MYP 4&5 Physics - 1 - copy - copy

Subject	Grade	Points
Physics	**MYP 5**	A 27 B 25 C 22 D 26

Question 1

Knowing and understanding

This task (questions 1 to 3) addresses the key concept of **change** and focuses on (Knowing and understanding).

Specific heat capacity and latent heat are both related to the amount of energy required to change the temperature or state of a substance.

The specific heat capacity is a physical property of the material a substance is composed of and can be used to help identify the substance the way density can help identify an incompressible substance like a solid or liquid.

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Specific heat capacity is the amount of heat energy required to raise the temperature of one gram of a substance by one degree Celsius (or Kelvin). Different substances have different specific heat capacities, which can affect how they react to changes in temperature. For example, water has a relatively high specific heat capacity, which means it takes a lot of energy to raise its temperature.

Latent heat, on the other hand, is the amount of energy required to change the state of a substance from one phase to another without changing its temperature. This includes the energy required to melt a solid substance into a liquid or vaporize a liquid substance into a gas. Latent heat is also known as "hidden heat" because it does not cause a change in temperature, but instead is used to break the bonds between molecules in a substance.

The amount of latent heat required to change the state of a substance is known as its "heat of fusion" or "heat of vaporization," depending on whether it is melting or boiling. Like specific heat capacity, different substances have different latent heats, which can affect their behavior when undergoing phase changes. For example, water has a relatively high heat of vaporization, which makes it a useful coolant in many applications.

Q 1.1 **Calculate** the amount of heat energy required to increase the temperature of $500\ g$ of water from $20\ °C$ to $40\ °C$. Given that the specific heat capacity of water is $4.18\ J\,g^{-1}\,°C^{-1}$. A 2

Words: 0

Q 1.2 **Calculate** the amount of heat energy required to melt $100\ g$ of ice at $0\ °C$. Given that the latent heat of fusion of water is $334\ J\,g^{-1}$. A 2

Words: 0

Q 1.3 A $50\,g$ block of ice at $-10\,°C$ is heated to $0\,°C$ and then melted. **Calculate** the total amount of heat energy required. Given that the specific heat capacity of ice is $2.05\,J\,g^{-1}\,°C^{-1}$, the latent heat of fusion of water is $334\,J\,g^{-1}\,°C^{-1}$, and the specific heat capacity of water is $4.18\,J\,g^{-1}\,°C^{-1}$. A 4

Words: 0

Question 2

A wind turbine converts kinetic energy from wind into electrical energy.

Wind turbines are typically deployed in wind farms, where multiple turbines are installed in close proximity to harness the collective power of the wind. They are a sustainable and renewable energy source, reducing reliance on fossil fuels and contributing to the reduction of greenhouse gas emissions.

Q 2.1 **Explain** why, in reality, the power generated by a wind turbine may be lower than the theoretical maximum due to factors such as turbulence and wind variability. A 2

Words: 0

Q 2.2 A large-scale wind farm consisting of multiple wind turbines is used to generate electricity. **Describe** the energy transfers that occur in a wind farm. A 3

Words: 0

Q 2.3 The wind farm has a total power output of 50 MW. If the electricity is transmitted at a voltage of 33 kV, **calculate** the maximum current that could be supplied to the grid. A 4

Words: 0

Question 3

Gravity is responsible for providing the centripetal force that allows a satellite to maintain its circular motion around a celestial body.

A satellite is any object that orbits around a larger object. In the case of the moon, it orbits around the Earth. The moon is the fifth-largest natural satellite in the Solar System, and it is also the largest relative to the size of its host planet.

Q 3.1 **Explain** **the gravitational force at play in maintaining the orbit of a geostationary satellite.** A 3

Words: 0

Q 3.2 **Calculate** the gravitational force experienced by a geosynchronous satellite with a mass of $500\ kg$ orbiting at an altitude of $10{,}000\ km$ above Earth's surface. A 4

