automotive mobility, and at the same time learn about the electric drive system and how charging takes place

**What are students going to learn and why is important?**
*The importance of this lesson lies in the fact that students learn and reflect on the importance of the ecological transition, At the same time they will become aware of how the charging system of an electric car takes place*

**What are the things that students need to have covered as material to perform the exercise successfully?**

*Of course, to face this lesson they will first have to know the world of electric mobility*

# Requirements

**Duration:** 60 minutes

**Format:** Individual or team (max 4 persons)

**Resources:**

- Paper
- Pen
- Materials for online searches

# Activity Description

The activity of the lesson in question should be set up in such a way as to sensitize the student to understand above all the ecological transaction, i.e., the importance and why of switching from endothermic engine to electric mobility. At first, the importance and necessity of this transition will be explained through the slides (lesson 1) “The future electric”. It will then continue with lesson 2 (The electric car) to make the student understand how an electric car works, (Features, safety, etc.). Finally with lesson 3 (Charging infrastructure) to understand how charging stations work.

## STEP 1: Introduction and Objective Setting (10Min)

Start by presenting the activity to the class, explaining the evolution of charging stations and how they work

## STEP 2: Brainstorming (10 min)

At this point he creates small class groups that can answer these questions
At the European level there is talk of increasing charging stations for electric cars, if you were a member of the European Community with a say in the matter, how would you provide for this growth? Do you have any proposals?

## STEP 3: Development concept (10 min)

At this point, after collecting all the answers from the various groups, comment and correct the questions

## STEP 4: Argumentation of the answers (15 min

At this point, ask the groups other questions such as they could be:

1. how long do i need for a full charge?
2. How much does it cost to charge an electric car?
3. How to calculate charging speed?
4. How much does an electric car consume?
5. IHow much $CO_2$ does an electric car produce?

## STEP 5: Argumentation of the answers (15 min)

After having students answer the questions above, open a discussion on each answer in order to resume the discussion of electric mobility and raise students' awareness of the change

## STEP 6: Conclusion (5 min)

Summarize the main takeaways from the lesson and reinforce the value of engaging in constructive debates to explore complex issues.
Thank students for their participation and encourage them to continue exploring electric vehicle-related topics both inside and outside the classroom.

# Annex 1:

Use the annex below to set the tone for the debate team

At the end of these lessons, to verify that the students have learned these notions, have a report made by dividing the class in two on these topics:

| Group 1 | Group 2 |
|---|---|
| The number of charging stations will always be increasing, this is due to a substantial increase in electrically powered cars. | Compared to conventional batteries, batteries used for electric cars contain pollutants. |
| Together with your group, indicate the strategic points where charging stations can be built and explain why | With your group, research the contents of the batteries in question and do an analysis of the storage and their life cycle. |

# 3

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# Ready, Set, Build!

Unit 3, Lesson 1: Generators, Types and Uses

POWER UP

# Introduction

- **Which lesson and unit is this activity connected to?**
  *This activity is connected to Unit 3, Lesson 1: Generators, Types and Uses.*

- **What is the goal of this activity?** *The aim of this activity is for the students to get a first-hand experience in building their own generator, using basic electrical materials. With this, they will be able to share insights within the team, improvise and problem-solve.*

- **What are students going to learn and why is it *important*?**
  *Students will learn about electromagnetic induction, the link between magnets and electric current, how generators convert mechanical to electrical energy, and basic circuit assembly and troubleshooting. This knowledge is essential for grasping fundamental scientific principles, enhancing critical thinking and problem-solving skills, and fostering interest in STEM fields, which are vital for future technological innovation.*

- **What are the things that students need to have covered as material to perform the exercise successfully?**
  *Students need a basic understanding of how electricity is generated from external sources, along with the differences between Alternating Current (AC) and Direct Current (DC), as outlined in the Unit 3 module..*

# Requirements

**Duration: minimum** 90 mins,

- Introduction and Explanation of the Activity (10 minutes)
- Brainstorming (20 minutes)
- Design Development and Prototyping (45 mins)
- Prototype Presentation (10 mins per group)
- Feedback and Reflection (20 minutes)

**Format:** Team of 3- 5 students

**Resources:**

- Wood dowel 3/8" diameter
- Wood Dowel 1" diameter.
- Rod magnet 3" long
- Insulated copper wire 27 AWG, 200 feet
- 1.2 Volt Screw Base light Bulb
- Base for the light bulb
- Small sand paper
- Wood Glue
- 1/2 Square foot Balsa wood (1/8" diameter)

# Activity Description

**Prepare in advance all the necessary materials mentioned above.

## STEP 1:Introduction and Explanation of the Activity (10 mins.)

Explain the goal of building a simple generator and its importance in understanding electricity generation.

Provide a brief explanation of the principles of electromagnetic induction and how generators work.

Outline the steps that will be followed during the activity.

## STEP 2: Brainstorming (20 mins)

Encourage students to discuss what materials they think will be needed and possible designs for the generator. They can only use materials that are available and prepared by the teacher. (see list above). Have them choose (or assign) between AC-based or DC-based generators.

Have students brainstorm different ways to arrange the components for maximum efficiency.

## STEP 3: Design Development and Prototyping: (45 mins)

**Sketching**

Each group sketches their design for the generator. Remind them to include all components in the sketches.

**Building the Prototype**

Encourage the students to explore different ways to build a working generator.

This is an example of a step-by-step procedure:

**Preparation:**

- Cut two square pieces from the balsa wood (3.5" x 3.5").
- Make a 3/8" hole in the center of each square.
- Cut four 1" x 3 7/16.
- Cut a 3/4" piece from the 1" wood dowel. Make a 3/8" hole in the center of it. Insert a 6" long 3/8" wood dowel in the hole, apply some glue. Center it and wait for it to dry.
- Make another hole with the diameter of your rod magnet in the center of the larger wood dowel piece for the magnet to go through.

**Procedure:**

- Insert the magnet in the hole of the wood dowel. Center it and use some glue to secure it.
- Use one large square balsa wood and four smaller rectangular balsa woods to make a box.
- Insert your wood dowel into the hole in the center of the box. At this time the magnet is inside the box.
- Place the other large square to complete the box. Apply some glue to the edges and wait for the glue to dry. By now, you have a box and inside the box you have a magnet that can spin when you spin the wood dowel.
- Wrap 200 turns of copper wire around the box and use masking tape to secure it.
- Remove the insulation from the ends of the wire and connect it to the screws of the bulb holder or base.
- Insert the light bulb
- Spin the wood dowel fast to get the light.

***Reminder: Always test and adjust accordingly.***

## STEP 4: Prototype Presentation (10 mins per group)

Ask students to prepare their prototypes. They should highlight the main features of the design, how it works, and why certain decisions were made. Remind them to briefly practice the presentation to ensure clarity and confidence.

Groups present their designs and prototypes to the class. If possible, they can demonstrate the working model. Reflect on the activity, discussing what was learned, what challenges were faced, and how they were overcome.

## STEP 5: Feedback and Reflection (20 mins)

Provide your feedback on the presentations and discuss any variations in designs and their potential effectiveness. Ask other groups to give feedback on each group's prototype and ask them what would they do differently. This promotes further discussion and potential new ideas.

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# Ready, Set, Build! 2.0

Unit 3, Lesson 2: Transformers, Types and Uses

POWER UP

# Introduction

- **Which lesson and unit is this activity connected to?**
  *This activity is connected to Unit 3, Lesson 2: Transformers, Types and Uses.*

- **What is the goal of this activity?** *The aim of this activity is for the students to get a first-hand experience in building their own transformer, using basic electrical materials. With this, they will be able to share insights within the team, improvise and problem-solve.*

- **What are students going to learn and why is it *important*?**
  *Students are going to learn the principles of electromagnetic induction, the relationship between magnets and electric current, how generators convert mechanical energy into electrical energy, and basic circuit assembly and troubleshooting skills. This is important because the students will understand fundamental scientific principles, improve critical thinking and problem-solving skills, and increase their interest in science, technology, engineering, and mathematics (STEM) fields, which are crucial for innovation and addressing future technological challenges.*

- **What are the things that students need to have covered as material to perform the exercise successfully?**
  *Students should have a basic knowledge about how electricity is transformed from external sources. They should also know the difference of Alternating Current and Direct Current, which can be found in the Unit 3 module.*

# Requirements

**Duration: minimum** 90 mins,

- Introduction and Explanation of the Activity (10 minutes)
- Brainstorming (20 minutes)
- Design Development and Prototyping (45 mins)
- Prototype Presentation (10 mins per group)
- Feedback and Reflection (20 minutes)

**Format:** Team of 3- 5 students

**Resources:**

# Activity Description

**Prepare in advance all the necessary materials mentioned above.

## STEP 1:Introduction and Explanation of the Activity (10 mins.)

Explain the goal of building a simple transformer and its importance in understanding electricity generation.

Provide a brief explanation of the principles of electromagnetic induction and how generators work.

Outline the steps that will be followed during the activity.

## STEP 2: Brainstorming (20 mins)

Encourage students to discuss what materials they think will be needed and possible designs for the generator. They can only use materials that are available and prepared by the teacher. (see list above). Have them choose (or assign) between AC-based or DC-based generators.

Have students brainstorm different ways to arrange the components for maximum efficiency.

## STEP 3: Design Development and Prototyping: (45 mins)

**Sketching**

Each group sketches their design for the generator. Remind them to include all components in the sketches.

**Building the Prototype**

Encourage the students to explore different ways to build a working generator.

This is an example of a step-by-step procedure:

**Preparation:**

- Cut two square pieces from the balsa wood (3.5" x 3.5").
- Make a 3/8" hole in the center of each square.
- Cut four 1" x 3 7/16.
- Cut a 3/4" piece from the 1" wood dowel. Make a 3/8" hole in the center of it. Insert a 6" long 3/8" wood dowel in the hole, apply some glue. Center it and wait for it to dry.
- Make another hole with the diameter of your rod magnet in the center of the larger wood dowel piece for the magnet to go through.

**Procedure:**

- Insert the magnet in the hole of the wood dowel. Center it and use some glue to secure it.
- Use one large square balsa wood and four smaller rectangular balsa woods to make a box.
- Insert your wood dowel into the hole in the center of the box. At this time the magnet is inside the box.
- Place the other large square to complete the box. Apply some glue to the edges and wait for the glue to dry. By now, you have a box and inside the box you have a magnet that can spin when you spin the wood dowel.
- Wrap 200 turns of copper wire around the box and use masking tape to secure it.
- Remove the insulation from the ends of the wire and connect it to the screws of the bulb holder or base.
- Insert the light bulb
- Spin the wood dowel fast to get the light.

***Reminder: Always test and adjust accordingly.***

## STEP 4: Prototype Presentation (10 mins per group)

Ask students to prepare their prototypes. They should highlight the main features of the design, how it works, and why certain decisions were made. Remind them to briefly practice the presentation to ensure clarity and confidence.

Groups present their designs and prototypes to the class. If possible, they can demonstrate the working model. Reflect on the activity, discussing what was learned, what challenges were faced, and how they were overcome.

## STEP 5: Feedback and Reflection (20 mins)

Provide your feedback on the presentations and discuss any variations in designs and their potential effectiveness. Ask other groups to give feedback on each group's prototype and ask them what would they do differently. This promotes further discussion and potential new ideas.

# 4

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# Brainstorming

## Unit 4, Electric Vehicle, Production & Battery Development

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*"This activity related to the material covered in lesson 1 from unit 4."*

- **What is the goal of this activity?**
  *The goal of brainstorming is to generate a wide range of creative ideas in an open and non-judgmental environment to solve a specific problem or explore opportunities*

- **What are students going to learn and why is it important?**
  Brainstorming is important for students because it encourages creative thinking, collaboration, and problem-solving skills, helping them to generate diverse ideas and develop innovative solutions..

- **What are the things that students need to have covered as material to perform the exercise successfully?**
  Students need open-mindedness, creativity, collaboration, and a willingness to share and build on ideas for effective brainstorming.

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# Requirements

**Duration:** 20 minutes

**Format:** teams of 3 to 4 people

**Resources:**

- Own opinion
- Internet

# Activity Description

- **Define the Focus**: Identify key areas like innovation in battery technology, charging infrastructure, or environmental impact.
- **Encourage Free Thinking**: Allow all ideas, no matter how unconventional, to be shared without judgment.
- **Explore Trends**: Discuss emerging technologies and societal trends that could influence the future of electric vehicles.
- **Collaborate and Build**: Encourage participants to expand on others' ideas to create more comprehensive solutions.
- **Categorize Ideas**: Group similar ideas and identify key themes or priorities for further exploration.

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# Market Place

## Unit 4, Lesson 1: Electric Vehicle Production

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*"This activity related to the material covered in lesson 1 from unit 4."*

- **What is the goal of this activity?**
  *"The goal of this activity is for students to learn how electric cars be produced.*

- **What are students going to learn and why is it important?**
  "*By doing a "marketplace" the students will learn to work in different groups. The present their results and discuss with their group members.*

- **What are the things that students need to have covered as material to perform the exercise successfully?**
  Different *worksheets*

# Requirements

**Duration:** 90 minutes

**Format:** individual

**Resources:**

- 5 prepared learning stations with worksheets

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# Activity Description

## STEP 1: Explanation of the method

**Theoretical overview (10 minutes):**
Objective, Page 8 – Introduction

.

## STEP 2: Learning stations

**Activity: Learning stations (75 minutes):**
Show the method

“market place" is a teaching method that involves organizing the classroom into different activity centers or stations where students engage in various learning tasks.

Divide your class into 5 groups. Group 1 gets topic 1. Group 2 gets topic 2, etc. The groups read and work on the topic. They present the results at a stand, like in a marketplace. A student presents to the groups. The other group members walk around and look at the other groups and stands. After 10 minutes there is a change so that everyone goes around and explains.

## STEP 3: Compare the results

The students present their results in the plenum.
The teacher uses the solution to check the results and intervenes in an emergency

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# Learning Station Worksheet

| Electric Cars | Conventional Cars |
|---|---|
| 1. Battery Production: | 1. Internal Combustion Engine: |
| 2. Electric Motor: | 2. Transmission: |
| 3. Lightweight Construction: | 3. Fuel System: |
| 4. Charging Technology: | 4. Exhaust System: |
| 5. Software Integration: | 5. Electrics and Electronics: |

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# 5

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# Cybersecurity in Electric Vehicles

## Lesson 1: Potential Risks of Cyber Attacks

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 1:* ***Potential Risk of Cyber Attacks*** *from Unit 5:* ***Cybersecurity in Electric Vehicles****.*

**- What is the goal of this activity?**
*The goal of this activity is for students to identify cybersecurity risks and propose preventive measures for electric vehicles in a fun way.*

**- What are students going to learn and why is it important?**
*By playing an educative game about cybersecurity, students will learn more about cybersecurity. Also, this game lets them apply their knowledge in a practical and collaborative setting.*

*Understanding cybersecurity in electric vehicles is essential for future automotive mechanics to ensure vehicle safety, protect sensitive data, maintain customer trust, comply with industry standards, seize career opportunities, and adapt to technological advancements in the automotive sector*

.**- What are the things that students need to have covered as material to perform the exercise successfully?**
They should be done with Lesson 1 from Unit 5 which is focusing on Cybersecurity Risks in Electric Vehicles.

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# Requirements

**Duration:** 90 minutes (2 hours)

**Format:** Team with 3-4 members

**Resources:**

- Lists of paper
- Pens or markers
- Flipchart or Whiteboard (optional, for displaying game rules or information)
- Game Rules – Attachment n. 1

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# Activity Description

Engage students in a collaborative game to identify cybersecurity risks and propose preventive measures for electric vehicles.
The game effectively engages students in learning about cybersecurity risks specific to electric vehicles while promoting teamwork, critical thinking, and practical application of cybersecurity concepts.

## STEP 1: Team Formation

Organise students into teams of 3-4 members each. A smaller team size encourages active participation from each member. It's easier for everyone to contribute to discussions, brainstorming sessions, and decision-making processes.

Let students call their Teams by name they agree on..

## STEP 2: Game Introduction

Explain the purpose of the game: to explore cybersecurity risks specific to electric vehicles and develop strategies to mitigate these risks. Combine this part with the brainstorming part of the lesson 1 of the module from Unit 5.

## STEP 3: Game Rounds

**Round 1: Identify the Risk**

- Provide each team with a specific cybersecurity scenario related to electric vehicles (e.g., remote hacking of an electric vehicle's control systems).
- Teams discuss and identify potential risks associated with the scenario. They should consider how the cyber attack could affect the vehicle, its users, and broader implications.
- Time allocation: 20-30 minutes

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**Round 2:** Propose Preventive Measures
- After identifying risks, teams brainstorm and write down preventive measures or strategies to mitigate the identified risks.
- Encourage teams to consider technical (e.g., software updates, encryption), procedural (e.g., secure protocols for data transmission), and educational (e.g., user awareness training) measures.
- Time allocation: 20-30 minutes.

## STEP 4: Preparation for Presentation

Teams prepare a brief presentation summarizing their identified risks and proposed preventive measures. Each team should designate a spokesperson or rotate roles for presenting.

## STEP 5: Presentation and Discussion

- Each team presents their findings to the class
- Encourage other teams and the instructor to provide constructive feedback and ask clarifying questions
- Facilitate a discussion on the feasibility and effectiveness of the proposed measures
- Time allocation: 30-45 min

## STEP 6: Scoring (optional)

- Optionally, award points based on the thoroughness of risk identification, creativity of proposed preventive measures, and quality of presentation.
- Alternatively, facilitate a class discussion to evaluate and discuss the strengths and weaknesses of each team‘s approach without assigning points.
- Time allocation: 30-45 min

## STEP 7: Wrap-Up

Conclude the game with a brief of key insights and lessons learned about cybersecurity in electric vehicles. Discuss how the concepts explored in the game can be applied in real-world scenarios and careers, such as automotive mechanics.

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# Game Facilitation tips

- **Monitor Time**: Keep track of time during each round to ensure teams have enough time to complete tasks and prepare their presentations
- **Encourage Participation**: Encourage all team members to contribute actively to discussions and decision-making processes.
- **Provide Guidance**: Offer guidance and clarification as needed, especially regarding cybersecurity concepts and terminology.
- **Promote Respectful Feedback**: Emphasize constructive feedback and encourage teams to learn from each other's presentations

By following this structured approach, the Cybersecurity Risk Assessment - Electric Vehicle Edition game not only engages students actively in learning but also promotes critical thinking, teamwork, and practical application of cybersecurity principles in the context of electric vehicles.

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# Attachement 1: Game Rules

## Allowed during the game:

**TEAM COLLABORATION**
Team members can freely discuss the scenarios, share ideas, and collaborate on identifying risks and proposing preventive measures

**USE OF CLASSROOM RESOURCES**
Teams can use paper, pens, markers, and any materials provided in the classroom to take notes and prepare their presentations.

Teams can use the flipchart or whiteboard (if available) for brainstorming or outlining their ideas.

**INTERNER RESEARCH**
If allowed by the instructor, teams can use classroom computers or their own devices to conduct research on cybersecurity topics related to their scenarios. Students should use credible sources and reference them if needed.

**ASKING FOR CLARIFICATION**
Teams can ask the instructor for clarification on the scenarios, cybersecurity concepts, or any game-related rules at any time.

**ACTIVE PARTICIPATION**
All team members should actively participate in discussions, brainstorming sessions, and presentations.

## Not allowed during the game:

**EXTERNAL ASSISTANCE**
Teams cannot seek help from individuals outside the classroom, such as friends, family members, or online forums. Teams cannot use pre-prepared materials or information not generated during the game session.

**DISRUPTIVE BEHAVIOR**
Teams should not engage in behavior that disrupts other teams' work, such as loud talking, interrupting, or interfering with other teams' discussions.

**PLAGARISM**
If internet research is allowed, teams must not copy and paste information directly from sources without proper attribution. All ideas and solutions should be the team's own work, inspired by their research.

**IGNORING TIME LIMITS**
Teams must adhere to the time limits set for each round to ensure the game progresses smoothly and fairly for all participants.

**DISRESPECTFUL CONDUCT**
All team members should treat each other, and other teams, with respect during discussions and feedback sessions. Negative or disrespectful comments are not allowed

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# Cybersecurity in Electric Vehicles

## Lesson 2: Cybersecurity: Risks and Protections

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 2:* ***Cybersecurity: Risks and Protection*** *from Unit 5:* ***Cybersecurity in Electric Vehicles****.*

**- What is the goal of this activity?**
*The goal of this activity is for students to learn how to protect EV's from cyber attacks using their own devices.*

- **What are students going to learn and why is it important?**
  *Each of part of the activity called Cybersecurity challenge provides a hands-on, engaging way to teach students about cybersecurity for phones and EVs. They emphasize practical skills, critical thinking, and collaboration, ensuring that students not only learn about cybersecurity but also understand how to apply it in real-world scenarios.*

**.- What are the things that students need to have covered as material to perform the exercise successfully?**
They should be done with Lesson 2 from Unit 5 which is focusing on Cybersecurity of EV's.

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# Requirements

**Duration:** 50 minutes

**Format:** Team with 3-4 members. This activity can be scaled based on the number of students. For example, with a class of 24 students, you can form 6-8 Teams. Minimum number of participants is 6 students.

**Resources:**

- Pre-prepared cybersecurity challenges ( Attachment)
- Smartphones
- Prizes for winning teams (optional)

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# Activity Description

The Cybersecurity Challenge with smartphones is a competitive and educational activity designed to teach students practical cybersecurity skills for protecting their mobile devices. This could help to understand why is the cybersecurity so important in our lives and also related to electric vehicles. By engaging in this challenge, students learn to identify cyber threats and implement effective strategies to safeguard their devices. The game concludes with a review of solutions and recognition of the top-performing teams, reinforcing the importance of cybersecurity in everyday life.

## STEP 1: Team Formation

Organise students into teams of 3-4 members each. A smaller team size encourages active participation from each member. It's easier for everyone to contribute to discussions, brainstorming sessions, and decision-making processes.

Let students call their Teams by name they agree on.

## STEP 2: Challenge Introduction

- Explain the challenge: Students will complete in Teams to solve cybersecurity puzzles related to smartphone security.
- Outline the rules:
- - Teams must work collaboratively
- Each team will receive a set of challenges and must solve them withing the given time
- Points will be awarded for each correctly solved challenge
- The team with the highest score at the end of both rounds wins.

## STEP 3: Challenge Rounds

**Round 1: Phone security**

- Distribute a set of cybersecurity challenges related to phone security.
- Students work in teams to complete the challenges as quickly and accurately as possible.
- Time allocation: 15 minutes

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Examples of Challenges:
- Identify phishing attempts: Present a series of email or message screenshots, and teams must identify which ones are phishing attempts.
- Set up secure passwords: Teams create strong passwords based on given criteria (e.g., length, complexity).
- Configure privacy settings: Provide scenarios where teams must adjust smartphone settings to enhance privacy (e.g., app permissions, location services).

**Round 2: EV security**

Examples of Challenges:
- Updating firmware: Provide steps for updating a device's firmware and ask Teams to put them in the correct order.
- Setting up secure communications: Teams outline a process for setting up a secure Bluetooth connection
- Recognizing suspicious activities: Present scenarios where Teams must identify signs of potential cyber attacks on an EV system.

More challenges in the attachment n. 1

## STEP 4: Review and Awards

Review the correct solutions to each challenge. Announce the winning team(s) based on the highest score. Optionally, award small prizes or certificates to the winning team(s).

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# Additional notes

- **Flexibility: You can adjust the number and complexity of challenges based on the students‘ knowledge level and available time**

- **Engagement**: Encourage Teams to work quickly but accurately, fostering a sense of urgency and competition.

- **Provide Support**: Be available to answer questions and provide hints if needed, ensuring all Teams can participate effectively.

By following this structure, the Cybersecurity Challenge with smartphones will be an engaging, educational, and competitive activity that helps students learn important cybersecurity concepts and practices.

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# Attachment 1: Cybersecurity challenges

## Examples

**IDENTIFYING MALICIOUS APPS:**
Provide screenshots of app descriptions and reviews. Teams must identify which apps might be malicious based on their permissions, reviews, and other indicators.

**CREATING A BACKUP PLAN:**
Ask teams to outline steps for setting up a regular backup plan for a smartphone, including using cloud services and local storage options.

**RECOGNIZING SOCIAL ENGINEERING:**
Present various scenarios of social engineering attempts (e.g., a phone call from someone claiming to be tech support). Teams must identify tactics used and propose how to respond.

**SECURING WI-FI CONNECTIONS:**
Provide scenarios of connecting to different Wi-Fi networks (e.g., public, home, office). Teams must identify security risks and suggest secure practices (e.g., using a VPN).

**CONFIGURING SECURITY FEATURES:**
Provide a list of security features (e.g. Biometric authentication, screen lock, Find My Device). Teams must configure a smartphone to maximize security using these features.

**PASSWORD MANAGEMENT:**
Teams cannot seek help from individuals outside the classroom, such as friends, family members, or online forums. Teams cannot use pre-prepared materials or information not generated during the game session.

**DISRUPTIVE BEHAVIOR**
Teams should not engage in behavior that disrupts other teams' work, such as loud talking, interrupting, or interfering with other teams' discussions.

**PLAGARISM**
If internet research is allowed, teams must not copy and paste information directly from sources without proper attribution. All ideas and solutions should be the team's own work, inspired by their research.

**IGNORING TIME LIMITS**
Teams must adhere to the time limits set for each round to ensure the game progresses smoothly and fairly for all participants.

**DISRESPECTFUL CONDUCT**
All team members should treat each other, and other teams, with respect during discussions and feedback sessions. Negative or disrespectful comments are not allowed.

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# Cybersecurity in Electric Vehicles

## Lesson 3: Questions for Students (Recap the lesson with the help of educative videos, games, and others)

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 3:* ***Cybersecurity: Questions for Students*** *from Unit 5:* ***Cybersecurity in Electric Vehicles****.*

- **What is the goal of this activity?**
  *The goal of this activity is to review with students everything they have learned about cybersecurity in Lessons 1 and 2.*

- **What are students going to learn and why is it important?**
  *For main parts of the 3rd lesson: Questions for students there is a activity connected to Cybersecurity. Through each aktivity, students can better remember the main points to take away from the lesson.*

- **.- What are the things that students need to have covered as material to perform the exercise successfully?**
  They should be done with Lessons 1 and 2 from Unit 5 because they will review and memorize all the topics and key points from those lessons.

# Requirements

**Duration:** 75 minutes

**Resources:**

- Pre-prepared quiz printed
- Pre-prepared crosswords printed
- Smartphones
- Prizes for winning teams (optional)

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# Activity Description

In this guidance, you can find aktivity for each part of Lesson 3. You can recap the lesson with help of educative videos, games, and other activities.

## STEP 1: Video about the difference between classic and electric car

Let student watch video which describe differences between classic and electric car.
Link: https://www.youtube.com/watch?v=ewcWN-rHQ6Q

This video is connected to part of the lesson 3 called Basic Knowledge. In the video there is a comparison of those totally different technologies scientifically, and come to understand which is superior. Here there are used Tesla model S as electric car to compare with its petrol engine car counterpart.
**Duration**: 5 minutes

## STEP 2: Advanced Knowledge True/False Quiz

Use Kahoot for teachers and prepare True or False Quiz about Ethics in Cybersecurity (connected to the part of lesson 3 called Advanced Knowledge.
**Duration**: 20 minutes

**Questions**

1. It is ethical to use social engineering tactics to gain unauthorized access to systems if it helps identify security flaws. TRUE/**FALSE**
2. Cybersecurity professionals must always get consent before testing the security of a system. **TRUE**/FALSE
3. Data integrity ensures that information is protected from being accessed by unauthorized individuals. TRUE/**FALSE**
4. Disclosing security vulnerabilities responsibly helps improve overall cybersecurity. **TRUE**/FALSE
5. It is acceptable to access someone's personal data if it is for a good cause. TRUE/**FALSE**
6. Using weak passwords is a common cause of cybersecurity breaches. **TRUE**/FALSE
7. Multi-factor authentication (MFA) significantly increases the security of user accounts. **TRUE**/FALSE
8. All cybersecurity threats come from external sources, such as hackers and cybercriminals. TRUE/**FALSE**
9. Encrypting data makes it completely immune to all forms of cyber attacks. TRUE/**FALSE**
10. Regularly updating software and systems helps protect against known vulnerabilities. **TRUE**/FALSE

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# STEP 3: Testing your critical thinking

On the 5 examples, the students can test their critical thinking and see which behaving is right and which is wrong in such a situation.
**Duration**: 35 min

**Example 1: Evaluating Cybersecurity Measures**
**Situation**: A new software update claims to enhance the cybersecurity of electric vehicles.

1. Question: What specific features does the software update include to improve cybersecurity, and how do these features address current vulnerabilities?

1. Answer: Look for features such as advanced encryption, intrusion detection systems, and automatic security patching. Evaluate how these features mitigate known vulnerabilities like data breaches, remote control takeovers, or malware infections.

2. Question: Are there any potential drawbacks or risks associated with this update that could affect the vehicle's performance or user privacy?

2. Answer: Consider potential issues such as increased system complexity leading to new vulnerabilities, impact on vehicle performance (e.g., slower response times), or excessive data collection infringing on user privacy

**Example 2: Assessing the Impact of a Cyberattack**
**Situation**: A cyberattack has compromised the control systems of several electric cars in a city.

1. Question: What immediate steps should be taken to ensure the safety of affected vehicles and their passengers?

1. Answer: Immediate steps include remotely disabling the compromised control systems, alerting vehicle owners and authorities, and deploying emergency response teams to assist affected passengers.

2. Question: How could this cyberattack affect public trust in electric vehicles, and what measures can be implemented to restore confidence?

2. Answer: The attack could lead to widespread fear and skepticism about the safety of electric vehicles. Measures to restore confidence include transparent communication about the incident, rapid resolution of vulnerabilities, and implementation of stronger security protocols.

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**Example 3: Predicting Future Cybersecurity Threats**
**Situation**: Experts predict new types of cyber threats will emerge with the increased connectivity of electric vehicles.

1. Question: What are some potential new cyber threats that electric vehicles might face in the future, and how can manufacturers prepare for them?

1. Answer: Potential threats include vehicle-to-vehicle (V2V) communication hacks, autonomous vehicle manipulation, and infrastructure attacks. Manufacturers can prepare by investing in advanced cybersecurity research, developing resilient architectures, and collaborating with cybersecurity experts.

2. Question: How can the industry balance the need for innovation in vehicle connectivity with the necessity of robust cybersecurity measures?

2. Answer: The industry can balance these needs by adopting a security-by-design approach, prioritizing security in the development process, and continuously updating security measures to keep pace with technological advancements.

**Example 4: Formulating Regulatory Strategies**
**Situation**: The EU is considering new regulations to enhance the cybersecurity of electric vehicles.

1. Question: What key elements should be included in the new regulations to effectively improve cybersecurity standards for electric vehicles?

1. Answer: Key elements should include mandatory cybersecurity assessments, regular updates and patches, data protection requirements, and guidelines for incident response and reporting.

2. Question: How might these regulations impact manufacturers, and what steps can they take to comply while maintaining innovation and competitiveness?

2. Answer: Regulations might increase compliance costs and require changes in production processes. Manufacturers can comply by integrating security measures early in the design process, investing in R&D for secure technologies, and fostering a culture of security awareness.

**Example 5: Designing Educational Programs**
**Situation:** A training program is being developed to educate future auto mechanics on cybersecurity for electric vehicles.

1. Question: What critical cybersecurity topics should be included in the training program to ensure future auto mechanics are well-prepared?

1. Answer: Topics should include basic cybersecurity principles, common vulnerabilities and threats, secure diagnostic and repair practices, and hands-on training with cybersecurity tools and technologies.

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2. Question: How can hands-on exercises and real-world scenarios be incorporated into the training to enhance learning and critical thinking?

2. Answer: Incorporate simulated cyberattacks on vehicle systems, role-playing exercises for incident response, and collaborative projects to design and implement security solutions, encouraging practical application of theoretical knowledge.

These examples and questions will help students develop critical thinking skills by analyzing real-world scenarios, considering various perspectives, and applying their knowledge to solve complex problems related to the cybersecurity of electric vehicles.

## STEP 4: Crossword of key words about Cybersecurity

The crossword will help students to remember key words and terms related to cybersecurity of EVs.

**Duration**: 15 min

See the next page.

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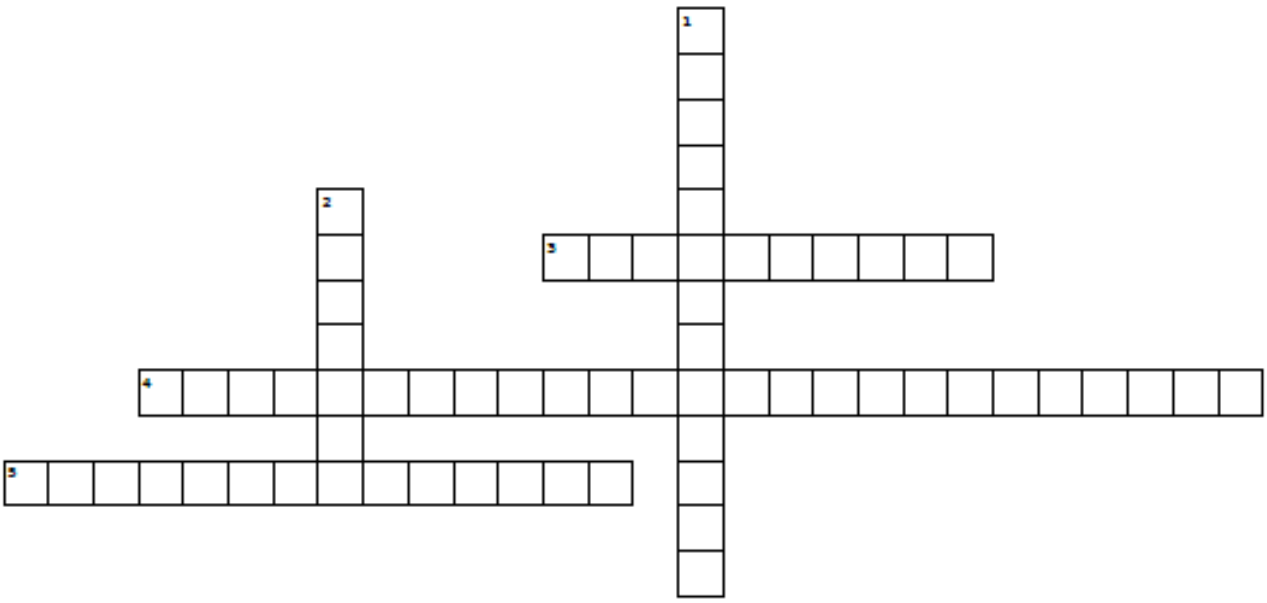
# Cybersecurity crossword



Down:

1. protecting computer systems, networks, and data from digital attacks, unauthorized access
2. an attempt by hackers to exploit vulnerabilities in computer systems or networks

Across:

3. type of malware that encrypts files and systems and demands a ransom to decrypt them
4. another layer of security to your online accounts by requiring you to enter an additional authentication factor
5. emails, text messages and websites which are used to trick drivers and passengers into sharing their personal information or clicking on a malicious link

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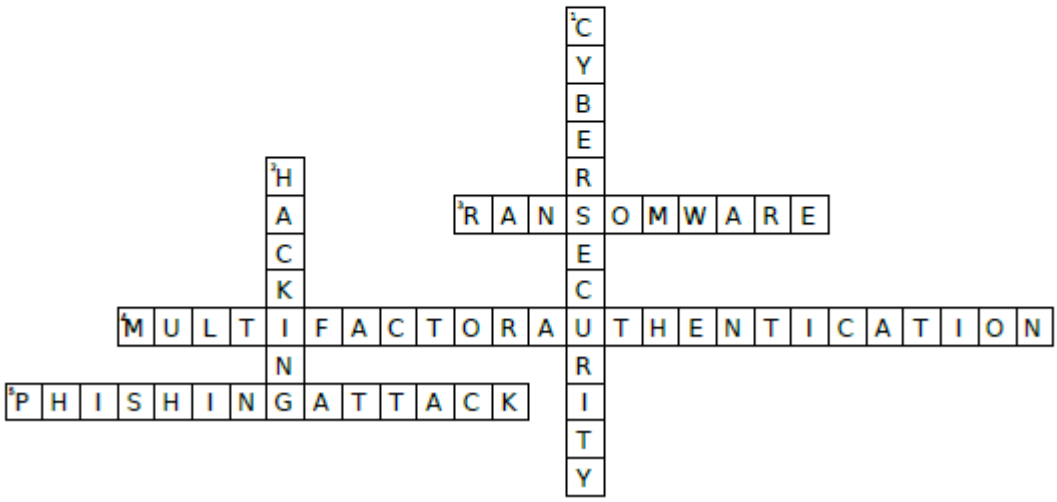
# Cybersecurity crossword




Down:

1. protecting computer systems, networks, and data from digital attacks, unauthorized access
2. an attempt by hackers to exploit vulnerabilities in computer systems or networks

Across:

3. type of malware that encrypts files and systems and demands a ransom to decrypt them
4. another layer of security to your online accounts by requiring you to enter an additional authentication factor
5. emails, text messages and websites which are used to trick drivers and passengers into sharing their personal information or clicking on a malicious link

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# 6

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# Group-Puzzle

## Unit 6, Lesson 1: Importance of workplace safety/hazards in EV

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*"This activity related to the material covered in lesson 2 from unit 6."*

- **What is the goal of this activity?**
  *"The goal of this activity is for students to practice their own workspeed and to get the knowledge about the topic.*

- **What are students going to learn and why is it important?**
  "*By doing the learning stations the students will learn to work in their own speed.*

- **What are the things that students need to have covered as material to perform the exercise successfully?**
  Prepared Learning Stations

# Requirements

**Duration:** 90 minutes

**Format:** teams of 3 to 4 people

**Resources:**

- Worksheet home group
- Worksheet expert group
- Materials to devide the groups
- Prepared text for the topics

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# Activity Description

## STEP 1: Home Group I

**Theoretical overview (15 minutes):**
Divide the class into groups with 3-4 Students.
Explain the method.
Show a video of kinds of hazards.

.

## STEP 2: Expert Group

**Activity**: **Group work (60 minutes):**
Method: "group puzzle"
Each member of a main group takes his/her pace in an expert group and works on one of three topics.
After that every main group member explains his topic to the other main group members.

| Kind of hazard Group 1 | Kind of hazard Group 2 | Kind of hazard Group 3 |
|---|---|---|
| Electric shock | Battery-related hazards | Electromagnetic interference |
| Fire hazards | Cruch and pinch points | Risk of Electric Vehicle Accidents |
| Arc flash | Chemical exposure | Confined Space Hazards |
| Noise exposure | Ergonomic hazards | Risk of Asphyxiation |
| Vehicle movement | Chemical spills | Psychological Stress |

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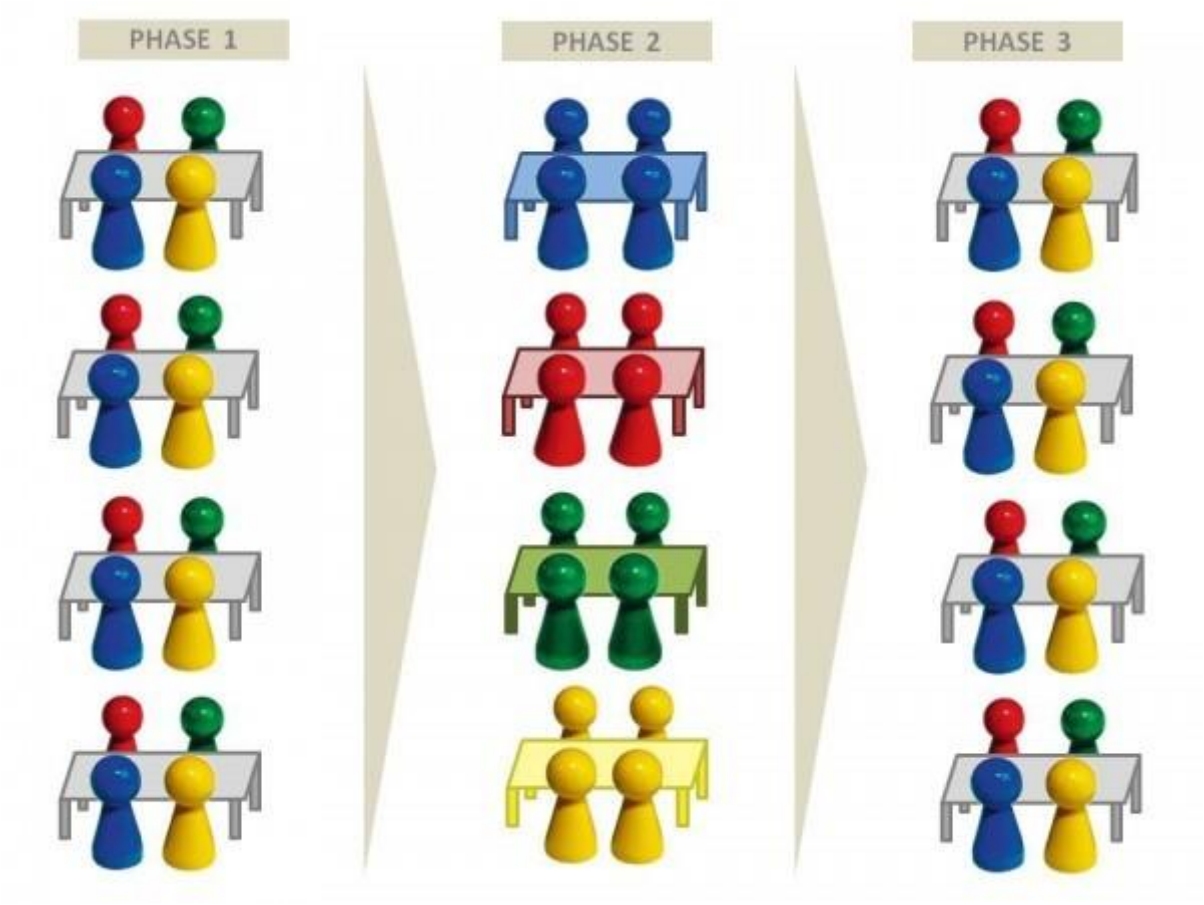
# STEP 3: Home Group II

The students present their results to the other group members.