Words: 0

Question 4

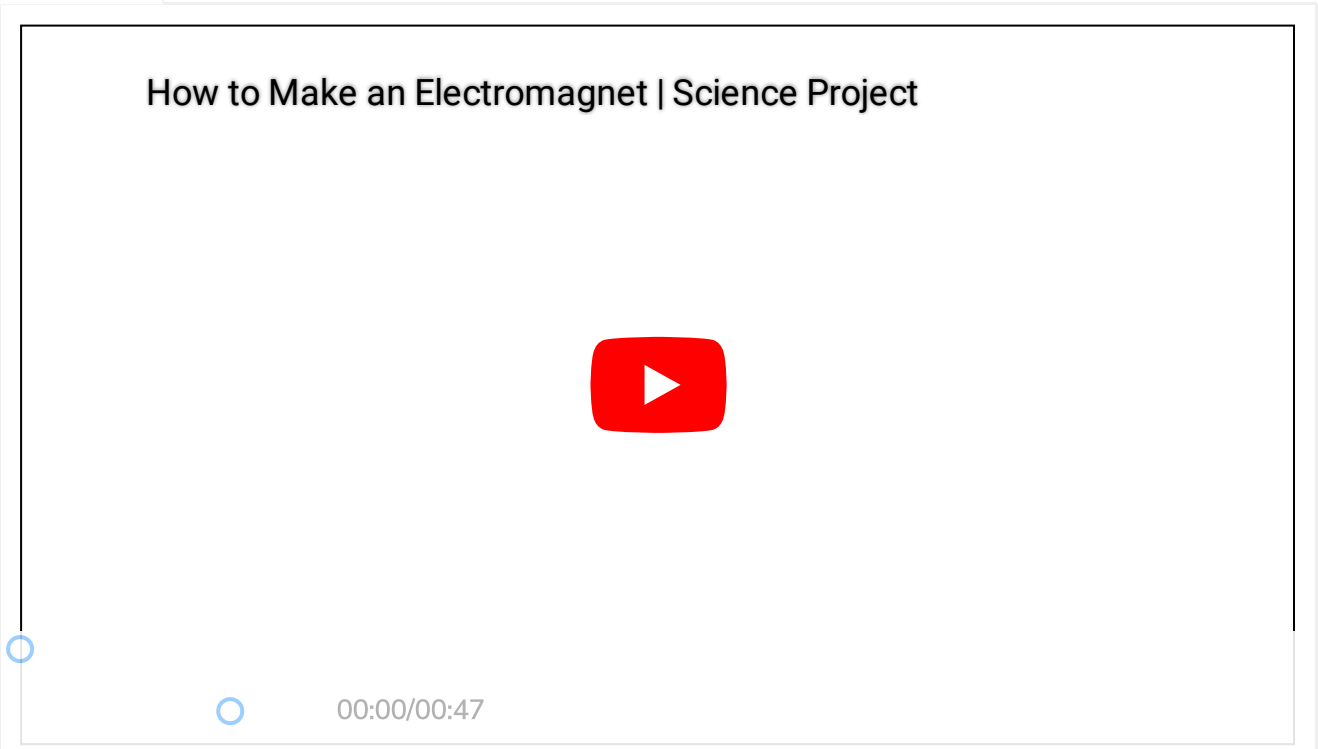
Investigation skills

This task (questions 4 to 6) addresses the key concept of **relationships** and focuses on **criterion B** (Inquiring and designing) and **criterion C** (Processing and evaluating). In this task you will investigate different relationships in science.

Michael Faraday's 1831 discovery of electromagnetic induction laid the foundation for the development of electrical devices such as generators and transformers.

Faraday's experiment was a ground-breaking experiment in physics that demonstrated the relationship between electricity and magnetism. In 1831, Michael Faraday conducted an experiment in which he discovered electromagnetic induction.
This principle is the basis for the functioning of electromagnets, which use an electric current to produce a magnetic field. By passing an electric current through a wire coil wrapped around a core material, such as iron, the magnetic field can be amplified, creating a strong electromagnet.

Video 1



Q 4.1 **Select** the factors affecting the strength of an electromagnet. A 3

(May have multiple correct answers)

A Number of turns in the coil

B Voltage applied to the coil

C Current flowing through the coil

D Length of the wire

E Shape of the coil

F Type of wire

Q 4.2 **Suggest** a research question for this investigation. B 1

Words: 0

Q 4.3 **Identify** **one** independent, dependent and **two** control variables. B 4

Words: 0

Q 4.4 **Formulate** and **explain** a hypothesis suitable for the research question. B 3

Words: 0

The method followed by the student is given below.

1. Starting with the head of the nail, wrap the wire into 5 coils proceeding down the nail. Leave both ends free. Strip, using the cutters, an inch of the insulation at the end of each wire.
2. Put the battery in its holder. Attach the ends of the wire to the opposite poles of the holder.
3. A current should now run through the wire and nail, creating an electromagnet.
4. Draw or take a picture of your apparatus.
5. Touch the point of the nail to the pile of washers.
6. Count how many it picks up.
7. Do this four separate times to find an average.
8. Record each trial on a chart.
9. Repeat the steps with 10, 15, and 20 coils on the electromagnet

Q 4.5 The data collected by the student is given below. C 4

Find the missing values and complete the table.

No of coils	Trial 1	Trial 2	Trial 3	Trial 4	Average
5	2	3	4	2	
10	5	6	5	7	
15	9	8	10	9	
20	11	10	12	13	

Q 4.6 Using the data, **deduce** the relationship between the investigated variables. C 2

Words: 0

Q 4.7 **Evaluate** the validity of the method used. C 2

Words: 0

Q 4.8 **Suggest** an extension to this investigation. C 1

Words: 0

Question 5

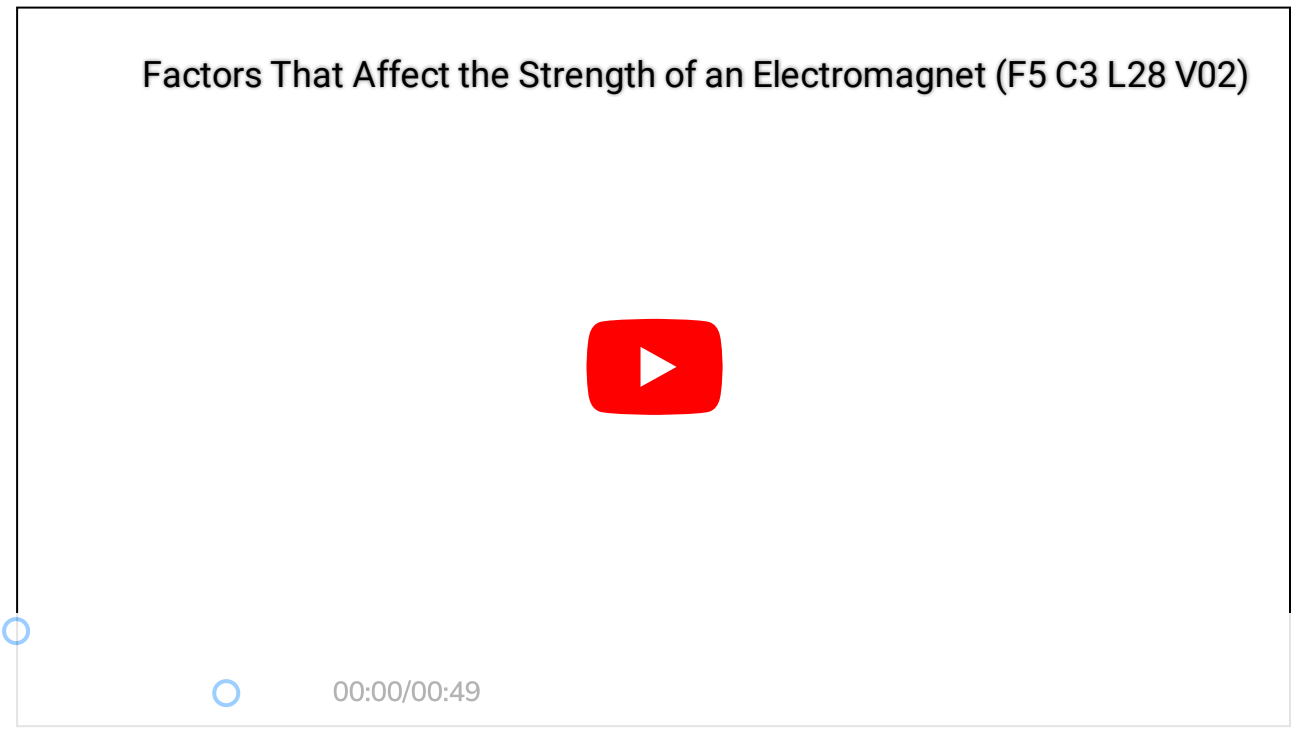
The current in the coil directly influences the strength of the electromagnet.