Quelle: Sozialform mit Methode – Von der Gruppenarbeit zum Gruppenpuzzle - Schule-Lernen-Bildung im 21. Jahrhundert (schule21.blog)

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# Learning Stations

## Unit 6, Lesson 2: Personal protective equipment

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*"This activity related to the material covered in lesson 1 from unit 6."*

- **What is the goal of this activity?**
  *"The goal of this activity is for students to practice the work in groups and to get the knowledge about the topic.*

- **What are students going to learn and why is it important?**
  "*By doing the group puzzle the students will learn to work in different groups. The present their results and discuss with their group members.*

- **What are the things that students need to have covered as material to perform the exercise successfully?**
  Different *worksheets*

# Requirements

**Duration:** 90 minutes

**Format:** alone

**Resources:**

- 4 to 6 prepared learning stations with worksheets

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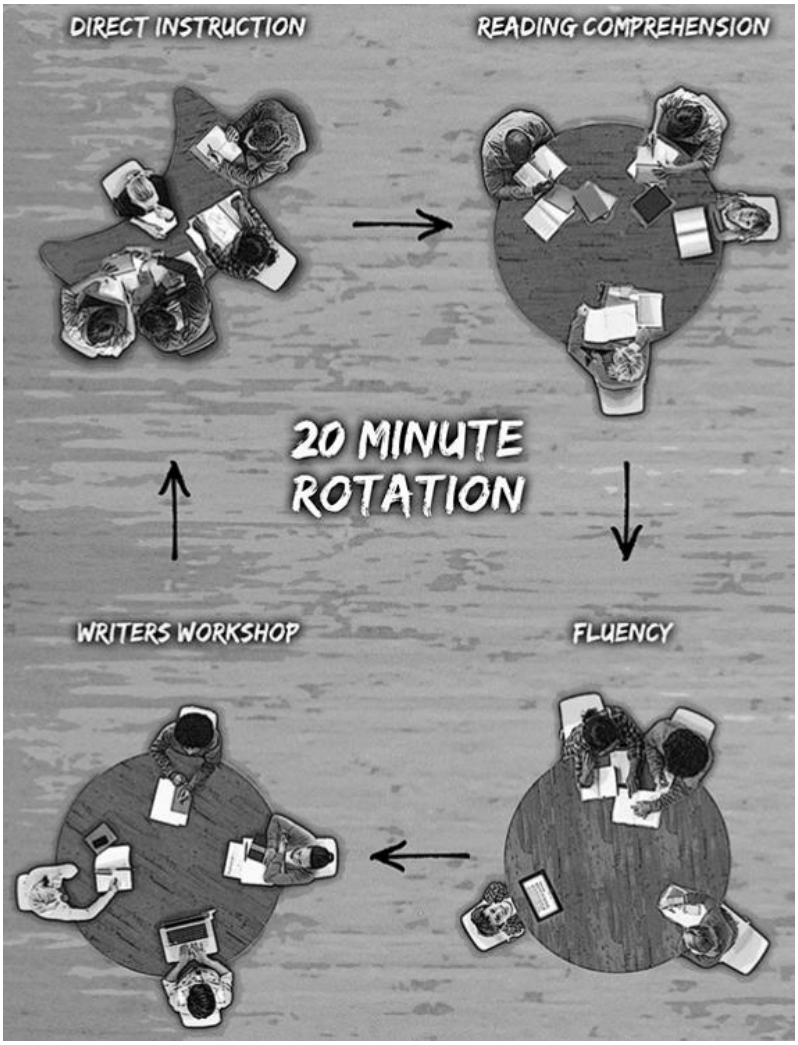
# Activity Description

## STEP 1: Explanation of the method

**Theoretical overview (5 minutes):**
Show the method

## STEP 2: Learning stations

**Activity: Learning stations (75 minutes):**
"Learning stations" is a teaching method that involves organizing the classroom into different activity centers or stations where students engage in various learning tasks. In this case the students have several stations for the different kinds of PPE. They inform themselves with scripts, videos or little experiments.




Quelle: 4 Strategies For Implementing Learning Stations In Your Classroom - (teachthought.com)

## STEP 3: Compare the results

The students present their results in the plenum.

| Station 1-4 | Station 5-8 | Station 9-12 |
|---|---|---|
| Safety Glasses/Goggles | Safety Gloves | Safety Shoes/Boots |
| Respirator Mask | Face Shield | Insulated Tools |
| High-Visibility Clothing | Ear Protection | Fire-resistant Clothing |
| Arc Flash Protection | Emergency Equipment | Safety Training |

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# Self-Driving Vehicles

## Lesson 1: Discovering Types, Advantages and Future

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 1:* ***Understanding the World of Autonomous Vehicles*** *from Unit 7:* ***Self-Driving Vehicles****.*

- **What is the goal of this activity?**

*The goal of this activity is for students to engage students in understanding the different types and advantages of self-driving vehicles through role-playing and debates, enhancing their critical thinking, public speaking, and collaborative skills.*

- **What are students going to learn and why is it important?**

*Students will gain a comprehensive understanding of self-driving vehicles, including their types and advantages while developing critical thinking, public speaking, collaboration, and research skills. They will learn to evaluate the technological, regulatory, environmental, and societal impacts of autonomous vehicles, and articulate diverse perspectives through structured debates.*

*This learning experience is crucial as it prepares students for a future shaped by advanced technologies, fostering informed and responsible citizenship. It also equips them with essential life skills such as critical thinking, effective communication, and teamwork, which are invaluable in both academic and professional settings.*

**- What are the things that students need to have covered as material to perform the exercise successfully?**

*They should be done with Lesson 1 from Unit 7 which focuses on a basic knowledge about Self-Driving Vehicles.*

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# Requirements

**Duration:** 60-90 minutes (1-2 hours)

**Format:** In this type of game there are debaters and an Audience so you should divide your class cca half and half according to the number of students

Example of Role and Audience Assignment:

For a class of 24 students:
**Debaters**: 12 students
Divide into 6 roles with 2 students per role (e.g., Automotive Engineers, Tech Company Representatives, etc.).

**Audience**: 12 students
Assign specific tasks to audience members to keep them engaged

**Resources:**

- Lists of paper
- Pens or markers
- Flipchart or Whiteboard (optional, for displaying game rules or information)
- Role descriptions
- Samrtphones (optional)

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# Activity Description

In this role-playing debate activity, students will explore the topic of self-driving vehicles, focusing on their types and advantages. Each student will be assigned a specific role, such as an automotive engineer, tech company representative, or environmental activist, and will present arguments from their assigned perspective. Through structured debates, students will develop critical thinking, public speaking, and collaborative skills, while the audience engages by asking questions and providing feedback, ensuring an interactive and educational experience for the entire class.

## STEP 1: Introduction of the activity and the rules

Explain the purpose of the activity: to recap the advantages of self-driving cars, their types but also see this topic from different types of views (roles).

## STEP 2: Dividing students to Roles and Audience

To ensure fairness and inclusivity, consider the following steps for assigning roles and selecting the audience:

### Role Assignment

**Volunteering and Interest**: Ask students to volunteer for roles they are interested in or feel passionate about. This can increase engagement and motivation.

**Random Selection**: If multiple students are interested in the same role, use a random selection method (e.g., drawing names from a hat) to decide.

**Rotation**: Rotate roles in subsequent debates or activities so that each student has the opportunity to participate in different capacities over time.

### Audience Selection

**Equal Distribution**: Ensure that every student gets an opportunity to be both a debater and an audience member by dividing the class equally. For example, if you have 24 students, you could have 12 debaters and 12 audience members, and switch roles in a future debate.

**Structured Roles**: Assign audience members specific tasks, such as note-taking, question preparation, or providing feedback. This ensures active participation and learning even when they are not debating.

**Switch Roles:** In the next debate session, rotate the students so that those who were in the audience now take on debating roles and vice versa.

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## Example Role Descriptions:

- Automotive Engineers:

Focus on the technological advancements and safety features of self-driving vehicles. Highlight the differences between fully autonomous and semi-autonomous systems.

- Tech Company Representatives:

Emphasize the innovation and potential for future developments in self-driving technology. Discuss the competitive advantages and market potential.

- Government Regulators:

Address the regulatory framework and safety standards for self-driving vehicles. Discuss the role of government in ensuring public safety and promoting technological advancements.

- Environmental Activists:

Highlight the environmental benefits of self-driving vehicles, such as reduced emissions and energy efficiency. Discuss the potential impact on urban planning and sustainability.

- Urban Planners:

Focus on how self-driving vehicles can change urban infrastructure and transportation planning. Discuss the potential for reducing traffic congestion and improving public transportation.

- Insurance Company Representatives: Address the impact of self-driving vehicles on insurance policies and risk assessment. Discuss potential changes in liability and premium calculations.

- Public Safety Advocates:

Emphasize the importance of safety and the potential reduction in accidents with self-driving vehicles. Discuss concerns and the need for rigorous testing and standards.

- General Public: Represent a diverse range of opinions from enthusiastic supporters to skeptical citizens.. Discuss personal experiences, potential benefits, and concerns about self-driving vehicles.

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# STEP 3: Explain the format of the debate

- Each group will present their viewpoint on the given debate topic.
- Each group will present their viewpoint on the given debate topic.
- Other students (audience) can ask questions or provide feedback at the end of each round.

**Debate Questions:**

1. **Safety**:
"How do self-driving vehicles enhance road safety compared to traditional vehicles?„
"What are the potential risks associated with self-driving technology, and how can they be mitigated?„

2. **Environmental Impact**:
"What are the environmental advantages of self-driving vehicles?„
"Can self-driving vehicles significantly reduce carbon emissions and traffic congestion?„

3. **Economic Impact**:
"How will the rise of self-driving vehicles affect employment in the transportation industry?„
"What are the economic benefits for consumers and businesses adopting self-driving technology?

4. **Regulation and Policy**:
"What role should government regulations play in the development and deployment of self-driving vehicles?„
"How can policymakers balance innovation and public safety in the realm of autonomous vehicles?„

**Conducting the Debate:**

- **Introduction:** Briefly introduce the topic and objectives of the debate. Assign roles and provide time for students to prepare.
- **Opening Statements:** Each group presents a 2-minute opening statement.
- **Debate Rounds:** Each debate topic is discussed in rounds (3-4 topics). Each group has 2-3 minutes to present their arguments followed by 1-2 minutes for rebuttals**.**
- **Audience Questions:** Allow audience members to ask questions and interact with the debaters.
- **Closing Statements:** Each group provides a 1-2 minute closing statement.
- **Debrief and Reflection:** Discuss what was learned and gather feedback from students.

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# STEP 4: Debrief and Reflection

**Objective**: The debrief and reflection session aims to consolidate learning, gather feedback, and allow students to express their thoughts and feelings about the activity**.**

**Duration**: 10-15 minutes

**Structure:** Group Reflection (5-7 minutes):
- What were the main arguments presented for and against self-driving vehicles?
- How did it feel to argue from the perspective of your assigned role?
- Were there any surprising points or perspectives you hadn't considered before?
- How did you handle any disagreements or challenges during the debate?

**Prompt Questions:**
Activity:
Conduct a brief group discussion where students share their experiences and insights. You can use a talking stick or another method to ensure everyone gets a chance to speak**.**

**Personal Reflection (3-5 minutes):**
Prompt Questions:
- What did you learn about self-driving vehicles that you didn't know before?
- Which skills do you think you improved during this activity?
- How can the knowledge and skills gained from this activity be applied in real-life situations?

- Activity**:**
Ask students to write a short personal reflection in their journals or on a piece of paper. Encourage them to be honest and thoughtful about their learning experience**.**

**Feedback and Suggestions (2-3 minutes):**
Prompt Questions:
- What did you enjoy most about the debate activity?
- What challenges did you encounter, and how could the activity be improved?

Activity:
Collect verbal feedback from students or distribute a quick feedback form to gather their thoughts on the activity's strengths and areas for improvement.

**Teacher Summary (2-3 minutes):**
Summarize the key points discussed during the debrief and highlight the importance of the skills and knowledge gained. Reinforce the value of considering multiple perspectives and the importance of effective communication and critical thinking in understanding complex issues like self-driving vehicles.

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**Example Summary:**

"Today, we delved into the fascinating and complex world of self-driving vehicles. By stepping into different roles, you explored various perspectives and arguments, which helped you develop a deeper understanding of the topic. I was impressed by your ability to articulate your points and engage in meaningful discussions. Remember, the skills you practiced today—critical thinking, public speaking, and empathy—are essential in many aspects of life. Great job, everyone!'

By following this debrief and reflection structure, you can help students solidify their learning and gain valuable insights into their experiences and personal development.

**Team members can freely discuss the scenarios, share ideas, and collaborate on identifying risks and proposing preventive measures**

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# Self-Driving Vehicles

## Lesson 2: Technology for autonomous vehicles

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 2:* ***Discovering Types, Advantages, and Future of Autonomous Vehicles*** *from Unit 7:* ***Self-Driving Vehicles****.*

- **What is the goal of this activity?**

*The goal of this activity is to provide students with a comprehensive and engaging understanding of the technology behind self-driving vehicles. By rotating through various interactive learning stations, students will explore key components such as sensors, machine learning, and autonomous navigation systems, while also considering the ethical and social implications. This hands-on, varied approach aims to cater to different learning styles, foster critical thinking, and stimulate curiosity about emerging technologies, ultimately equipping students with a deeper appreciation and knowledge of the innovations shaping the future of transportation..*

- **What are students going to learn and why is it important?**

*Students will learn about the technology behind self-driving vehicles, including the different types of sensors (such as LIDAR, radar, and cameras) and their functions, the role of machine learning and artificial intelligence in processing data and making driving decisions, and the principles of autonomous navigation systems. Additionally, they will explore the ethical and social implications of self-driving technology through interactive discussions and role-playing scenarios.*

*Understanding the technology behind self-driving vehicles is crucial as it represents a significant advancement in transportation that will likely impact many aspects of daily life, including safety, efficiency, and the environment. By gaining knowledge in this area, students are better prepared for future technological landscapes and can make informed decisions and contributions as future professionals and citizens. Additionally, the activity fosters essential skills such as critical thinking, problem-solving, and ethical reasoning, which are valuable in any field.*

**- What are the things that students need to have covered as material to perform the exercise successfully?**

They should be done with Lesson 2 from Unit 7 which focuses on a technologies for autonomous vehicles.

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# Requirements

**Duration:** 90 minutes (2 hours)

**Format:** In this type of gamified lesson called: "Autonomous Adventures " there will be 4 learning stations. Each station will be made by a group of students which will explain the technology used in autonomic vehicles such as sensors, machine learning, and autonomous navigation systems.

**Setup**: Number of Stations: 4

**Rotation Time:** 15 minutes per station

**Materials:** Provide materials specific to each station, including worksheets, digital devices, hands-on kits, etc.

**Timers:** Use timers to keep track of rotation times.

The Guidelines is made on an example when those are the main stations:

Station 1: LIDAR models, radar diagrams, camera components, interactive worksheets/apps.

Station 2: Video on AI and machine learning, quiz/discussion questions, tablets/computers.

Station 3: Coding platforms (e.g., Scratch), maze worksheets, toy cars.

Station 4: Scenario cards, role descriptions, discussion prompts.

General: Station passports, stickers/stamps, timers, journals/paper, writing utensils.

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# Activity Description

In this gamified lesson on self-driving vehicles, students will rotate through a series of interactive learning stations, each designed to explore different aspects of autonomous vehicle technology. Activities will include hands-on exploration of sensors and their functions, understanding machine learning and AI through videos and quizzes, programming virtual self-driving cars, and debating the ethical and social implications of this technology. This engaging, multi-faceted approach aims to cater to diverse learning styles, encourage active participation, and deepen students' understanding of the innovations shaping the future of transportation.

## STEP 1: Introduction of the activity and the rules

- Introduce the concept of learning stations and explain that students will rotate through different stations, each focusing on a unique aspect of self-driving vehicle technology.
- Explain the rules and expectations for behavior and participation at each station.
- Distribute a "station passport" where students can collect stamps or stickers after completing each station activity (Attachment)

## STEP 2: Learning Stations

**Station 1: Sensors and Perception**

- Activity: Explore the different types of sensors used in self-driving vehicles (e.g., LIDAR, radar, cameras). Students will match sensor types to their functions using an interactive worksheet or digital app.
- Objective: Understand how sensors collect data about the vehicle's surroundings.
- Materials: LIDAR models, radar diagrams, camera components, interactive worksheets/apps.

**Station 2: Machine Learning and AI**

- Activity: Watch a short video on how machine learning and AI enable self-driving cars to make decisions. : https://www.youtube.com/watch?v=gCm4fhv9WRI
- Follow up with a quiz or discussion questions.
- Objective: Learn about the role of AI and machine learning in processing sensor data and making driving decisions.
- Materials: Video, quiz/discussion questions, tablets/computers.

**Station 3: Autonomous Navigation Systems**

- Activity: Use a simple coding platform to program a virtual self-driving car to navigate through a course. Alternatively, use a maze activity with toy cars.
- Objective: Understand how autonomous navigation systems plan and follow routes.
- Materials: Coding platforms (e.g., Scratch), maze worksheets, toy cars.

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**Station 4: Ethical and Social Implications**

Activity: Participate in a role-playing scenario where students debate the ethical and social implications of self-driving vehicles (e.g., job displacement, safety concerns).
Objective: Reflect on the broader impact of self-driving technology on society.
Materials: Scenario cards, role descriptions, discussion prompts.

## STEP 3: Debrief & Reflection

1. **Group Discussion (10 minutes):**
Gather students and facilitate a discussion about their experiences at each station.
Prompt Questions: What was the most interesting thing you learned today?Which station activity did you enjoy the most and why?How do you think self-driving vehicles will impact our lives in the future?

2. **Personal Reflection (5 minutes):**
Ask students to write a short reflection in their journals or on a piece of paper about what they learned and how they feel about self-driving technology.

3. **Collect Station Passports (5 minutes):**
Collect the station passports and review the collected stamps or stickers to ensure all students participated in each activity.

**4. Summary and Conclusion:**
Summarize the key points covered in the lesson. Emphasize the importance of understanding the technology behind self-driving vehicles and the potential they hold for the future.

Encourage students to continue exploring and learning about emerging technologies.

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# Attachment: Station Passport

A "Station Passport" is a fun and interactive tool used to track student progress as they move through various learning stations in the classroom. Each student receives a passport at the beginning of the lesson, which contains sections or pages corresponding to each station they will visit.

Each page is dedicated to a different learning station.

- **Station 1: Sensors and Perception**

Brief description of the station activity. Space for a stamp or sticker upon completion. Reflection prompt: "What did you learn about the different sensors used in self-driving vehicles?„

- **Station 2: Machine Learning and AI**

Brief description of the station activity. Space for a stamp or sticker upon completion. Reflection prompt: "How does AI help self-driving vehicles make decisions?"

- **Station 3: Autonomous Navigation Systems**

Brief description of the station activity. Space for a stamp or sticker upon completion. Reflection prompt: "What challenges did you face while programming the virtual car?"

- **Station 4: Ethical and Social Implications**

Brief description of the station activity. Space for a stamp or sticker upon completion. Reflection prompt: "What are some ethical concerns related to self-driving vehicles?„

**Completion Page:** Space for overall reflections and feedback.

**Prompts**: "What was your favorite station and why?" "How do you think self-driving vehicles will impact our future?"Teacher's signature or stamp of completion.

## How to Use the Station Passport:

**Distribution:**
Hand out the Station Passports at the beginning of the lesson.

**Station Rotation:**
As students complete activities at each station, they get their passport stamped or stickered by the teacher or a designated student helper.

**Reflection:**
Students write brief reflections at each station, reinforcing what they learned and encouraging critical thinking.
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**Completion and Collection:**

After visiting all stations, students complete the final reflection page. Collect the passports to review student engagement and understanding.

**Benefits**:

- Engagement: Adds a fun, gamified element to the lesson.
- Tracking: Allows both students and teachers to track progress and participation.
- Reflection: Encourages students to reflect on their learning, enhancing retention and understanding.

The Station Passport is a simple yet effective tool to enhance the interactive and educational experience of the "Autonomous Adventures" lesson.