A group of MYP students decides to find the relationship between the current in the coil and the strength of the electromagnet.

They hypothesize that , "As the current flowing through the coil increases, the strength of the electromagnet will also increase."

The experiment they conducted and the data they obtained is given below.

Video 1



Q 5.1 With the help of the data, **evaluate** the validity of the hypothesis. C 2

Words: 0

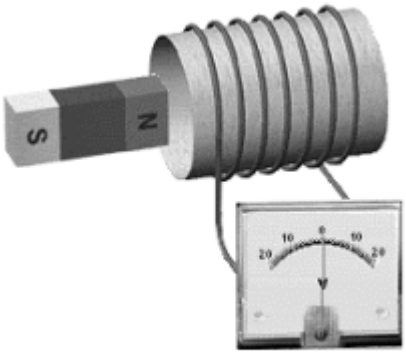
Q 5.2 **Suggest** **two** safety precautions one has to take while conducting this experiment. B 2

Words: 0

Question 6

Electromagnetic induction is the phenomenon where a changing magnetic field induces an electric current in a nearby conductor.

Electromagnetic induction is a phenomenon where an electromotive force (EMF) is induced in a conductor when it is exposed to a changing magnetic field. This phenomenon is the basis for the operation of generators, transformers, and other electrical devices.



The image shows a setup to demonstrate electromagnetic induction.

Q 6.1 **Design** an investigation to verify the effect of changing magnet position on electromagnetic Induction. B 15

In your plan you should include:

- the research question that this investigation will test
- a hypothesis that can be tested by this investigation
- the independent and the dependent variable
- one control variable and why it should be controlled
- how you will collect sufficient relevant data
- a method detailing your procedure including any measuring equipment needed

Words: 0

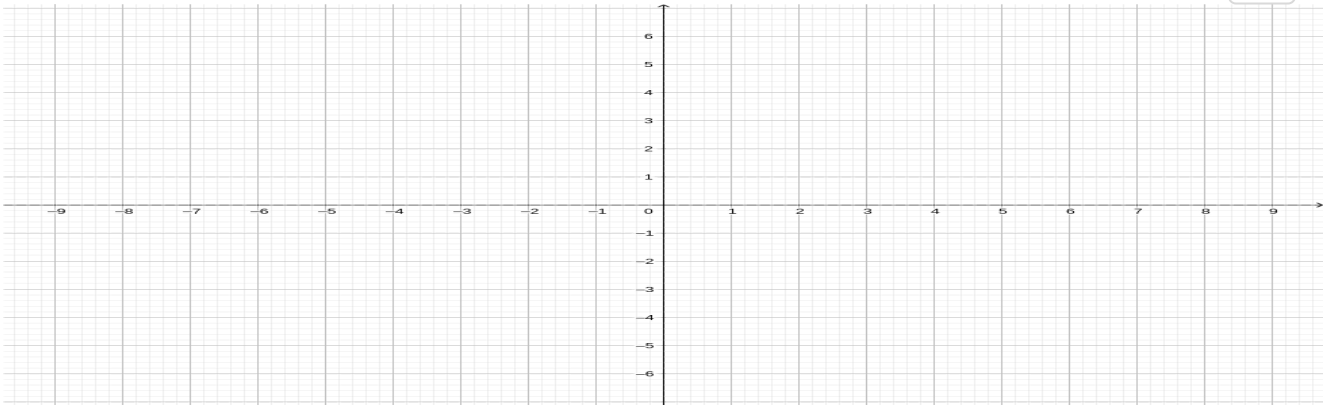
Q 6.2 The data consists of the distance between the magnet and the coil of wire, as well as the measured induced voltage for each of the three trials at that distance. C 5

- 5 cm, 1.2 V, 1.3 V, 1.1 V
- 10 cm, 0.9 V, 1.0 V, 0.8 V
- 15 cm, 0.6 V, 0.7 V, 0.5 V
- 20 cm, 0.4 V, 0.5 V, 0.3 V
- 25 cm, 0.3 V, 0.4 V, 0.2 V
- 30 cm, 0.2 V, 0.3 V, 0.1 V

Present the raw data in a data table.