A preview from the station passport:

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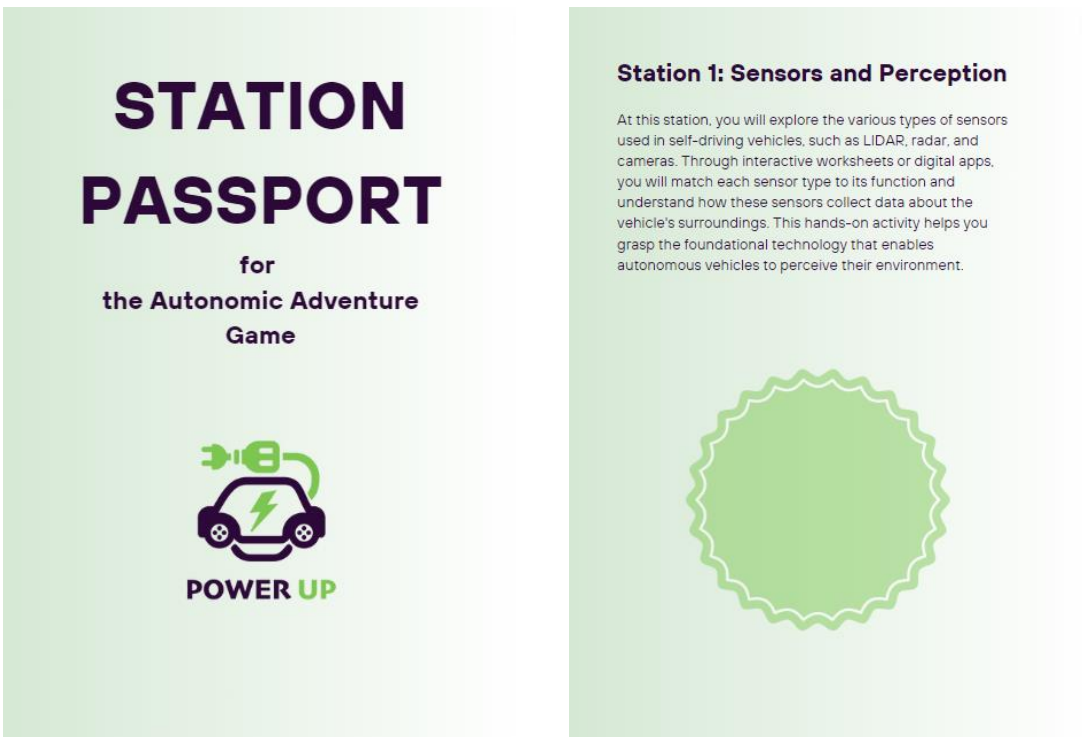


Full version of the station passport:
https://www.canva.com/design/DAGLHK5EkfU/_JT6Budlef-M2QYalN061g/watch?utm_content=DAGLHK5EkfU&utm_campaign=designshare&utm_medium=link&utm_source=editor

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# Self-Driving Vehicles

## Lesson 3: Questions for Students (Recap of UNIT 7: Designing their own self-driving vehicle)

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 3 :* ***Questions for Students*** *from Unit 7..*

- **What is the goal of this activity?**

*The goal of the "Design Your Own Futuristic Self-Driving Vehicle" activity is to encourage students to think creatively and innovatively about the future of transportation. By designing a vehicle with unique functions or technologies, students will apply their knowledge of autonomous vehicles in a fun and imaginative way..*

**- What are students going to learn and why is it important?**

*Through the "Design Your Own Futuristic Self-Driving Vehicle" activity, students will learn to apply their understanding of autonomous vehicle technology creatively and innovatively. They will deepen their knowledge of different types of autonomous vehicles, their advantages, and the cutting-edge technologies involved, such as sensors, mapping, and artificial intelligence. This activity is important because it fosters critical thinking, teamwork, and problem-solving skills, preparing students for future challenges in a rapidly evolving technological landscape. Additionally, it emphasizes the importance of innovation in driving progress and addressing real-world transportation needs.*

**- What are the things that students need to have covered as material to perform the exercise successfully?**

They should be done with Lesson 3 from Unit 7, focused on self-driving vehicles.

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# Requirements

**Duration:** 90 minutes (2 hours)

**Format:** This type of gamified lesson called: "Design your own Futitristic Vehicle" engage students in a creative design activity where they invent a new type of self-driving vehicle with unique functions and technologies that do not exist yet.

**Setup**: Team Formation (each team - 4-5 members)

**Materials:**

- Paper
- Markers or pens
- Poster boards
- Art supplies (optional: glue, scissors, magazines for college)
- Internet access for research (optional)
- Price for the winner

**Timers:** Use timers to keep track of rotation times.

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# Activity Description

In the "Design Your Own Futuristic Self-Driving Vehicle" activity, students will work in teams to brainstorm, design, and pitch a novel autonomous vehicle that incorporates unique functions or technologies not yet available. This engaging project encourages creative thinking and application of their knowledge about autonomous vehicle types, advantages, sensors, mapping, AI, and future trends. Each team will create a visual representation of their innovative vehicle and present a 3-minute pitch to the class, fostering collaboration, critical thinking, and a deeper appreciation for the technological advancements shaping the future of transportation.

## STEP 1: Introduction of the activity and the concept

- Introduce the activity its goals and rules to the students (Attachment 1)
- Explain the purpose of the "Design Your Own Futuristic Vehicle" activity and the importance of creative thinking in innovation..
- Divide students into teams of 4-5 members each, ensuring a mix of skills and knowledge levels within each team.

*Instructions: "Your task is to design a futuristic self-driving vehicle with a new function or technology that doesn't exist yet. Think about the types of autonomous vehicles we've discussed, their advantages, and the technologies involved. You'll need to create a visual representation of your vehicle and prepare a 3-minute presentation to pitch your idea to the class."*

## STEP 2: Brainstorming & Design

- Allow teams to brainstorm, design, and prepare their presentations.
- Provide materials, answer questions, and offer guidance as needed.
- Set the timer for 45 minutes

*Guidance: Use the materials provided to brainstorm and create a visual representation of your futuristic self-driving vehicle. Be sure to highlight the unique function or technology that makes your vehicle stand out. Prepare a 3-minute presentation to pitch your idea, explaining how it works and its benefits. You have 45 minutes to work on your project."*

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## STEP 3: Presentations

- Teams present their futuristic self-driving vehicle designs to the class, each of team has 3 minutes, they can use paper, tablets or anything else they made
- Facilitate the presentations and ensure smooth transitions between teams.

## STEP 4: Discussion & Voting

- Encourage students to interaction, feedback, and critical thinking
- Use the next 10 minutes for the discussion and voting process, moderate the discussion and the team with the most votes wins the challenge

## STEP 5: Wrap-up Discussion

- Summarize key points and reflect on learning, lead a discussion to highlight important takeaways and encourage reflection.
- Moderate the discussion and voting process, the team with the most votes wins the challenge

**Discussion Points:**

- Summarize the key points from each presentation.
- Discuss the importance of creativity and innovation in the field of autonomous vehicles.
- Reflect on the potential impact of these futuristic designs on society and technology.

**Script Example:** "Let's wrap up by summarizing the key points from each presentation. What did you find most innovative? How do you think these futuristic designs could impact the future of autonomous vehicles? Thank you all for your hard work and creativity today!„

**Learning Outcome:**
Students will learn to apply critical thinking and creativity to the design process, understand the potential future advancements in autonomous vehicle technology, and appreciate the importance of innovation in solving real-world problems.
This activity is both educational and enjoyable, allowing students to express their creativity while deepening their understanding of autonomous vehicles and their potential future developments.

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# Attachment: Rules

Objective: To design and pitch a new type of self-driving vehicle with unique features or technologies that do not currently exist.

**1. Team Formation**
Form teams of 4-5 members. Each team should include a mix of skills and knowledge to ensure diverse ideas and perspective

**2. Topic Assignment**
Each team is responsible for designing a self-driving vehicle that incorporates innovative functions or technologies not currently available. Teams will receive no specific topic but should focus on creating a unique and feasible vehicle concept.

**3. Preparation Time**
Teams have 45 minutes to brainstorm, design, and prepare their presentations. Use the materials provided and digital tools if necessary to create a visual representation of your vehicle and prepare a 3-minute pitch.Brief description of the station activity. Space for a stamp or sticker upon completion.
Reflection prompt: "What challenges did you face while programming the virtual car?"

**4. Presentation Guidelines**
Each team will present their vehicle concept to the class. Presentations must be 3 minutes long. Be clear and concise, explaining the vehicle's unique features, how it works, and its benefits.

**5. Visual Representation**
Teams must create a visual representation of their vehicle, such as a poster, drawing, or model. Creativity is encouraged, but the design should be clear and understandable.

**6. Pitch content**
During the pitch, each team should cover the following points:

Concept Overview: Describe the vehicle and its unique features.
Functionality: Explain how the vehicle operates and how it integrates new technologies.
Benefits: Discuss the advantages and potential impact of the vehicle on future transportation..

**7. Q&A Session**
After each presentation, there will be a 2-minute Q&A session where other students and the teacher can ask questions or provide feedback. Teams should be prepared to answer questions and engage in discussion.

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**8. Voting**
After all presentations, students will vote for the most innovative and feasible vehicle design. Each student can vote once but cannot vote for their own team. The team with the most votes will be recognized as the winner of the challenge.

**9. Respect and Collaboration:**
All team members should collaborate respectfully and share responsibilities equally. Listen to each other's ideas and provide constructive feedback.

**10. Time management**
Adhere to the time limits for both preparation and presentations. Teams will be given a warning when they have 1 minute remaining during their pitch.

These rules will ensure a structured and fair process, encourage creativity, and provide an engaging learning experience for all participants

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# 8

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# Charging Station Infrastructrue

## Lesson 1: Guide to EV Charging Infrastructure

POWER UP

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# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 1:* ***Guide to EV Charging Infrastructure*** *from Unit 8:* ***Charging Station Infrastructure***

- **- What is the goal of this activity?**
  *The goal of the activity called "Build the Ultimate Charging Network" activity is to engage students in the strategic planning and design of an optimal charging station infrastructure for a hypothetical city. Through this hands-on project, students will learn to consider various factors such as types of chargers, locations, energy sources, and user needs, fostering a deeper understanding of the complexities involved in supporting electric vehicle adoption.*

- **What are students going to learn and why is it important?**
  *Students will learn about the different types of charging stations and their specific uses, the importance of strategic placement and energy source considerations, and how to address diverse user needs within a city. This activity is important because it enhances critical thinking, problem-solving, and planning skills, preparing students to understand and tackle real-world challenges in the growing field of electric vehicles and sustainable transportation.*

.**- What are the things that students need to have covered as material to perform the exercise successfully?**
They should be done with introduction part in Lesson 1 from Unit 8 which is focusing on EV Charging Infrastructure.

# Requirements

**Duration:** 60 minutes (2 hours)

**Format:** Team with 4-5 members

**Resources:**

- Large city map (printed or projected) showing key locations such as residential areas, commercial zones, highways etc.
- Pens, markers and sticky notes
- Fact sheets or cards about different types of charging stations (Level 1, Level 2, DC Fast Chargers) and their characteristics
- Information cards about energy sources (solar, wind, grid elektricity)
- Scenario cards describing different user needs (e.g., daily commuters, long-distance travelers, commercial fleets)
- Evaluation criteria handout (criteria could include cost, efficiency, accessibility, and environmental impact)

# Activity Description

In the "Build the Ultimate Charging Network" activity, students are divided into teams and tasked with designing a comprehensive charging station infrastructure for a hypothetical city. Using a large city map, fact sheets on various types of chargers, and scenario cards detailing different user needs, teams will strategically plan the placement and types of charging stations, as well as the energy sources powering them. They will then present their plans, explaining their choices and how their network addresses factors like cost, efficiency, accessibility, and environmental impact. The activity culminates in a class discussion and evaluation of the different plans.

## STEP 1: Game Preparation & Introduction

**Preparation for the game:**

You need to have prepared in advanced these materials for each team:
- fact sheets
- scenario cards
- evaluation criteria handouts

Tips on how to prepare the cards you can be found in the attachment n. 1.

**Game introduction:**

- Begin by discussing the importance of charging infrastructure for electric vehicles and the different types of charging stations

- Explain the task: each team will design a charging station network for a hypothetical city, considering various factors such as types of chargers, locations, energy sources, and user needs.
- Explain the rules of the game (Attachment n.2)
- Time Allocation: 10 minutes

## STEP 2: Planning Phase

- Teams will spend 20 minutes planning their charging network.
- They must decide on the types and number of charging stations to place in different areas of the city.
- They need to consider the energy sources for the charging stations and how to meet the needs of different users.
- Teams should mark the locations of the charging stations on the city map and use sticky notes to indicate the type of chargers and energy sources.

## STEP 3: Presentation Phase

Each team will present their charging network to the class, explaining their choices and how their network meets the city's needs.

Presentations should cover:

- The types and locations of charging stations
- The chosen energy sources and their distribution
- How the network meets the needs of different user scenarios
- Considerations for cost, efficiency, accessibility, and environmental impact

## STEP 4: Evaluation and Discussion

- After all presentations, the class will discuss the different networks
- Use the evaluation criteria handout to guide the discussion
- Encourage students to ask questions and provide feedback on each others‘ plans
- Highlight the complexities and trade-offs ubvolved in designing a charging infrastructure

# Attachment n. 1: Game Cards

## Cards and their purpose

### 1. Fact Sheets

- **Purpose:** Provide students with key information and data to inform their design decisions.

- **Examples:**

- Types of Charging Stations: Describes Level 1, Level 2, and DC fast chargers
- Power and Capacity: Information on power output, charging times, and compatibility with various EV models
- Location Considerations: Factors to consider when choosing a location for charging

The link for downloading the examples of the cards or just the template:

https://www.canva.com/design/DAGMfz5CJ90/Dv_Sve70Qo7ILwyxkphY0g/view?utm_content=DAGMfz5CJ90&utm_campaign=designshare&utm_medium=link&utm_source=editor

### 2. Scenario Cards

- **Purpose:** Provide realistic and varied situations for teams to design their charging stations around.

- **Examples:**

- Urban Setting: High demand area in a city center.
- Suburban Setting: Residential area with moderate demand
- Rural Setting: Low-demand area with limited infrastructure.

The link for downloading the examples of the cards or just the template:

https://www.canva.com/design/DAGMgM0iWRE/fBuJ40cHkK7Fv4aUBquiLw/view?utm_content=DAGMgM0iWRE&utm_campaign=designshare&utm_medium=link&utm_source=editor

## Cards and their purpose

### 3. Evaluation Criteria Handouts

- **Purpose:** Offer a structured framework for assessing the quality and feasibility of each team's design.

- **Examples:**

- Efficiency: How well does the design meet charging needs efficiently?
- Sustainability: Does the design incorporate renewable energy sources or other sustainable practices?
- Accessibility: Is the charging station accessible to a diverse range of users, including those with disabilities?

The link for downloading the examples of the cards or just the template: https://www.canva.com/design/DAGMgLtOutU/Ys5VBSFgyZ5KSEwrbNzFrg/view?utm_content=DAGMgLtOutU&utm_campaign=designshare&utm_medium=link&utm_source=editor

## Summary of Cards Needed:

**1. Fact Sheets**: 5 cards covering different aspects of charging stations.

**2. Scenario Cards**: 5 cards each presenting a unique setting for the charging station.

**3. Evaluation Criteria Handouts**: 5 cards detailing different criteria to judge the designs.

These cards will provide the students with the necessary information, context, and framework to effectively design and present their charging station concepts.

# Attachment n.2: Game Rules

## Game Rules for "Design a Charging Statio“

**Objective:**

Design and present a comprehensive plan for an electric vehicle (EV) charging station based on a given scenario, using provided fact sheets and adhering to evaluation criteria.

- **TEAM FORMATION**

Form teams of 3-4 members. Each team should have a mix of skills and knowledge to encourage diverse ideas and collaboration.

- **RESEARCH AND PLANNING**

Teams use the fact sheets to research and plan their charging station design. They must consider the types of chargers, power and capacity, location considerations, safety regulations, cost and pricing, and sustainability.

Teams use the fact sheets to research and plan their charging station design. They must consider the types of chargers, power and capacity, location considerations, safety regulations, cost and pricing, and sustainability.

- **DESIGN CREATION (20 minutes)**

Teams create a visual representation of their charging station. This can be a drawing, poster, or digital presentation. The design should clearly illustrate the layout, types of chargers, and any innovative features.

Teams should use provided materials like paper, markers, or digital tools to create their visual representation.

- **PRESENTATION PREPARATION (10 minutes)**

Teams prepare a 5-minute presentation to pitch their charging station design. The presentation should include:

- An overview of the design
- Key features and technologies
- Justification for location and setup
- How the design meets the scenario requirements
- Considerations for efficiency, sustainability, accessibility, cost-effectiveness, and innovation

- **PRESENTATION AND Q&A**

Each team presents their design to the class. After the presentation, there will be a 2-minute Q&A session where other students and the teacher can ask questions or provide feedback.

Time management is crucial. Each team must adhere to the 5-minute presentation limit.

- **EVALUATION AND VOTING (10 minutes)**

After all presentations, students and the teacher will use the evaluation criteria handouts to assess each design. Criteria include efficiency, sustainability, accessibility, cost-effectiveness, and innovation.

Each student and the teacher can vote for the best design, but cannot vote for their own team. The team with the most votes wins the challenge.

- **WRAP-UP DISCUSSION (10 minutes)**

Conclude with a class discussion on the various designs, what was learned, and how these designs could impact the future of EV charging infrastructure. Discuss any real-world applications or considerations that emerged during the activity.

## General Game Rules:

- Collaboration: All team members must participate equally. Respect each other's ideas and contribute to the discussion.
- Originality: Designs must be original and created during the activity. Plagiarism or copying from other sources is not allowed.
- Respect: During presentations and the Q&A session, show respect to the presenting team by listening attentively and asking constructive questions.
- Time Management: Adhere to the time limits for each phase of the activity to ensure a smooth and fair process.

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# Charging Station Infrastructrue

Lesson 2: Questions for Students (Recap UNIT 8)

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 2:* ***Question for Students*** *from Unit 8:* ***Charging Station Infrastructure.***

- **What is the goal of this activity?**
  *The goal of the activity called „EV Transition Challenge" is to to test and enhance students' knowledge about the transition to electric vehicles, including infrastructure, societal readiness, and technical challenges, through an interactive Kahoot quiz and subsequent strategy development.*

- **What are students going to learn and why is it important?**
  *Students will deepen their understanding of the issues surrounding the transition to electric vehicles, such as infrastructure needs, societal attitudes, and technical challenges. This is important because it prepares them to think critically about real-world problems and develop innovative solutions that can facilitate a smoother transition to EVs.*

- .**What are the things that students need to have covered as material to perform the exercise successfully?**
  They should be done with introduction part in Lesson 2 from Unit 8 which is focusing on EV Charging Infrastructure.

# Requirements

**Duration:** 80 minutes (1,5 hours)

**Format:** Team with 4-5 members

**Resources:**

- Kahoot platform
- Computer or tablet for each student or team
- Projector or screen to display Kahoot questions
- Whiteboard or flipchart for group strategy development
- Markers and sticky notes

# Activity Description

In this activity, students will first participate in an interactive Kahoot quiz designed to test their knowledge on the transition to electric vehicles. Following the quiz, students will be divided into teams and given specific scenarios related to the EV transition. Each team will develop strategies to address their assigned scenario and then present their solutions to the class. The activity concludes with a wrap-up discussion to reflect on the quiz results and the proposed strategies.

## STEP 1: Introduction and Set Up

- Explain the Objective: Briefly explain the objective of the game and what the students are expected to learn.
- Organize Students: Divide the students into teams of 4-5 members. Ensure that each team has a mix of skills and knowledge to ensure diverse ideas and perspectives.
- Kahoot Setup: Make sure all students or teams have access to a computer or tablet for participating in the Kahoot quiz.
- Time Allocation: 10 minutes

## STEP 2: Kahoot Quiz

- Start the Quiz: Launch the Kahoot quiz on the projector or screen.
- Answer Questions: Students participate in the quiz, answering questions individually or collaboratively. Each question tests their knowledge on infrastructure needs, societal readiness, and technical challenges of EVs.
- Review Results: Briefly review the results of the quiz to identify areas where students performed well and where they might need more understanding.

## STEP 3: Strategy Development

- Assign Scenarios: Give each team a scenario card detailing a specific challenge related to the transition to EVs (e.g., “Develop a strategy to improve EV charging infrastructure in rural areas”). *
- Brainstorm Solutions: Teams brainstorm and create a strategy to address their assigned challenge. They use the whiteboard or flipchart to outline their ideas.
- Prepare Presentation: Each team prepares a 5-minute presentation to explain their strategy, including key points such as the concept overview, functionality, and benefits.

*next scenarios are available in the Attachment n.1

## STEP 4: Presentation and Discussion

- Team Presentations: Each team presents their strategy to the class, ensuring their presentation is clear and concise.
- Q&A Session: After each presentation, allow for a 2-minute Q&A session where other students and the teacher can ask questions or provide feedback.
- Class Discussion: Hold a class discussion to review and critique the strategies, exploring their practicality and effectiveness.

## STEP 5: Wrap-Up

- Summarize Key Points: Summarize the key points from the quiz and presentations.
- Reflect on Learnings: Encourage students to reflect on what they learned about the transition to EVs and the challenges involved.
- Final Thoughts: Discuss how the exercise helped them understand the complexities of EV adoption and the importance of developing innovative solutions.

# Attachment n. 1: Scenario Cards

## Examples of scenarios for the cards

### 1. Scenario 1: Rural Charging Infrastructure

- **Challenge:** Develop a strategy to improve EV charging infrastructure in rural areas where charging stations are scarce.

### 2. Scenario 2: Public Perception

- **Challenge**: Create a campaign to change public perception and reduce prejudice against electric vehicles.

### 3. Scenario 3: Environmental Benefits

- **Challenge: Challenge**: Create a campaign to change public perception and reduce prejudice against electric vehicles.

### 4. Scenario 4: Legislative Support

**Challenge:** Propose legislative measures to support the adoption of EVs, such as tax incentives and subsidies.

### 5. Scenario 5: Technical Innovation

**Challenge:** Identify a technical innovation that could significantly enhance the performance or convenience of EVs and develop a strategy to implement it.

# Attachement n.2: Game Rules

## Game Rules for "EV Transition Challenge “

**Objective:**

Design and present a comprehensive plan for an electric vehicle (EV) charging station based on a given scenario, using provided fact sheets and adhering to evaluation criteria.

- **TEAM FORMATION**

- Teams should consist of 4-5 students.
- Each team should assign roles (e.g., researcher, presenter, strategist).

- **KAHOOT QUIZ PARTICIPATION**

- Each student or team must answer the Kahoot questions individually or collaboratively.

- No external help or devices allowed during the quiz.

- **STRATEGY DEVELOPMENT**

- Teams must work collaboratively and use the materials provided.

- Each team has 20 minutes to develop their strategy and prepare their presentation.

- **DISCUSSION ETIQUETTE**

- Respectful communication and constructive feedback are mandatory..
- Teams should be prepared to answer questions from peers and the teacher.

- **TIME MANAGEMENT**

- Adhere to the time limits for each phase of the activity.

- Teams will be given a warning when they have 1 minute remaining for presentations.

# 9

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# Maintenance and Repair of EVs

## Lesson 1: Ensuring Electric Mobility Endurance

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# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 1:* ***Ensuring Electric Mobility Endurance*** *from Unit 9:* ***Maintenance and Repair of EVs.***

- **What is the goal of this activity?**
  *The goal of the activity called „EV Diagnostic Escape Room" is to simulate real-life EV diagnostic and maintenance scenarios, requiring students to apply their knowledge and problem-solving skills to "escape" the room.*

- **What are students going to learn and why is it important?**
  *In the EV Diagnostic Escape Room game, students will learn to apply diagnostic techniques and tools to solve real-life electric vehicle (EV) problems, enhancing their understanding of EV systems such as battery health, powertrain, high-voltage systems, and thermal management. This hands-on approach will develop their critical thinking, problem-solving, and teamwork skills. Understanding these diagnostic and maintenance processes is crucial for future automotive professionals, as it prepares them to address the technical challenges of modern EVs, ensuring safety, efficiency, and reliability in the growing electric vehicle industry.*

- **What are the things that students need to have covered as material to perform the exercise successfully?**
  They should be done with Lesson 1 from Unit 9 which is focusing on diagnostics and maintenance of electric vehicles.

# Requirements

**Duration:** 65 minutes (1 hour, 5 minutes)

**Format:** Team with 4-5 members

**Resources:**

- Puzzles and clues related to EV diagnostics
- Props and replicas of diagnostic tools or online game (if you are able to make it) which allow students to decide about steps in different scenarios of diagnostic
- If it‘s possible design the place where the game take place as an escape room
- Timer (projected)

# Activity Description

Students will be placed in an escape room setup where they must solve a series of puzzles related to EV diagnostics and maintenance to unlock the door and escape. Each puzzle will represent a different aspect of EV diagnostics, such as battery health checks, thermal management issues, and powertrain diagnostics.

## STEP 1: Preparation and Introduction to students

**Preparation:**

- Create stations representing different diagnostic challenges related to EV systems.
- Each station should have props, clues, and puzzles that lead to the next station or solution.
- Example stations: Battery Health, Powertrain, High-Voltage System, Thermal Management, and Vehicle Communication Network.

**Introduction to students:**

- Form teams of 4-5 students.
- Ensure a mix of knowledge and skills within each team.
- Explain the goal of the game and the rules (Attachment n. 1). The goal is to solve all diagnostic challenges and "escape" the room by finding the final solution.
- Emphasize the importance of teamwork, critical thinking, and applying their knowledge of EV diagnostic

- Allocated time for preparation and introduction: 15 min

## STEP 2: Begin the Game (30 min)

- **Battery Health Station**

- Provide a scenario with symptoms of battery issues.
- Students use a mock battery analyzer and interpret data to diagnose the problem.
- Solution leads to a clue for the next station.

- **Powertrain Station**

- Present a challenge involving the electric motor or drivetrain.
- Students use diagnostic software to identify a fault code and determine the issue.
- Solution provides a clue for the next station.

- **High-Voltage System Station**

- Set up a scenario involving the high-voltage system (e.g., inverter or converter issue)
- Students solve a puzzle related to voltage regulation or safety protocols.
- Solution gives a clue for the next station.

- **Thermal Management Station**

- Introduce a problem with the EV's thermal management system.
- Students use tools to diagnose temperature inconsistencies and suggest fixes.
- Solution provides a clue for the next station

- **Vehicle Communication Network Station**

- Present an issue with the vehicle's communication network (e.g., CAN bus).
- Students troubleshoot connectivity problems and identify the faulty component.
- Solution leads to the final clue.

## STEP 3: Final Challenge: Integrated Diagnostic Challenge

- Combine elements from previous stations into a comprehensive diagnostic scenario.
- Teams must apply knowledge from all stations to solve this final puzzle.
- Successful completion signifies they have "escaped" the room.

## STEP 4: Wrap-Up and Discussion

1. **DEBRIEF:**
- Discuss the solutions and diagnostic processes for each station.
- Highlight key learning points and common challenges.

**2. REFLECTION**
- Ask students to reflect on what they learned about EV diagnostics.
- Encourage them to share their thoughts on the importance of these skills in real-world scenarios.

**3. FEEDBACK**
- Gather feedback on the activity to improve future sessions.
- Celebrate team efforts and successful problem-solving.

# Attachement n.1: Game Rules

## Game Rules for "EV Diagnostic Escape Room“

**Objective:**

To collaboratively solve diagnostic challenges and escape the room by using your knowledge of electric vehicle (EV) systems and tools.

- **TEAM FORMATION**

- Teams should consist of 4-5 students.
- Each team should assign roles (e.g., researcher, presenter, strategist).

- **GAME CONDUCT**

**Collaboration**

- All team members must contribute to solving the challenges.
- Respect and listen to each team member‘s idea and inputs

**Equipment Handling**

- Treat all props and diagnostic tools with care.
- Do not force, break, or damage any equipment or materials.

**Resource of Usage**

- No use of phones, tablets, or external resources
- Utilize only the provided tools and information within the game setup.

- **STATION RULES**

**Sequential Progression**

- Complete each station before moving to the next one.
- Follow the clues and instructions precisely as provided at each station.

**Clue and Solution Management**

- Write down or memorize each clue or solution as you progress.
- Do not remove any clues or materials from the stations..

**Time Management**

- Allocate time efficiently at each station to ensure all challenges are addressed.
- Be mindful of the total game time and the time spent at each station.

- **INTERACTION AND BEHAVIOUR**

**Respect**

- Treat all classmates, teachers, and game materials with respect.
- No disruptive or distracting behavior during the game.

**Questions and Assistance**

- If your team is stuck, you may ask the instructor for one hint per station.
- Use hints wisely as they are limited.

**Fair Play**

- Do not interfere with other teams' progress or stations.
- Maintain integrity and honesty throughout the game.

- **SAFETY AND SUPERVISION**

**Safety First**

- Follow all safety instructions related to the use of diagnostic tools and props.
- Report any issues or accidents to the instructor immediately

**Supervision**

- The instructor will be present to supervise and assist as needed.
- Follow the instructor's guidance and instructions at all times.

**Final Challenge**

- Collaborate effectively to solve the final integrated challenge.
- Apply knowledge from all previous stations to find the solution.

**Wrap-Up**

- Participate actively in the debriefing session.
- Reflect on your learning experience and share insights with the class.

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# Maintenance and Repair of EVs

Lesson 2: Questions for Students (Recap UNIT 9)

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 1:* ***Ensuring Electric Mobility Endurance*** *from Unit 9:* ***Maintenance and Repair of EVs.***

- **What is the goal of this activity?**
  *The goal of the activity called „EV Diagnostic Escape Room" is to simulate real-life EV diagnostic and maintenance scenarios, requiring students to apply their knowledge and problem-solving skills to "escape" the room.*

- **What are students going to learn and why is it important?**
  *In the EV Diagnostic Escape Room game, students will learn to apply diagnostic techniques and tools to solve real-life electric vehicle (EV) problems, enhancing their understanding of EV systems such as battery health, powertrain, high-voltage systems, and thermal management. This hands-on approach will develop their critical thinking, problem-solving, and teamwork skills. Understanding these diagnostic and maintenance processes is crucial for future automotive professionals, as it prepares them to address the technical challenges of modern EVs, ensuring safety, efficiency, and reliability in the growing electric vehicle industry.*

- **What are the things that students need to have covered as material to perform the exercise successfully?**
  They should be done with Lesson 1 from Unit 9 which is focusing on diagnostics and maintenance of electric vehicles.

# Requirements

**Duration:** 65 minutes (1 hour, 5 minutes)

**Format:** Team with 4-5 members

**Resources:**

- Puzzles and clues related to EV diagnostics
- Props and replicas of diagnostic tools or online game (if you are able to make it) which allow students to decide about steps in different scenarios of diagnostic
- If it‘s possible design the place where the game take place as an escape room
- Timer (projected)

# Activity Description

Students will be placed in an escape room setup where they must solve a series of puzzles related to EV diagnostics and maintenance to unlock the door and escape. Each puzzle will represent a different aspect of EV diagnostics, such as battery health checks, thermal management issues, and powertrain diagnostics.

## STEP 1: Preparation and Introduction to students

**Preparation:**

- Create stations representing different diagnostic challenges related to EV systems.
- Each station should have props, clues, and puzzles that lead to the next station or solution.
- Example stations: Battery Health, Powertrain, High-Voltage System, Thermal Management, and Vehicle Communication Network.

**Introduction to students:**

- Form teams of 4-5 students.
- Ensure a mix of knowledge and skills within each team.
- Explain the goal of the game and the rules (Attachment n. 1). The goal is to solve all diagnostic challenges and "escape" the room by finding the final solution.
- Emphasize the importance of teamwork, critical thinking, and applying their knowledge of EV diagnostic

- Allocated time for preparation and introduction: 15 min

## STEP 2: Begin the Game (30 min)

- **Battery Health Station**

- Provide a scenario with symptoms of battery issues.
- Students use a mock battery analyzer and interpret data to diagnose the problem.
- Solution leads to a clue for the next station.

- **Powertrain Station**

- Present a challenge involving the electric motor or drivetrain.
- Students use diagnostic software to identify a fault code and determine the issue.
- Solution provides a clue for the next station.

- **High-Voltage System Station**

- Set up a scenario involving the high-voltage system (e.g., inverter or converter issue)
- Students solve a puzzle related to voltage regulation or safety protocols.
- Solution gives a clue for the next station.

- **Thermal Management Station**

- Introduce a problem with the EV's thermal management system.
- Students use tools to diagnose temperature inconsistencies and suggest fixes.
- Solution provides a clue for the next station

- **Vehicle Communication Network Station**

- Present an issue with the vehicle's communication network (e.g., CAN bus).
- Students troubleshoot connectivity problems and identify the faulty component.
- Solution leads to the final clue.

## STEP 3: Final Challenge: Integrated Diagnostic Challenge

- Combine elements from previous stations into a comprehensive diagnostic scenario.
- Teams must apply knowledge from all stations to solve this final puzzle.
- Successful completion signifies they have "escaped" the room.

## STEP 4: Wrap-Up and Discussion

1. **DEBRIEF:**
- Discuss the solutions and diagnostic processes for each station.
- Highlight key learning points and common challenges.

**2. REFLECTION**
- Ask students to reflect on what they learned about EV diagnostics.
- Encourage them to share their thoughts on the importance of these skills in real-world scenarios.

**3. FEEDBACK**
- Gather feedback on the activity to improve future sessions.
- Celebrate team efforts and successful problem-solving.

# Attachement n.1: Game Rules

## Game Rules for "EV Diagnostic Escape Room“

**Objective:**

To collaboratively solve diagnostic challenges and escape the room by using your knowledge of electric vehicle (EV) systems and tools.

- **TEAM FORMATION**

- Teams should consist of 4-5 students.
- Each team should assign roles (e.g., researcher, presenter, strategist).

- **GAME CONDUCT**

**Collaboration**

- All team members must contribute to solving the challenges.
- Respect and listen to each team member‘s idea and inputs

**Equipment Handling**

- Treat all props and diagnostic tools with care.
- Do not force, break, or damage any equipment or materials.

**Resource of Usage**

- No use of phones, tablets, or external resources
- Utilize only the provided tools and information within the game setup.

- **STATION RULES**

**Sequential Progression**

- Complete each station before moving to the next one.
- Follow the clues and instructions precisely as provided at each station.

**Clue and Solution Management**

- Write down or memorize each clue or solution as you progress.
- Do not remove any clues or materials from the stations..

**Time Management**

- Allocate time efficiently at each station to ensure all challenges are addressed.
- Be mindful of the total game time and the time spent at each station.

- **INTERACTION AND BEHAVIOUR**

**Respect**

- Treat all classmates, teachers, and game materials with respect.
- No disruptive or distracting behavior during the game.

**Questions and Assistance**

- If your team is stuck, you may ask the instructor for one hint per station.
- Use hints wisely as they are limited.

**Fair Play**

- Do not interfere with other teams' progress or stations.
- Maintain integrity and honesty throughout the game.

- **SAFETY AND SUPERVISION**

**Safety First**

- Follow all safety instructions related to the use of diagnostic tools and props.
- Report any issues or accidents to the instructor immediately

**Supervision**

- The instructor will be present to supervise and assist as needed.
- Follow the instructor's guidance and instructions at all times.

**Final Challenge**

- Collaborate effectively to solve the final integrated challenge.
- Apply knowledge from all previous stations to find the solution.

**Wrap-Up**

- Participate actively in the debriefing session.
- Reflect on your learning experience and share insights with the class.

# 10

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# Computer and Peripheral Equipment

## Lesson 1: Functions and Types

POWER UP

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# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 1:* ***Functions and Types*** *from Unit 10:* ***Computer and Peripheral Equipment.***

- **What is the goal of this activity?**
  *The goal of the "Electric Vehicle Showdown" is to reinforce students' understanding of electric vehicle components, charging technologies, and their impact on performance and the environment in a fun and engaging way. By participating in this interactive game, students will enhance their knowledge of how electric vehicles operate, identify key components, and analyze their advantages and challenges, prepairing them for future discussions and development in elektromobility.*

- **What are students going to learn and why is it important?**

Through the "Electric Vehicle Showdown," students will learn about the essential components of electric vehicles, including batteries, electric motors, and charging systems, as well as the principles of range, energy consumption, and environmental impact. Understanding these concepts is crucial as it equips students with the knowledge to evaluate and compare electric vehicles with traditional combustion engines, appreciate the benefits and limitations of current technologies, and anticipate future advancements. This knowledge is vital for making informed decisions about transportation technologies and contributing to discussions on sustainable mobility solutions.

- .**What are the things that students need to have covered as material to perform the exercise successfully?**
  They should be done with Lesson 1 from Unit 10 which is focusing on Functions and Types of computer and peripheral equipment.

# Requirements

**Duration:** 90 minutes (2 hours)
20 minutes for each round

**Format:** Team with 3-4 members

**Resources:**

- Question Cards (Attachment n. 2)
- Answer Sheets
- Markers and Whiteboard
- Timer
- Rules (Attachment n. 1)
- PowerPoint or similar digital tool

# Activity Description

In the "Electric Vehicle Showdown," students will engage in a competitive, interactive game designed to test and reinforce their knowledge of electric vehicles (EVs). Divided into small teams, students will answer a series of questions related to EV components, charging technologies, performance metrics, and environmental impacts. Each team will compete to earn points by providing accurate answers, with a 30-second time limit for each question. The activity is structured in four rounds, focusing on different aspects of electric vehicles, including their powertrain, charging systems, energy consumption, and environmental benefits. Through this engaging format, students will deepen their understanding of electric vehicle technologies, compare them to traditional combustion engines, and appreciate their role in sustainable transportation. The game fosters teamwork, critical thinking, and problem-solving skills, making it an effective and enjoyable way to learn about the future of mobility.

## STEP 1: Introduction

- Explain the activity's goals and rules (Attachment n.2), Introduce the "Electric Vehicle Showdown" and explain how it will help students understand EV components and technologies

Script Example: "Today, we're going to dive into the world of electric vehicles through a fun and competitive game called 'Electric Vehicle Showdown.' You'll work in teams to answer questions about EV components, charging technologies, performance, and environmental impacts. Let's see which team can showcase the most knowledge about electric vehicles!"

## STEP 2: Team Formation

Organize students into small teams to encourage collaboration and diverse input. Teams of 3-4 members strike a balance between inclusivity, effective teamwork, and efficiency, making them ideal for interactive and collaborative activities like the "Electric Vehicle Showdown."

# STEP 3: Game overview and Rules

Provide clear instructions on how the game will be played and scored.Rules:Teams will take turns answering questions related to EV components, charging technologies, performance, and environmental impact.

- Each correct answer earns points.
- Incorrect answers will be followed by a brief explanation from the teacher.
- Teams will have a limited time to answer each question (e.g., 30 seconds).
- The team with the most points at the end wins.

**Game Structure**:

- **Round 1: EV Components (20 minutes)**

Example Questions:
- What is the primary function of an electric vehicle's battery?
- How does an electric motor differ from an internal combustion engine?

- **Round 2: Charging Technologies (15 minutes)**

Example Questions:
- What are the different types of EV charging levels, and how do they affect charging time?
- Explain the impact of fast charging on battery life.

- **Round 3: Range and Energy Consumption (15 minutes)**

Example Questions:
- What factors influence the range of an electric vehicle?
- How does driving style affect energy consumption in electric cars?

- **Round 4: Pros and Cons & Environmental Impact (10 minutes)**

Example Questions:
- Compare the maintenance costs of EVs to internal combustion engines.
- What are the environmental benefits of electric vehicles compared to traditional cars?

# STEP 4: Scoring and Review

- Summarize scores and review key points.
- Announce the winning team and provide a brief review of the answers and explanations..

# STEP 5: Wrap-Up Discussion

- Reflect on the activity and discuss key learnings.
- Facilitate a brief discussion on what students found most interesting or challenging.

Discussion Points:

- What did you find most interesting about the different EV components and technologies?
- How does this knowledge help you understand the future of electric vehicles?

By following this structured approach, the Cybersecurity Risk Assessment - Electric Vehicle Edition game not only engages students actively in learning but also promotes critical thinking, teamwork, and practical application of cybersecurity principles in the context of electric vehicles.

**Learning Outcome:** Students will gain a deeper understanding of the various aspects of electric vehicles, including their core components, charging methods, energy efficiency, and environmental benefits. This activity also fosters teamwork, critical thinking, and effective communication skills.

# Attachement 1: Game Rules

## General Rules:

**1. Team Formation**

Form teams of 3-4 members. Each team should ensure that all members participate actively and contribute to the discussion.

**2. Question and Answer Format**

Teams must discuss and agree on an answer within 30 seconds after a question is presented. External sources (e.g., smartphones, textbooks) are not allowed.

**3. Question and Answers Format**

Teams must provide their final answer within the 30-second time limit. Answers must be clear and concise

**4. Question Categories**

Teams will select questions from categories including EV components, charging technologies, range and energy consumption, and environmental impact. Teams cannot skip questions once selected

**5. Scoring**

Points are awarded for each correct answer. Incorrect answer will be followed by a brief exmplanation from the teacher. Points will not be awarded for incorrect answer.

**6. Team interaction**

Teams can discuss answers internally but must not consult with other teams or use external aids during the game.

**7. Time management**

Teams must manage their discussion time effectively, adhering to the 30-second limit per question. No additional time will be provided.

**8. Presentations of Answers**

Teams must state their final answer clearly when the time is called. Once presented, answers cannot be changed.

**9. Behvior**

Maintain respectful and constructive communication within teams and with other teams. Disruptive behavior will not be tolerated.

**10. Final Scores**

The team with the highest score at the end of all rounds will be declared the winner. Final scores are recorded by the teacher and are not subject to change.

# Attachement 2: Questions for cards

Here are 30 questions for the "Electric Vehicle Showdown" game, covering various topics related to electric vehicles (EVs), including components, charging technologies, performance, and environmental impact. Each question is followed by the correct answer.

**Questions and Answers:**

**- Question:** What component of an electric vehicle stores electrical energy for propulsion?
**Answer:** Battery

**- Question:** What is the primary function of an electric motor in an EV?
**Answer:** To convert electrical energy into mechanical energy to drive the wheels.

**- Question:** Which type of battery is most commonly used in electric vehicles?
**Answer:** Lithium-ion battery

**- Question:** What is the term used to describe the distance an EV can travel on a single charge?
**Answer:** Range

**- Question:** What technology allows electric vehicles to be charged quickly?
**Answer:** Fast charging or DC fast charging

**- Question:** What is the term for the process of replenishing an electric vehicle's battery?
**Answer:** Charging

**- Question:** What is regenerative braking in an electric vehicle?
**Answer:** A system that recovers energy during braking and converts it back into electrical energy to recharge the battery.

**- Question:** Which type of charging connector is used for Tesla vehicles in the U.S.?
**Answer:** Tesla Supercharger connector

**- Question:** What is the environmental benefit of using electric vehicles compared to traditional internal combustion engine vehicles?
**Answer:** Reduced greenhouse gas emissions

**- Question:** What component controls the power distribution between the battery and the electric motor?
**Answer:** Controller or power inverter

**- Question:** What is the main advantage of a heat pump system in electric vehicles?
**Answer:** Improved efficiency for heating and cooling the cabin with less energy consumption.

**- Question:** Which sensor technology helps electric vehicles detect obstacles and other vehicles?
**Answer:** Radar

**- Question:** What is the purpose of the Vehicle-to-Grid (V2G) technology?
**Answer:** To allow EVs to feed energy back into the grid, helping to balance supply and demand.

**- Question:** What is the function of the onboard charger in an electric vehicle?
**Answer:** To convert AC power from the charging station into DC power to charge the battery.

**- Question:** What is the function of the onboard charger in an electric vehicle?
**Answer:** To convert AC power from the charging station into DC power to charge the battery.

**- Question**: Which type of electric motor provides high torque at low speeds and is often used in EVs?
**Answer:** Permanent magnet synchronous motor (PMSM)

**- Question:** What term describes the time it takes for an electric vehicle to recharge its battery to 80% capacity using fast charging?
**Answer:** Charging time

**- Question:** What is the main difference between Level 1 and Level 2 charging for electric vehicles?
**Answer:** Level 1 charging uses a standard household outlet, while Level 2 charging uses a dedicated charging station for faster charging.

**- Question:** Which component of an electric vehicle helps with mapping and localization for autonomous driving?
**Answer:** GPS or Global Positioning System

**- Question:** What is the role of thermal management systems in electric vehicles?
**Answer:** To regulate the temperature of the battery and motor to maintain optimal performance and safety.

**- Question:** How does an electric vehicle differ from a hybrid vehicle in terms of propulsion?
**Answer:** An electric vehicle is fully powered by electricity, while a hybrid vehicle uses both an internal combustion engine and an electric motor**.**

**- Question:** What is the significance of the EPA rating for electric vehicles?
**Answer:** It provides an estimate of the vehicle's energy efficiency and range on a single charge.

**- Question:** What is a key advantage of using an induction motor in electric vehicles?
**Answer**: It does not require permanent magnets, which can reduce costs and simplify the motor design.

**- Question:** What does the term "autonomous vehicle" refer to?
**Answer:** A vehicle that can operate and navigate without human intervention using sensors and artificial intelligence.

**- Question**: Which technology allows an electric vehicle to communicate with other vehicles and infrastructure?
**Answer:** Vehicle-to-Everything (V2X) communication

**- Question** What impact do electric vehicles have on urban air quality?
**Answer:** They reduce air pollution and improve urban air quality by eliminating tailpipe emissions.

**- Question:** What does "battery degradation" refer to in the context of electric vehicles?
**Answer:** The gradual reduction in battery capacity and performance over time and usage.

**- Question:** What is a common use of LIDAR technology in autonomous vehicles?
**Answer:** To create high-resolution maps and detect objects around the vehicle.

**- Question:** What is the function of the electric vehicle's Battery Management System (BMS)?
**Answer:** To monitor and manage the battery's health, charge levels, and safety.

**- Question:** How does the "charging infrastructure" affect the adoption of electric vehicles?
**Answer:** The availability and accessibility of charging stations can influence the convenience and feasibility of owning an EV.

**- Question:** What future technology is expected to enhance EV performance by improving battery energy density and charging speeds?
**Answer:** Solid-state batteries

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# Computer and Peripheral Equipment

Lesson 2: Peripheral devices in electric cars

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 2:* ***Peripheral devices in electric cars*** *from Unit 10:* ***Computer and Peripheral Equipment.***

- **What is the goal of this activity?**

  *The goal of the "Peripheral Device Relay Race" is to reinforce students' understanding of the key peripheral devices used in electric cars, including their functions and types. Through an engaging and competitive relay race format, students will enhance their recall and comprehension of these crucial components, fostering a deeper appreciation for the technological intricacies of electric vehicles.*

- **What are students going to learn and why is it important?**

*Through this activity, students will learn to identify and describe key peripheral devices in electric vehicles, such as batteries, electric motors, MCUs, onboard chargers, heat pumps, and DC/DC converters. Understanding these components is essential as it equips future automotive technicians and engineers with the knowledge to diagnose, repair, and innovate within the rapidly evolving field of electric mobility. This foundational knowledge is crucial for ensuring the efficient and safe operation of electric vehicles, thereby contributing to the advancement of sustainable transportation technologies.*

.**What are the things that students need to have covered as material to perform the exercise successfully?**

They should be done with Lessons 1 and 2 from Unit 10 which is focusing on Functions and Types of computer and peripheral equipment.

# Requirements

**Duration:** 45 minutes (1 hour)

**Format:** Team with 4-5 members

**Resources:**

- Flashcards with the names and descriptions of peripheral devices (battery, electric motor, MCU, on-board charger, heat pump, DC/DC converter).
- Cones or markers to define the relay race course.
- Markers and Whiteboard
- Scoreboard to keep track of team points
- Rules  (Attachment n. 1)
- Timer

The activity can be done in a classroom, gym, or outdoor space large enough to set up a relay race course.

# Activity Description

In the Peripheral Device Relay Race, students are divided into teams of 4-5 members. Each team participates in a relay race where members run to a midpoint, pick a flashcard with the name of a peripheral device, and then match it to its correct description at a designated area. Teams accumulate points based on the accuracy of their matches, with the team completing the relay with the most correct matches emerging as the winner. This activity combines physical movement with cognitive recall, making learning dynamic and enjoyable.

## STEP 1: Introduction

Preparation

- Prepare flashcards with the names of peripheral devices on one side and their descriptions/functions on the other.
- Set up a relay race course with cones or markers in the classroom or outdoor space.

When the setup will be ready, start to explain the rules of the game (Attachment n. 1) and the gial

## STEP 2: Team Formation

Organize students into small teams to encourage collaboration and diverse input. Teams of 4-5 members strike a balance between inclusivity, effective teamwork, and efficiency, making them ideal for interactive and collaborative activities.

Each team receives a blank flipchart and markers.

# STEP 3: Relay Race Procedure

Provide clear instructions on how the game will be played and scored. The entire relay race must be completed within 30 minutes. Teams should manage their time effectively to ensure all members participate and all flashcards are matched.

**Basic instructions:**

- At the start signal, the first member of each team runs to the midpoint, picks a flashcard with a device name, and runs to the designated area with device descriptions.
- The student matches the device name to its correct description by placing the flashcard in the appropriate slot or next to the correct description.
- The student then runs back to tag the next team member, who repeats the process.
- Each team member must participate at least once.

# STEP 4: Scoring and Review

- Points are awarded for each correctly matched flashcard.
- The team with the most correct matches at the end of the relay wins.
- In case of a tie, the team that finished first is the winner.

# STEP 5: Wrap-Up Discussion

1. **Summary of Key Points:**

Begin the wrap-up discussion by summarizing the key components covered in the activity: batteries, electric motors, MCUs, on-board chargers, heat pumps, and DC/DC converters.

2. **Reflection Questions:**

- Ask each team to share their experience during the relay race. What challenges did they face? How did they overcome them?
- Encourage students to reflect on the importance of each peripheral device in the functioning of electric vehicles. Which device did they find most interesting and why?3

3. **Application to Real-World Scenarios:**

- Discuss how the knowledge of these components is applied in real-world scenarios. For instance, how does understanding the function of the MCU help in diagnosing issues in an electric vehicle?
- Highlight recent advancements in electric vehicle technology related to these components and their impact on vehicle performance and sustainability.

**4. Feedback and Suggestions:**

Discussion Points:

- Invite students to provide feedback on the activity. What did they enjoy most? What could be improved for future iterations?
- Ask students for suggestions on other activities or topics they would like to explore in future lessons.

**4. Conclusion:**

Conclude the discussion by emphasizing the importance of understanding peripheral devices in electric cars. This knowledge is crucial for anyone pursuing a career in the automotive industry, particularly in the rapidly growing field of electric vehicles.

Encourage students to continue exploring and learning about electric vehicle technology, staying updated with the latest advancements and innovations.

The activity aims to provide a well-rounded understanding of peripheral devices in electric cars, fostering both academic knowledge and practical skills essential for future careers in the automotive and electric vehicle industries.

# Attachement 1: Game Rules

## General Rules:

- **Team Formation:** Form teams of 4-5 students. Ensure each team has a mix of skills and knowledge for diverse ideas and perspectives. Teams line up at the designated starting line.
- **Flashcard Preparation:** Flashcards with device names and descriptions are shuffled and placed at the midpoint of the relay course. Each flashcard represents a peripheral device and its corresponding description.
- **Relay Race Procedure:** At the start signal, the first team member runs to the midpoint, picks a flashcard with a device name, and runs to the area with device descriptions. Match the device name to its correct description by placing the flashcard in the appropriate slot or next to the correct description. The student then runs back to tag the next team member, who repeats the process. Each team member must participate at least once. Continue until all flashcards are matched or time runs out.
- **Scoring:** Points are awarded for each correctly matched flashcard. The team with the most correct matches at the end of the relay wins. In the event of a tie, the team that completed the relay race first is declared the winner.
- **Time Management:** The relay race must be completed within 30 minutes. Teams should manage their time effectively to ensure all members participate and all flashcards are matched.
- **Behavior**: Teams must work together respectfully and collaboratively. Do not interfere with other teams' progress or matches. Maintain fair play; any team found cheating will be disqualified**.**
- **Prohibited Actions:** Interfering with other teams' matches or flashcards. Cheating or dishonest behavior. Leaving your designated area during the race except when running to the midpoint or back.
- **Facilitator Role:** The facilitator/teacher will oversee the activity, keep time, and ensure fair play. The facilitator will tally scores and announce the winning team. The facilitator may provide hints or guidance if a team is struggling but will not directly solve matches.
- **Safety:** Ensure that the relay course is clear of obstacles to prevent accidents. Run safely and avoid collisions with other participants.
- **Respect and Collaboration:** Listen to each other’s ideas and work as a team. Share responsibilities and provide constructive feedback. Support your teammates and encourage each other.
- **Wrap-Up Discussion:** Participate in a wrap-up discussion to reflect on what was learned during the activity. Discuss the application of knowledge to real-world scenarios and provide feedback on the activity. These general rules ensure a fair, safe, and engaging learning experience for all participants, promoting teamwork, respect, and effective time management.

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# Computer and Peripheral Equipment

Lesson 3: Questions for Students (Recap UNIT 10 with the help of an educative game

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 3:* ***Peripheral devices in electric cars*** *from Unit 10:* ***Computer and Peripheral Equipment.***

- **What is the goal of this activity?**

  *The goal of the activity called "Electric Car Innovation Lab" is to engage students in a creative and collaborative process to brainstorm, develop, and present innovative ideas for the future of electric cars, focusing on the integration of computer and peripheral technologies. This activity aims to enhance students' understanding of the technological advancements and challenges in electric vehicle development.*

- **What are students going to learn and why is it important?**

*Students will learn about the critical role of computer and peripheral technologies in the manufacturing, operation, and optimization of electric cars. This knowledge is important because it prepares them for future careers in the automotive and technology sectors, fosters innovative thinking, and helps them understand the intersection of engineering and sustainability.*

.**What are the things that students need to have covered as material to perform the exercise successfully?**

They should be done with Lessons 1, 2, and most of the lesson 3 from Unit 10 where students can find questions and answers they should know about computer and peripheral equipment.

# Requirements

**Duration:** 90 minutes (2 hours)

**Format:** Team with 4-5 members

**Resources:**

- Flipcharts or large sheets of paper
- Markers and pens.
- Post-it notes
- Laptops or tablets (optional)
- Timer

# Activity Description

The Electric Car Innovation Lab is an interactive and collaborative activity designed to engage students in the creative process of brainstorming and developing innovative ideas for the future of electric cars. Over the course of 90 minutes, students will work in teams to explore how computer and peripheral technologies can be integrated or improved to enhance electric vehicles. Through brainstorming sessions, idea development, and presentations, students will gain a deeper understanding of the technological advancements and challenges in electric vehicle development. The activity culminates in a voting session and wrap-up discussion, fostering creativity, teamwork, and critical thinking skills.

## STEP 1: Introduction

- Prepare students for the game, explain the rules and goals
- Set up a relay race course with cones or markers in the classroom or outdoor space.

Example Brief: "Electric cars are revolutionizing transportation by offering cleaner, more efficient alternatives to traditional gasoline vehicles. As technology continues to advance, the integration of computer and peripheral technologies in electric vehicles (EVs) is becoming increasingly important. Today's activity will challenge you to think creatively and collaboratively to design innovative features or technologies for future electric cars."

## STEP 2: Team Formation

Divide the class into teams of 4-5 members, ensuring a mix of skills (e.g., technical, creative, analytical). Each team selects a team name related to electric vehicles, such as "Eco Innovators" or "Green Tech Gurus."

## STEP 3: Brainstorming Session

Example: Teams brainstorm ideas for innovative features or technologies

- IDEA 1: A solar- powered auxiliary battery that charges while driving
- IDEA 2: Advanced AI driven route planning that adapts in real-time and no traffic and weather conditions
- IDEA 3. A multi-functional dashboard display that integrates augmented reality (AR) for enhanced navigation and safety

Teams write each idea on post-it notes and stick them on a flipchart.

Each team brainstorms innovative ideas for electric cars focusing on one or more of the following aspects:

- Manufacturing
- Operation
- Optimization

Teams should consider how computer and peripheral technologies can be integrated or improved.

## STEP 4: Idea Development

- Teams select their top three ideas from the brainstorming session.
- Teams develop each idea further by detailing the technology, functionality, and benefits.
- Teams create a visual representation or diagram of each idea on the flipchart.

Example: Teams select their top three ideas and develop them further.

Top Idea: The solar-powered auxiliary battery.
Details: Describe how the solar panels would be integrated into the car's design, the expected energy output, and the impact on range and efficiency.
Visual Representation: A diagram showing the placement of solar panels and the energy flow to the battery.

The activity should take 20 minutes.

## STEP 5: Presentations

Presentations Preparation (10 minutes)

- Example: Teams prepare a 5-minute presentation for their top idea.
- Content: Overview of the solar-powered auxiliary battery, its functionality, benefits, and a visual diagram.
- Practice: Teams rehearse their presentation to ensure clarity and timing.

Presentations (20 minutes):

- Example: Each team presents their idea to the class.
- Team Presentation: "We propose integrating solar panels into the roof and hood of the car to power an auxiliary battery. This will extend the vehicle's range, reduce dependency on charging stations, and enhance overall efficiency. Here's a diagram showing our design...„
- Q&A: Other students and the teacher ask questions about the feasibility and benefits of the idea.

# STEP 6: Voting and Wrap-Up Discussion

**Voting:**

- Students vote for the best idea and discuss the results.

**Discussion:**

- Reflect on the activity and discuss the importance of innovation in electric vehicles.

Example: Reflect on the activity and what was learned.
Teacher-led Discussion: "Let's talk about what we've learned today. Why do you think innovation is crucial for the future of electric vehicles? How can computer and peripheral technologies further improve EVs?„
Student Feedback: Students share their thoughts and insights from the activity.

# Attachement 1: Game Rules

**Rules for the Electric Car Innovation Lab**

**Objective:** To design and pitch innovative features or technologies for future electric cars, focusing on the integration of computer and peripheral technologies.

**1. Team Formation:**

- Form teams of 4-5 members.Ensure a mix of skills within each team (e.g., technical, creative, analytical).

**2. Brainstorming Session:**

- Teams will have 20 minutes to brainstorm as many ideas as possible.
- Each idea should be written on a post-it note and placed on a flipchart or large sheet of paper.
- All team members must contribute ideas. There are no bad ideas during brainstorming – be creative and think outside the box.

**3. Idea Development**:

- After brainstorming, each team selects their top three ideas.Teams will spend 20 minutes developing these ideas further.Develop details for each idea, including functionality, benefits, and visual representation.

- Create diagrams, sketches, or any other visual aids that will help explain the idea**.**

**4. Presentation Preparation:**

Teams have 10 minutes to prepare a 5-minute presentation for their top idea.The presentation should include:

- Concept overview.
- Functionality and integration of new technologies.
- Benefits and potential impact on future transportation.

Teams should rehearse their presentation to ensure clarity and timing.

**5. Presentations:**

- Each team will present their idea to the class within 5 minutes.
- The presentation must be clear and concise, using visual aids to support the explanation.
- After each presentation, there will be a 2-minute Q&A session where other students and the teacher can ask questions or provide feedback.

**6. Voting:**
- After all presentations, students will vote for the most innovative and feasible idea**.**
- Each student can vote once but cannot vote for their own team's idea.
- Voting will be conducted using a show of hands or an anonymous ballot.
- The team with the most votes will be recognized as the winner of the challenge**.**

**7. Wrap-Up Discussion:**
- A 10-minute wrap-up discussion will follow the voting.
- Discuss the importance of innovation in electric vehicles and the role of computer and peripheral technologies.
- Reflect on the activity and share insights or key takeaways.

**General Game Rules:**

- **Respect all team members and their ideas.**
- **Collaborate and communicate effectively within your team.**
- **Adhere to the time limits for each step of the activity.**
- **Engage actively during brainstorming, development, and presentations.**
- **Provide constructive feedback during Q&A sessions.**
- **Focus on creating feasible and innovative solutions that could realistically enhance electric vehicles.**
- **By following these rules, students will engage in a structured, yet creative, process to explore and innovate the future of electric vehicles, enhancing their understanding and skills in the field.**

# 11

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# Electric Car Component Guessing Game

Unit 11, lesson 1

POWER UP

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# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 1:* ***Fundamentals of Powertrain Systems*** *from Unit 11:* ***Powertrain Traction: From Fundamentals to Advanced Technologies***

- **What is the goal of this activity?**
  *The goal of this activity is to reinforce understanding of the components of an electric powertrain system in electric cars.*

- **- What are students going to learn and why is it important?**
  *Students will learn to identify and match key components of an electric powertrain system in electric cars, reinforcing their understanding of how these components work together to power the vehicle. .*

- **What are the things that students need to have covered as material to perform the exercise successfully?**

*To ensure student success, make sure that they are already acquainted with* ***Lesson 1 of Unit 11:*** **Powertrain Traction: From Fundamentals to Advanced Technologies**

# Requirements

**Duration:** 40 minutes broken down as follows:

- Introduction and Explanation of the Activity (10 minutes)
- Brainstorming (10 minutes)
- Card Matching (10 minutes)
- Final Review and Reflection (5 minutes)

**Format:** Team (3-4 students per group)

**Resources:**

- Large, flip chart sheets of paper or whiteboards
- Markers
- Access to relevant electric vehicle powertrain components and information (access to internet)
- flashcards or printed images of electric car components (Annex 1)
- Answer Key (Annex 2)

# Activity Description

Here you want to describe how the activity proceeds – consider how you can break down and describe the activity in steps and present it as follows.

## STEP 1: Introduction and Explanation of the Activity (10 minutes)

Divide the class into small groups of 3-5 students.

- Distribute the flashcards group. (Annex 1)
- Explain to the students that they will play a matching and guessing game to correctly identify and match each component with its corresponding function or description.
- Display the large poster board or whiteboard where the matches will be made.

## STEP 2: Brainstorming (10 minutes)

- Each group collaboratively discusses electric car components with their functions or descriptions on the board.

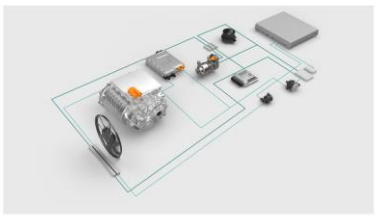
## STEP 3: Card Matching(10 minutes)

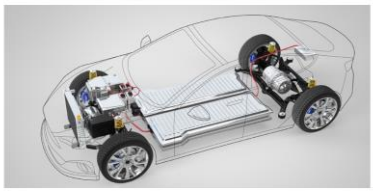
- Groups match the electric car components with their functions or descriptions on the board.

## STEP 4 Final Review and Reflection(10 minutes)

- Once all groups have completed their matches, review the answers together as a class.
- Provide feedback and clarification on any components that were matched incorrectly. (Annex 2)

# Annex 1:
## Flash Cards





# Annex 1:
## Flash Cards

**Drivetrain**

Transfers power from the electric motor to the wheels.

**Regenerative Braking System**

Captures kinetic energy during braking and converts it into electrical energy to recharge the battery pack.

**Inverter**

Converts direct current electricity from the battery pack into alternating current electricity to power the electric motor.

**Transmission System**

The transmission transfers power from the motor to the wheels.

**Thermal Management System**

Manages the temperature of the battery pack, electric motor, and other components to ensure optimal performance and longevity.

**Battery Pack**

Stores electrical energy for powering the electric motor.

**Power Electronics**

Captures kinetic energy during braking and converts it into electrical energy to recharge the battery pack.

**Electric Motor**

Converts electrical energy into mechanical energy to drive the wheels.

# Annex 1:

# Key:

| COMPONENT | FUNCTION |
|---|---|
| Regenerative Braking System | Captures kinetic energy during braking and converts it into electrical energy to recharge the battery pack. |
| Thermal Management System | Manages the temperature of the battery pack, electric motor, and other components to ensure optimal performance and longevity. |
| Battery Pack | Stores electrical energy for powering the electric motor. |
| Electric Motor | Converts electrical energy into mechanical energy to drive the wheels. |
| Transmission System | Transfers power from the motor to the wheels. |
| Inverter | Converts direct current electricity from the battery pack into alternating current electricity to power the electric motor. |
| Power Electronics | Includes components such as inverters, converters, and motor controllers that regulate the flow of electricity between the battery pack and electric motor. |
| Drivetrain | Transfers power from the electric motor to the wheels. |

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# Electric Car Powertrain Design

Unit 1, lesson 2

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# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity related to the material covered in lesson Lesson 2 "**Advanced Powertrain Technologies. Electric Powertrain."** from unit 11 "**Powertrain Traction: From Fundamentals to Advanced Technologies ."***

- **What is the goal of this activity?**
  *The goal of this activity is to analyze and discuss the building of powertrains for different types of electric vehicles, considering their specific characteristics, advantages, disadvantages, efficiency, and competitiveness compared to traditional cars.*

- **What are students going to learn and why is it important?**
  *This activity encourages critical thinking, collaboration, and holistic understanding of electric vehicle technology and its implications for the automotive industry. It provides participants with an opportunity to explore real-world applications and challenges of electric powertrains while fostering meaningful dialogue and knowledge exchange.*

**- What are the things that students need to have covered as material to perform the exercise successfully?**
*"To ensure student success, make sure that they are already acquainted with Unit 1 of Lesson 2: **Advanced Powertrain Technologies. Electric Powertrain.***

# Requirements

**Duration:** 55-60 minutes

**Format:** Team (3-4 students per group)

**Resources:**

- Classroom with seating arrangements conducive to group discussions
- Cards with different types of electric vehicles (see annex 1)
- Cards with Guiding Questions (Annex 1)
- Research resources (internet access)
- Writing materials for note-taking

# Activity Description

## STEP 1: Introduction and Objective Setting (10 minutes)

- Explain the objective of the lesson: to analyze and discuss the building of powertrains for different types of electric vehicles, considering their specific characteristics, advantages, disadvantages, efficiency, and competitiveness compared to traditional car.

## STEP 2: Team Formation (5-10 minutes)

Annex 1

- Divide participants into small groups, randomly assigning each group a two cards. A Task Card and a Group Card containing a type of electric vehicle as a topic: electric RV, electric race car, electric lorry or electric three-wheel car.

## STEP 3: Research and Analysis

(20 minutes)

- Instruct each group to conduct research on their assigned type of electric vehicle, focusing on its unique characteristics, weight distribution, intended use, and potential challenges.

## STEP 4: Presentation and Debate (15 minutes)

- Let each group share their discoveries and suggestions with the others. Encourage debates on the benefits of electric powertrains for their specific vehicle type, looking at different viewpoints and possible compromises.

# Annex 1:

## Task Card

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### ELECTRIC CAR POWERTRAIN DESIGN

15-20 min

- Research your assigned type of electric vehicle (race car, lorry, three-wheel car, or mini car).
- Analyze the powertrain design considering factors like motor placement, battery capacity, transmission options, and overall efficiency.
- Evaluate the efficiency and competitiveness of electric powertrains for your assigned vehicle type compared to traditional counterparts. Discuss potential barriers and opportunities

## Group Card

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### VEHICLE TYPES

1 Electric Race Car

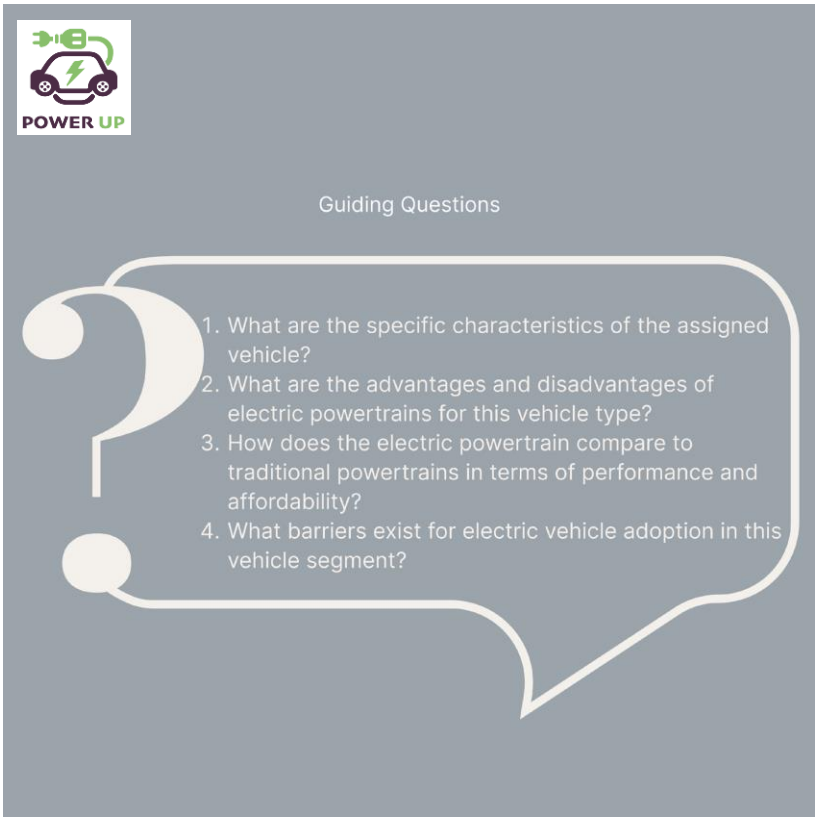
2 Electric Semi Truck

3 Electric Three-Wheeler

4 Electric RV

# Annex 1:

## Guiding Questions



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# Electric Car Maintenance Roleplay

Unit 11, lesson 3

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity related to the material covered in lesson Lesson 3 "**Navigating Innovation: Current Trends in Electric Vehicle Development"** from Unit 11 "**Powertrain Traction: From Fundamentals to Advanced Technologies"***

**- What is the goal of this activity?**

*The goal is to understand the importance of maintenance and diagnostics in powertrain systems of electric cars through interactive roleplay and problem-solving.*

- ***What are students going to learn and why is it important?***

*Through this activity, students will learn to:*

- *Gain a deeper understanding of the maintenance challenges and potential consequences associated with neglecting powertrain systems in electric cars.*
- *Learn about the role of preventive maintenance measures and effective diagnostics in ensuring the reliability, performance, and longevity of electric vehicles.*
- *Problem-solving to cultivate creativity for real-world challenges.*
- *Understand the significance of proactive maintenance practices in maximizing the efficiency and sustainability of electric cars, contributing to a cleaner and greener transportation future.*

- **What are the things that students need to have covered as material to perform the exercise successfully?**

*"To ensure student success, make sure that they are already acquainted with Unit 1 of Lesson 3: Maintenance and Diagnostics of Powertrain Systems*

# Requirements

**Duration:** 60 min

- Introduction and Objective Setting: 5 minutes
- Team Formation: 5-10 minutes
- Rules explanation: 10 minutes
- Instruction and Preparation : 15 minutes
- Roleplay: 30-40 minutes
- Wrap up: 10 minutes

**Format:** Team (3-4 students per group)

**Resources:**

- Character role cards for "Bad Owner" and "Mechanic."
- Scenario cards.
- Access to internet or resources for research during brainstorming sessions

**Rules**:

- Students must stay in character and adhere to their assigned roles throughout the roleplay session.
- The scenarios should focus on maintenance challenges and neglect rather than physical damage to the electric car.

# Activity Description

## STEP 1: Introduction and Objective Setting (5-10 minutes)

- Explain the objectives of the lesson.

## STEP 2: Team Formation (5-10 minutes)

- Encourage students to pull cards, thus randomizing the distribution in teams: the "Bad Owner" group and the "Mechanic" group.

## STEP 3: Rules explanation (10 minutes)

- Provide each group with scenario cards depicting different maintenance challenges related to powertrain systems in electric cars.

# Activity Description

## STEP 4: Instruction and Preparation (15 minutes)

- Instruct the "Bad Owner" group to brainstorm and discuss ways to neglect maintenance and worsen the given scenarios. Encourage them to think creatively about how poor maintenance decisions can impact the electric car's performance.

- Instruct the "Mechanic" group to brainstorm and discuss strategies to address and resolve the maintenance challenges presented by the "Bad Owner" group. Encourage them to consider diagnostic techniques, repair methods, and preventive measures.

## STEP 5: Roleplay (20-30 minutes)

- Facilitate a roleplay session where the "Bad Owner" group presents their scenarios and actions to the "Mechanic" group, who then respond with their proposed solutions.
- Encourage students to engage in dialogue, problem-solving, and negotiation during the roleplay session.
- After each scenario, facilitate a debriefing discussion where students reflect on the consequences of neglecting maintenance and the importance of proactive upkeep for electric cars.

## STEP 6: Wrap up (10 minutes)

- Conclude the activity by summarizing key takeaways and reinforcing the significance of maintenance and diagnostics in powertrain systems of electric vehicles.

# Annex 2:

## Bad Owner

Brainstorm and discuss ways to neglect maintenance and worsen the given scenarios. Think creatively about how poor maintenance decisions could impact the electric car's performance. Present your scenarios and actions to the "Mechanic" group, who will then respond with their proposed solutions.

Example Replicas:

"I always use the fastest charger because I've got places to be and no time to waste. Now the range has gone down, but honestly, I'll just charge it more often. Problem solved. Next!"

"The charging port is filthy, you say? Well, it's not a teacup! I just jam the plug in until it works. If it doesn't, I give it a good whack. That's how you fix things."

*Stay in character and adhere to their assigned roles throughout the roleplay session. The scenarios should focus on maintenance challenges and neglect, rather than physical damage to the electric car.*

# Annex 2:

## Car Mechanic

Brainstorm and discuss ways to address and resolve the maintenance challenges presented by the "Bad Owner" group. Consider diagnostic techniques, repair methods, and preventive measures.

Example Replicas:

"Using fast chargers all the time is like feeding your car a diet of pure espresso shots. Sure, it's quick, but it'll leave your battery feeling like it's run a marathon. Let's check the battery's health and devise a charging plan that balances speed and longevity."

"Your charging port is the lifeline of your electric car, not a stubborn jar of pickles. Shoving and whacking will only lead to more headaches. Let's give it a proper clean and ensure a perfect connection every time."

*Stay in character and adhere to their assigned roles throughout the roleplay session. The scenarios should focus on maintenance challenges and neglect, rather than physical damage to the electric car.*

# Annex 2:

Example Scenarios:

The owner uses tires not recommended for electric vehicles.

The owner always leaves the car plugged in overnight, even when the battery is already full.

The owner ignores all prompts to update the car's software.

The owner skips regular maintenance checks.

12

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# Future Trends and Innovations in EVs

## Lesson 1: Navigating the Electric Horizon

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# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 1:* ***Navigating the Electric Horizon*** *from Unit 12:* ***Future Trends and Innovations in EVs.***

**What is the goal of this activity?**
*For this lesson, you can use the game called ,"EV Innovation Jeopardy". The goal of this game is to reinforce students' understanding of current and future trends in electric vehicles by engaging them in a competitive, quiz-based game. This activity encourages students to recall and apply key concepts, fostering a deeper comprehension of advanced EV technologies and their implications for the future of transportation.*

**What are students going to learn and why is it important?**
*Students will learn about cutting-edge developments in electric vehicle technology, including Solid-State Batteries, Vehicle-to-Grid (V2G) technology, Autonomous Driving, AI Integration, Advanced Charging Infrastructure, and Advanced Driver-Assistance Systems (ADAS). Understanding these concepts is crucial for future mechanics as these innovations will shape the automotive industry. The knowledge gained will prepare students to work with the latest EV technologies and to anticipate future trends, making them more adaptable and forward-thinking professionals.*

**What are the things that students need to have covered as material to perform the exercise successfully?**
*They should be done with Lesson 1 from Unit 12 which is focusing on trends and innovations in electric vehicles industry.*

# Requirements

**Duration:** 90 minutes (1 hour)

**Format:** Team with 3-4 members

**Resources:**

- Projector or large screen fit the Jeopardy board setup
- Internet access (if using online Jeopardy tools) or a pre-made Jeopardy board (physical or digital)
- Buzzers (if available) or another method to determine which team answers first.
- Notepads and pens for teams
- Markers and Whiteboard for scoreboard (could be digital)
- Timer
- Rules  (Attachment n. 1)

# Activity Description

"EV Innovation Jeopardy" is a team-based quiz competition designed to review and reinforce knowledge of key trends and innovations in the electric vehicle industry. The game is structured into multiple categories, each representing a significant area of study such as Battery Advancements, Autonomous Driving, and Advanced Charging Infrastructure. Teams take turns selecting questions from the board, with each question carrying a different point value based on difficulty. The game concludes with a Final Jeopardy round, where teams wager their points on a challenging question. This activity combines fun and learning, ensuring that students actively engage with the material and retain critical information.

## STEP 1: Introduction

**Explain the activity's goals and rules (Attachment n.1)**
Introduce the „EV Innovation Jeopardy" and explain how it will help students understand trends and innovations in Evs

- The game is structured as a traditional Jeopardy game, with categories and point values displayed on a board.

- Teams take turns choosing questions from the board, answering them to earn a point
- The introduction should take about 5 minutes

## STEP 2: Team Formation

Organize students into small teams to encourage collaboration and diverse input. Teams of 3-4 members strike a balance between inclusivity, effective teamwork, and efficiency, making them ideal for interactive and collaborative activities like the " EV Innovation Jeopardy.„

This step takes about 5 minutes

# STEP 3: Jeopardy Game Play

Provide clear instructions on how the game will be played and scored.

**Game Setup**:

Ensure the Jeopardy board is visible on the screen or whiteboard.

**Game Categories (examples):**

- Solid-State Batteries
- V2G Technology
- Autonomous Driving
- Advanced Charging Infrastructure
- Advanced Driver-Assistance Systems (ADAS)
- Electric Vehicle Market Trends
- Environmental Impact of Evs

For each category, there should be prepared 5 questions. The example questions you will find in the Attachment n. 2 of this guideline.

**About the rounds and questions:**

Each team will take turns selecting a category and point value. When the team chooses, the teacher read out the question. The first team to buzz in will get to answer. A correct answer earns points, but a wrong answer costs points, so teams should choose carefully.

In the next rounds, the questions should be more challenging. The same rules applied. Note: It‘s up to you how many rounds will you prepare for the students. Our suggestion is 2 rounds.

Final Jeopardy Question Example:

- "Which future trend in EVs is most likely to have the greatest impact on reducing greenhouse gas emissions, and why?„

- Expected Answer: "Vehicle-to-Grid (V2G) technology, because it allows EVs to supply energy back to the grid, thus supporting renewable energy integration and reducing reliance on fossil fuels.„

- Instructor's Follow-Up: "Excellent answer! V2G technology is indeed a game-changer for both the EV industry and the environment.„

- This main part of the game takes 70 minutes)

# STEP 4: Scoring

**1. Round 1 and Round 2:**

- Points per question: Each category contains questions with values of 100, 200, 300, 400, and 500 points. The point value corresponds to the difficulty level of the question—higher points for more challenging questions.
- Correct Answer: If a team answers correctly, they earn the points associated with that question.
- Incorrect Answer: If a team answers incorrectly, they do not earn any points, and the next team has the opportunity to "steal" the question for the same point value.

**2. Stealing Questions:**

- If the first team fails to answer a question correctly, the question is open for other teams to answer. The team that answers correctly earns the full point value.
- Risk and Reward: Teams should consider whether to attempt to answer or pass, as incorrect answers lead to missed opportunities for points.

**3. Final Jeopardy:**

- **Wagering Points:** Before seeing the Final Jeopardy question, each team decides how many of their accumulated points they wish to wager. Teams can wager any amount of their points but cannot wager more points than they currently have.
- **Correct Answer:** If the team answers the Final Jeopardy question correctly, they add the amount they wagered to their total score.
- **Incorrect Answer**: If the team answers incorrectly, they lose the amount they wagered from their total score.
- **Strategic Plan**: Final Jeopardy is a critical moment in the game, as teams can make large gains or suffer significant losses depending on their wager and the correctness of their answer.

**Highest Score Wins:** At the end of the game, after the Final Jeopardy round, the team with the highest score is declared the winner.

**Tie-Breaker:** In the event of a tie, the instructor can ask a tie-breaker question. The first team to answer correctly wins the game.

This scoring system encourages teams to think strategically about their choices, balancing the risk and reward of each question and their wagers in Final Jeopardy.

The complete game rules you can find in the Attachment n. 1 of this guideline.

# STEP 5: Debrief and Discussion

- Take a few minutes to discuss with students what they learned. The teacher as the game instructor should ask questions as which topic did they like, what was the most challenging topic and why do they think these trends and technologies are important for the future of the automotive industry

- Wrap-up: The teacher should also explain that the game wasn't just about points, but also about understanding the innovations that will drive the future of transportation.

- This step takes 10 minutes

# Attachement 1: Game Rules

**1. Team Formation**

Form teams of 3-4 members. Each team should ensure that all members participate actively and contribute to the discussion.

**2. Answering Questions**

Teams take turns selecting a category and point value. After the question is read, the first team to buzz in gets to answer. Only one answer per team is allowed per question.

Correct answers earn the team the points; incorrect answers result in a deduction of points.

**3. Final Jeopardy Wager:**

Before the Final Jeopardy question is revealed, teams must decide how many of their points they wish to wager. This amount is written down and cannot be changed once the question is revealed.

**4. Time limits:**

Teams have 10 seconds to buzz in after a question is read. After buzzing in, teams have 15 seconds to provide their answer. For Final Jeopardy, teams have 30 seconds to write down their answer.

**5. Fair Play:**

Collaboration within your team is encouraged, but no external help (like smartphones or notes) is allowed during the game.

**6. Respect and Participation:**

All l team members should have a chance to participate in answering questions. Respect each other's ideas and work together to arrive at the best answe

**7. Winning**

The team with the most points at the end of Final Jeopardy wins. In the case of a tie, a tiebreaker question will be asked.

**8. Behavior**

Teams are expected to remain respectful and focused throughout the game. Disruptive behavior may result in penalties or disqualification.

This detailed structure ensures the game is engaging, educational, and fun, while also providing a comprehensive review of the lesson's key concepts.

# Attachement 2: Questions for categories

## ROUND 1 – CATEGORIES:

### Solid-State Batteries

1. What is the main advantage of solid-state batteries over traditional lithium-ion batteries? **(100 Points)**

Answer: Higher energy density and safety.

2. Solid-state batteries primarily use which type of electrolyte? **(200 Points)**

Answer: Solid electrolyte.

3. True or False: Solid-state batteries are expected to have longer lifespans compared to current lithium-ion batteries. **(300 Points)**

Answer: True.

4. What is a major challenge in the development of solid-state batteries for EVs? **(400 Points)**

Answer: High production costs and scalability issues.

5. Name one potential application of solid-state batteries outside of electric vehicles. **(500 Points)**

Answer: Consumer electronics or grid energy storage

### Vehicle-to-Grid (V2G) Technology

1. What does V2G stand for? **(100 Points)**

Answer: Vehicle-to-Grid

2. How does V2G technology benefit the electric grid? **(200 Points)**

Answer: It allows EVs to return electricity to the grid, helping balance supply and demand.

3. True or False: V2G technology can help reduce energy costs for EV owners. **(300 Points)**

Answer: True

4. What is one potential drawback of V2G technology? **(400 Points)**

Answer: Increased wear on the vehicle's battery

5. Name one country that is currently leading in the adoption of V2G technology. **(500 Points)**

Answer: Japan or Denmark.

## Autonomous Driving and AI Integration

1. What level of autonomous driving requires no human intervention in any driving environment? **(100 Points)**

Answer:  Level 5.

2. Which company is known for pioneering AI-driven autonomous driving technologies? **(200 Points)**

Answer:  Tesla or Waymo.

3. True or False: AI in autonomous driving helps improve vehicle safety by reducing human error. **(300 Points)**

Answer: True.

4. What is the primary role of machine learning in autonomous driving systems? **(400 Points)**

Answer: To process data from sensors and make real-time driving decisions.

5. Name one ethical challenge associated with autonomous driving. **(500 Points)**

Answer: Decision-making in unavoidable accident scenarios..

## Advanced Charging Infrastructure

1. What is the name of the fast-charging network developed by Tesla? **(100 Points)**

Answer: Supercharger.

2. True or False: Wireless charging pads for EVs are already commercially available. **(200 Points)**

Answer: True.

3. What is the typical charging time for a Level 2 charger? **(300 Points)**

Answer: 4-8 hours.

4. Name one benefit of an ultra-fast charging station over a standard one. **(400 Points)**

Answer: Significantly reduced charging time.

5. What is the maximum power output of a typical ultra-fast charging station? **(500 Points)**

Answer: 350 kW.

## Advanced Driver-Assistance Systems (ADAS)

1. What does ADAS stand for? **(100 Points)**

Answer:  Advanced Driver-Assistance Systems.

2. Name one common feature of ADAS. **(200 Points)**

Answer:  Adaptive cruise control, lane-keeping assist, or automatic emergency braking.

3. True or False: ADAS can completely eliminate the need for a human driver **(300 Points)**

Answer: False.

4. Which sensor is most commonly used in ADAS for detecting obstacles? **(400 Points)**

Answer: LIDAR or radar.

5. How does ADAS contribute to the safety of pedestrians?. **(500 Points)**

Answer: Through pedestrian detection systems that can automatically brake the vehicle.

## ROUND 2 (DOUBLE JEOPARDY) CATEGORIES:

## Solid-State Batteries

1. Which solid material is often used as an electrolyte in solid-state batteries? **(200 Points)**

Answer:  Ceramic or polymer.

2. True or False: Solid-state batteries have a faster charging time compared to traditional batteries. **(400 Points)**

Answer:  True.

3. Which major automaker announced plans to release vehicles with solid-state batteries by 2025? **(600 Points)**

Answer: Toyota.

4. What is the expected impact of solid-state batteries on the overall weight of electric vehicles? (800 Points)

Answer: Reduction in weight due to higher energy density.

5. Name one environmental benefit of using solid-state batteries **(1000 Points)**

Answer: Reduced risk of leaks or fires compared to liquid electrolytes.

## Vehicle-to-Grid (V2G) Technology

1. True or False: V2G technology can only be used with renewable energy sources **(200 Points)**

Answer: False.

2. What is one technical requirement for a vehicle to support V2G technology? (**400 Points)**

Answer: Bidirectional charging capability.

3. Name one ethical dilemma posed by autonomous driving. **(600 Points)**

Answer: Decision-making in unavoidable accidents or privacy concerns.

4. Which sensor technology is used to create a 3D map of the environment in autonomous vehicles? **(800 Points)**

Answer: LIDAR

5. What is the expected impact of autonomous driving on urban planning? **(1000 Points)**

Answer: Potential reduction in the need for parking spaces and changes in traffic flow management.

## Advanced Charging Infrastructure

1. True or False: All EVs can use the same type of charging connector. **(200 Points)**

Answer: False.

2. What is one benefit of DC fast charging stations over AC chargers? **(400 Points)**

Answer: Faster charging times.

3. Name one challenge facing the expansion of charging infrastructure. **(600 Points)**

Answer: High installation costs or grid capacity issues.

4. What is the name of the international standard for EV fast charging? **(800 Points)**

Answer: CCS (Combined Charging System).

5. How does smart charging technology help manage energy use during peak hours? (**1000 Points)**

Answer: CCS (Combined Charging System).

## Advanced Driver-Assistance Systems (ADAS)

1. True or False: ADAS features are mandatory in all new vehicles sold in the EU. **(200 Points)**

Answer:  True.

2. Name one key technology used in ADAS for lane-keeping assistance. (**400 Points)**

Answer:  Cameras or sensors.

3. What is the primary benefit of adaptive cruise control? **(600 Points)**

Answer: It automatically adjusts the vehicle's speed to maintain a safe following distance.

4. How does automatic emergency braking improve road safety? **(800 Points)**

Answer: By automatically applying the brakes to prevent or mitigate collisions.

5. Name one potential future development in ADAS technology. **(1000 Points)**

Answer: Fully autonomous driving or integration with smart infrastructure.

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# Future Trends and Innovations in EVs

Lesson 2: Sustainability, Government Policy and Challenges

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 2:* ***Sustainability, Government Policy and Challenges*** *from Unit 12:* ***Future Trends and Innovations in EVs.***

**What is the goal of this activity?**
*The goal of the "FutureDrive: The Sustainability Quest" is to immerse students in an interactive role-playing game where they take on different roles in the electric vehicle (EV) ecosystem. Through a series of missions, challenges, and negotiations, they will learn to navigate the interconnected world of sustainability, government policies, and technological challenges in electromobility.*

**What are students going to learn and why is it important?**
*Students will gain a deeper understanding of how various stakeholders in the EV industry—such as manufacturers, government officials, environmentalists, and utility companies—collaborate and sometimes clash to achieve sustainability goals. This activity is crucial for helping future mechanics and industry professionals grasp the broader context in which their technical skills will be applied.*

**What are the things that students need to have covered as material to perform the exercise successfully?**
*They should be done with Lesson 2 from Unit 12 which is focusing on sustainability, policy and challenges connected to electromobility.*

# Requirements

**Duration:** 90 minutes (1 hour)

**Format:** Team with 3-5 members

**Resources:**

- A classroom or open space divided into different “zones” (representing different stakeholder offices)
- Role cards for each student
- Scenario cards for each team.
- Decision sheet for each student
- Timer
- Scoreboard or tracking sheet

# Activity Description

In "FutureDrive: The Sustainability Quest" students are divided into teams, each representing a different stakeholder in the EV ecosystem (e.g., EV Manufacturers, Government Regulators, Environmental NGOs, Utility Companies). Each team is given specific missions to complete that require them to interact with other teams, negotiate deals, solve challenges, and make strategic decisions. The game emphasizes collaboration, negotiation, and strategic thinking, as teams must balance their own goals with the broader objective of advancing sustainable electromobility.

## STEP 1: Introduction

**Explain the activity's goals and rules (Attachment n.1)**
Introduce the „FutureDrive: The Sustainability Quest" and explain how it will help students understand how the sustainability, government policy, and challenges in the electrical mobile industry.

- The game is structured around multiple scenarios that reflect real-world challenges in sustainability, government policy, and electromobility.
- Teams must collaborate to develop solutions for each scenario
- The introduction should take about 5 minutes

## STEP 2: Team Formation

- Organize students into small teams to encourage collaboration and diverse input.
- Teams of 3-4 members strike a balance between inclusivity, effective teamwork, and efficiency, making them ideal for interactive and collaborative activities.
- Arrange tables for teams to work together, ensuring students have enough space to discuss and write.
- This step takes about 10 minutes

# STEP 3: Game Structure and Steps

**Introduction and Role Assignment:**

- **Objective:** Introduce the game, assign roles, and explain the overall objective.
- **Explanation:** Each team will be assigned a role such as an EV Manufacturer, Government Regulator, Environmental NGO, or Utility Company. Their goal is to complete missions that align with their role while contributing to the overall sustainability of the EV industry.
- **Example Statement**: "Welcome ! Today, you'll each take on a critical role in the EV ecosystem. Your mission is to complete your objectives while ensuring the industry moves toward a sustainable future."

**Mission Briefing:**

- **Objective**: Provide teams with their specific missions and objectives.
- **Instructions**: Each team receives a mission card that outlines their primary goals. These missions require interaction with other teams, strategic decision-making, and problem-solving.
- **Example Mission for EV Manufacturer:** "Your goal is to source sustainable materials for your next generation of batteries. Negotiate with the Government Regulator for subsidies and with the Utility Company for renewable energy supply. "

**Scenario Discussions:**

- **Scenario 1 (10 minutes):** Teams discuss the first scenario and develop their strategy.
- **Scenario 2 (10 minutes):** Teams discuss the second scenario and develop their strategy.
- **Scenario 3 (10 minutes):** Teams discuss the third scenario and develop their strategy.
- **Scenario 4 (10 minutes):** Teams discuss the fourth scenario and develop their strategy.
- **Scenario 5 (10 minutes):** Teams discuss the fifth scenario and develop their strategy.

You can find scenario card in the Attachment n., 2.

# STEP 4: Presentation and Scoring

- Each team presents their solutions for each scenario (3 minutes per team).
- After each presentation, the teacher and classmates can ask questions or provide feedback (1 minute).
- Scoring is done after all presentations.

# STEP 5: Wrapup and Debrief

- Discuss the key takeaways from the game.
- Reflect on the different strategies used and their effectiveness.
- Provide final feedback and announce the winning team.

# Attachement 1: Game Rules

**1. Team Formation**

**Rule**: Students will be divided into teams of 4-5 members. Each team should have a balanced mix of skills and perspectives.

**Note:** Roles within the team (e.g., Sustainability Expert, Policy Advisor) will be assigned randomly or by student choice.

**2. Role Assingment**

**Rule:** Each student will receive a role card outlining their specific responsibilities and perspective on the issues discussed.

**Example:** If you are the Sustainability Expert, focus on the environmental impact of decisions; if you are the Policy Advisor, consider government regulations and incentives.

**3. Scenario Presentation**

**Rule:** The game master (teacher) will present a scenario to all teams. Each scenario outlines a specific challenge related to the sustainability of electric vehicles, government policies, or related issues.

**Note**: Scenarios will be distributed one at a time, with a clear explanation and background information provided

**4. Strategy Development**

**Rule:** Teams will have 10 minutes to discuss the scenario and develop a strategy. During this time, each team member should contribute based on their role.

**Example**: The Financial Analyst might focus on cost implications, while the Technical Engineer evaluates technological feasibility.

**5. Decision Submission**

**Rule:** After the discussion period, teams must fill out a decision sheet, outlining their chosen strategy, the rationale behind it, and any potential trade-offs.

**Note:** All decisions must be supported by logical reasoning and consideration of the perspectives represented by each role in the team.

**6. Presentation**

**Rule:** Each team will have 3 minutes to present their solution to the class. The presentation should include:

- The proposed stratégy

- Key consideration and trade-offs

- The expected outcomes and potential challenges

**Note:** Teams should ensure that all members participate in the presentation, reflecting the collaborative nature of the exercise.

**7. Q&A and Peer Feedback**

**Rule:** After each presentation, other teams will have 2 minutes to ask questions or provide feedback. The presenting team must respond to these questions, defending or adjusting their strategy as necessary.

**Note:** This encourages critical thinking and allows teams to consider different viewpoints.

**8. Scoring and Evaluation**

**Rule:** Teams will be evaluated based on:

- Innovation: How creative and forward-thinking is the solution?
- Feasibility: Is the strategy realistic given current and future technologies and policies?
- Collaboration: How well did the team work together, and were all perspectives considered?
- Presentation: How clearly and persuasively did the team communicate their ideas?

**Note:** The teacher may use a scoring rubric or allow for peer scoring based on these criteria.

**9. Respectful Conduct**

**Rule**: All students must respect their teammates' ideas and contributions. Disagreements should be handled constructively, with an emphasis on collaboration and learning.

**Note:** The game is designed to foster cooperation and critical thinking, not competition or conflict.

**10. Time Management**

**Rule:** Adhere to the time limits for each part of the game (discussion, presentation, Q&A). The teacher will give a 1-minute warning before time runs out in each section.

**Note:** Efficient use of time is crucial for covering all scenarios within the 90-minute timeframe.

**11. Final Reflection**

**Rule:** At the end of the game, the class will engage in a 10-minute wrap-up discussion to reflect on the strategies developed, what they learned, and how the exercise relates to real-world challenges in electromobility.

These rules are designed to keep the game structured, engaging, and educational, ensuring that students learn about the complexities of sustainability, government policies, and challenges in the context of electric vehicles.

# Attachment 2: Cards for game

Summary:

For the game with 20 people you need:

- At least 5 Scenario Cards
- 20 Role Cards
- 20 Decision Sheets

**Example Scenarios for FutureDrive: The Sustainability Quest**

- **Scenario 1: Battery Recycling Program**

  **Description:** Your city is planning to implement a new battery recycling program. The goal is to reduce environmental impact and recover valuable materials from used electric vehicle (EV) batteries. Develop a strategy to make this program successful, considering costs, public engagement, and technological requirements.

- **Scenario 2: Expanding Charging Infrastructure**

  **Description:** A local government is considering investing in the expansion of EV charging stations across the city. Evaluate the best locations for new charging stations, potential funding sources, and how to ensure that the infrastructure meets future demand. Address issues like accessibility and convenience for users.

- **Scenario 3: V2G Technology Implementation**

  **Description**: Your company is exploring the implementation of Vehicle-to-Grid (V2G) technology, which allows EVs to supply energy back to the grid during peak demand. Propose a plan for integrating V2G technology into the existing grid infrastructure and assess the benefits and potential challenges.

- **Scenario 4: Solid-State Battery Breakthrough**

  **Description**: A new solid-state battery technology has been developed that promises longer range and faster charging times compared to traditional lithium-ion batteries. Assess the impact of this technology on EV performance, production costs, and market adoption. Develop a strategy for integrating this new technology into your product line.

- **Scenario 5: Policy Incentives for EV Adoption**

  **Description**: The government is considering new financial incentives to encourage EV adoption, such as tax credits or rebates. Design a policy proposal that maximizes the benefits of these incentives, targets key demographics, and ensures cost-effectiveness for the government.

- **Scenario 6: Addressing Charging Network Equity**

  **Description**: There are disparities in access to EV charging stations between affluent and underserved communities. Develop a plan to address these disparities, ensuring that charging infrastructure is accessible to all residents and considering factors like affordability and location.

**Scenario 7: Advanced Driver-Assistance Systems (ADAS) Integration**

**Description**: Your company is developing a new line of vehicles with advanced driver-assistance systems (ADAS). Evaluate how these systems can improve safety and driving experience, and propose strategies for integrating them effectively while addressing potential privacy and security concerns.

**Scenario 8: Reducing EV Production Costs**

**Description**: Production costs for EVs are currently high due to expensive materials and complex manufacturing processes. Propose a strategy to reduce production costs through innovations in manufacturing, supply chain management, or material science, while maintaining vehicle quality and performance.

**Scenario 9: Overcoming Public Prejudice Against Evs**

**Description**: There is a prevailing public prejudice against EVs, with concerns about range anxiety, performance, and cost. Develop a public relations campaign to address these misconceptions, highlight the benefits of EVs, and increase consumer acceptance.

**Scenario 10: Enhancing Thermal Management Systems**

**Description**: Effective thermal management is crucial for maintaining battery performance and vehicle safety. Propose advancements in thermal management systems that could improve the efficiency and reliability of EVs, and outline the potential benefits and challenges of these advancements.

These scenarios are designed to stimulate critical thinking and collaborative problem-solving, covering various aspects of sustainability, policy, and innovation in electromobility. They should help students explore real-world challenges and develop practical solutions.

**Role Cards**

Purpose: Role cards assign specific responsibilities and perspectives to each team member during the game. Each card provides a brief overview of the role's objectives and key points they need to consider while making decisions.

The example role cards: https://www.canva.com/design/DAGO-m4-fBY/yqWkENFGNtXFP431XOWQ-A/view?utm_content=DAGO-m4-fBY&utm_campaign=designshare&utm_medium=link&utm_source=editor

**Decision Sheets**

Purpose: Decision sheets are used by each team to record their proposed solutions or strategies for each scenario. They guide the team through the decision-making process and ensure that all key aspects are considered.

The example decision sheets: https://www.canva.com/design/DAGO-ovV6so/mtucDWmF6ddkyTfnDaKy1Q/view?utm_content=DAGO-ovV6so&utm_campaign=designshare&utm_medium=link&utm_source=editor

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# Future Trends and Innovations in EVs

Lesson 3: Questions for Students

POWER UP

# Introduction

**- Which lesson and unit is this activity connected to?**
*This activity is related to the material covered in Lesson 3:* ***Questions for Students*** *from Unit 12:* ***Future Trends and Innovations in EVs.***

**What is the goal of this activity?**
*The goal of this activity is to encourage students to critically analyze and articulate arguments related to key topics in electric vehicle technology, environmental impact, economic and social implications, and policy regulations. This activity aims to enhance students' understanding of complex issues and foster their ability to engage in informed discussions, a vital skill for their future careers as mechanics and technicians.*

**What are students going to learn and why is it important?**
*Students will learn how to evaluate and discuss the advantages and challenges of EV technology, as well as the broader impact of EVs on society, the environment, and the economy. Understanding these topics is essential for future professionals in the automotive industry, as they will need to navigate these complex issues in their careers. The ability to debate and understand different perspectives also helps students develop critical thinking, communication, and problem-solving skills.*

**What are the things that students need to have covered as material to perform the exercise successfully?**
*They should be done with Lesson 3 from Unit 12 which summarize all students learnt in lesson 12.*

# Requirements

**Duration:** 90 minutes (1 hour)

**Format:** Team with 3-5 members

**Resources:**

- Debate topic cards. (Example topic cards in the Attachment n. 2)
- Notepads and pens for each team
- Timer to keep track of debate rounds
- Score sheets for judges

# Activity Description

The EV Innovation Debate Tournament is a structured debate activity where students work in teams to discuss various aspects of electric vehicles, including their technological advancements, environmental impact, economic implications, and regulatory challenges. Each team will be assigned a proposition and must prepare arguments for and against it. The tournament involves several debate rounds, with teams presenting their positions and responding to opposing arguments. The objective is to articulate well-reasoned positions, supported by evidence, while also considering counterarguments. Judges will score each round, and the team with the highest score in the final round will be declared the winner.

## STEP 1: Introduction

**Explain the activity's goals and rules (Attachment n.1)**, and the structure of the tournament.

- Each team will receive a topic to debate
- Teams should prepare arguments for both sides—pro and con
- During the debate, each team will have the opportunity to present the case, rebut the opponents, and then summarize the position

## STEP 2: Team Formation

- Organize students into small teams to encourage collaboration and diverse input.
- Teams of 3-4 members strike a balance between inclusivity, effective teamwork, and efficiency, making them ideal for interactive and collaborative activities.
- Arrange tables for teams to work together, ensuring students have enough space to discuss and write.
- This step takes about 10 minutes

## STEP 3: Game structure

- **Introduction** Explain the rules, objectives, and structure of the tournament..
- **Preparation Time:** Teams prepare in 20 minutes their arguments for both sides of the debate.
- **Debate Rounds:** Each debate round lasts about 10 minutes, with 5 minutes per team to present arguments and rebuttals.

- Opening Statements (2 minutes per team)
- Rebuttals (2 minutes per team)
- Closing Statements (1 minute per team)

- **Judging and Feedback:** Judges (or teacher) provide feedback and announce the winners.
- **Final Round:** The winning teams from the initial rounds compete in a final debate, following the same structure

## STEP 4: Scoring and evaluation

In the EV Innovation Debate Tournament, scoring will be based on several key criteria to ensure a fair and comprehensive evaluation of each team's performance. Each debate will be judged on a 100-point scale, with points allocated as follows:

- **Quality of Arguments (30 points):** How well the team presents and supports their position with relevant facts, examples, and logical reasoning.
- **Rebuttals (30 points):** The effectiveness of the team's responses to opposing arguments, including their ability to refute claims and counter with strong evidence.
- **Presentation and Clarity (20 points):** The team's ability to communicate their ideas clearly, maintain focus, and engage the audience. This includes speaking style, organization of ideas, and overall persuasiveness.
- **Team Collaboration (10 points):** How well the team works together, including the distribution of speaking roles and overall coordination.
- **Creativity and Originality (10 points):** The use of innovative ideas, unique perspectives, or creative approaches to the topic.

Judges will use a scoring sheet to assess each team in these categories, with the total score determining the winning team in each round. The team with the highest overall score in the final round will be declared the winner of the tournament.

Detailed information for score sheets in the Attachment n.3.

# STEP 5: Wrapup and Debrief

- Discuss the key takeaways from the game.
- Reflect on the different strategies used and their effectiveness.
- Provide final feedback and announce the winning team.

# Attachement 1: Game Rules

**1. Team Formation**

**Rule**: Students will be divided into teams of 3-4 members. Each team will be assigned a specific stance on a debate topic, either "For" or "Against.“

**2. Topic Assignment**

**Rule:** Debate topics will be assigned to each team randomly. Topics will cover aspects such as EV advantages, technological advancements, environmental impacts, and policy implications. Teams will receive their topics and stances (pro or con) at the start of the preparation time.

**3. Preparation Time**

**Rule:** Teams will have 30 minutes to prepare their arguments and rebuttals. During this time, they can research, discuss, and plan their strategy. Use of notes and digital resources is allowed.

**4. Debate Structure**

**Rule:** Teams will have 10 minutes to discuss the scenario and develop a strategy. During this time, each team member should contribute based on their role.

**Example**: The Financial Analyst might focus on cost implications, while the Technical Engineer evaluates technological feasibility.

**5. Decision Submission**

**Rule:** Each debate will follow a structured format:

- Opening Statements (2 minutes per team): Each team presents its main arguments.
- Rebuttals (2 minutes per team): Teams respond to the opposing side's arguments.
- Second Round Arguments (2 minutes per team): Teams present additional points or reinforce earlier arguments.
- Closing Statements (1 minute per team): Each team summarizes its position and makes a final appeal.

**6. Time management**

**Rule:** Teams must adhere to the time limits for each segment. A timekeeper will signal when a team's time is about to expire. Failure to complete within the time limit may result in a deduction of points.

**7. Scoring Criteria**

**Rule:** Debates will be judged based on Quality of Arguments, Rebuttals, Presentation and Clarity, Team Collaboration, and Creativity and Originality. Each category has a specific point allocation (as outlined in the scoring section)..

**8. Role of the Judges:**

**Rule:** Judges will evaluate each debate using the scoring criteria and provide constructive feedback after each round. Judges' decisions are final.

**9. Advanced and Final Round**

**Rule:** Teams with the highest scores from the initial rounds will advance to the final round. The final debate will determine the overall winner of the tournament.

**10. Audience Participation**

**Rule**: Non-debating students will serve as the audience and may be invited to ask questions or provide feedback after the debates. Audience participation should be respectful and focused on the topic.

**11. Use of Visual Aids:**

**Rule:** Teams are allowed to use visual aids (e.g., slides, posters) to support their arguments. These must be prepared during the designated preparation time.

# Attachment 2: Debate Topics

**Example Debate Topics for EV Innovation Debate Tournament**

- **Topic**: "Electric vehicles will completely replace internal combustion engine vehicles within the next 20 years.“
- **Topic:** "The environmental benefits of electric vehicles outweigh the challenges of battery production and recycling.“
- **Topic:** "Government subsidies for electric vehicles should be increased to accelerate the transition to a green economy.“
- **Topic:** "Solid-state batteries will revolutionize the electric vehicle industry and solve the current limitations of EVs."
- **Topic:** "The expansion of charging infrastructure is the most critical factor in the widespread adoption of electric vehicles.„
- **Topic:** "Autonomous driving technology will significantly reduce traffic accidents and improve road safety.„
- **Topic:** "The economic impact of the electric vehicle industry will create more jobs than it displaces.„
- **Topic:** "Electric vehicles are not a sustainable solution due to the reliance on non-renewable resources for battery production.„
- **Topic:** "Vehicle-to-grid (V2G) technology is the future of energy management and will be crucial for grid stability.„
- **Topic:** "Strict emissions regulations are necessary to accelerate the development and adoption of electric vehicles."

# Attachment 3: Sheets for judges

The score sheet for the EV Innovation Debate Tournament should include the following categories, with a clear point system for each. Judges will use these sheets to assess each team's performance and provide feedback.

**Team Information:**

- **Debate Topic: _____**
- **Team Name: _____**
- **Position (For/Against): _____**

**Scoring Categories:**

- **Opening Statement (10 points):**

- Clarity and Structure of Arguments

- Persuasiveness of Initial Points

**Rebuttal (20 points):**

- **Effectiveness in Addressing Opponent's Arguments**
- **Strength of Counter-Arguments**
- **Logical Coherence**

**Second Round Arguments (15 points):**

- **Development of Additional Points**
- **Reinforcement of Key Arguments**
- **Depth of Analysis**

**Closing Statement (10 points):**

- **Summarization of Arguments**
- **Final Persuasive Appeal**

**Presentation and Clarity (15 points):**

- **Confidence and Delivery**
- **Use of Voice, Eye Contact, and Body Language**
- **Overall Clarity of Communication**

**Team Collaboration (10 points):**

- **Equal Participation of Team Members**
- **Coordination and Flow of Presentation**
- **Mutual Support and Respect**

**Creativity and Originality (10 points):**

- **Innovation in Arguments**
- **Unique Perspectives or Ideas Presented**
- **Use of Visual Aids or Other Supporting Materials**

**Additional Comments:**

- **Judge's Feedback: _____**
- **Judge's Name: _____**

**Total Score:**

- **Final Score (out of 80): _____**