Words: 0

Q 6.3 **Plot** the graph using the data provided in the observation table in Q 6.2. C 6



Question 7

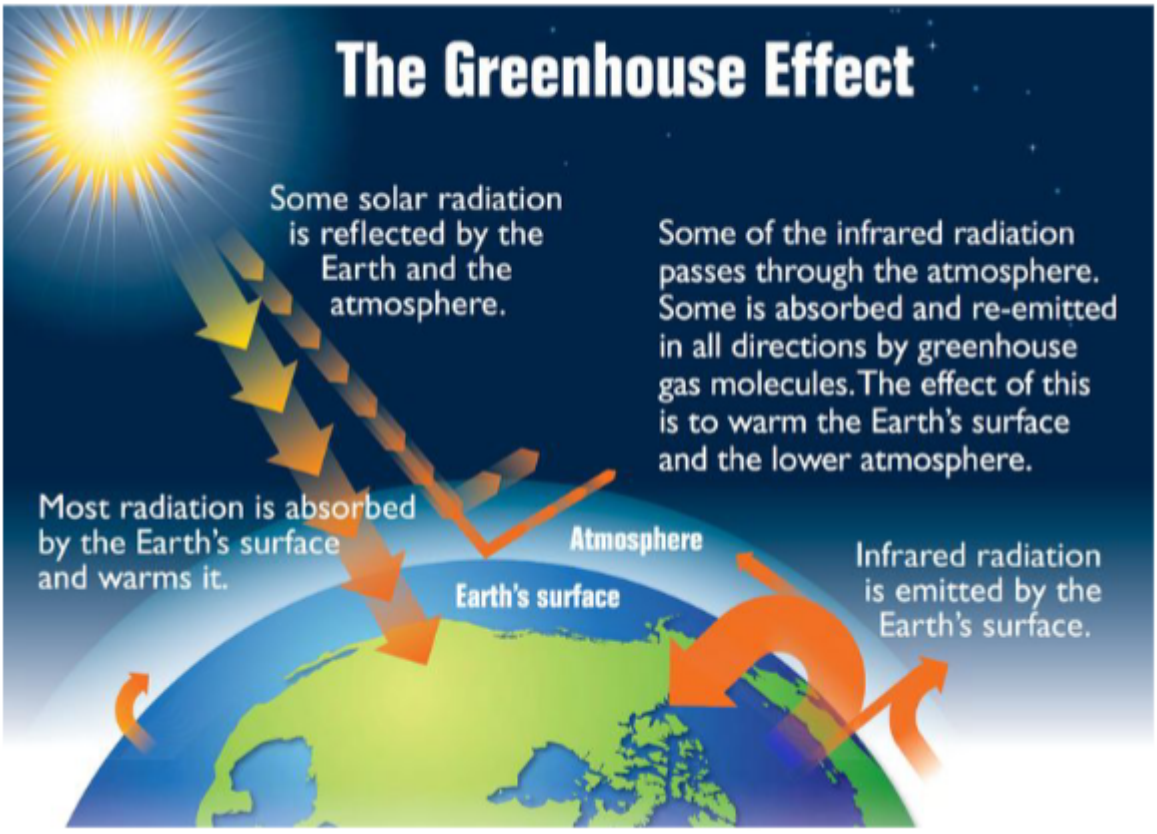
Applying science

The global context is **globalization and sustainability**. This task (questions 7 to 8) addresses the key concept of **systems** and assesses **criterion D** (Reflecting on the impacts of science).

A system is a group of interconnected parts that work together to achieve a particular function or purpose.

The greenhouse effect is a natural phenomenon that occurs when certain gases, such as carbon dioxide and water vapor, trap heat in the Earth's atmosphere. This process helps to regulate the Earth's temperature and keep it habitable for life. However, human activities such as burning fossil fuels and deforestation have increased the amount of greenhouse gases in the atmosphere, leading to an enhanced greenhouse effect and global warming.

The consequences of global warming include rising sea levels, more frequent and severe weather events, and changes in ecosystems that can have far-reaching impacts on human societies. As students of physics, it is important to understand the science behind the greenhouse effect and its role in climate change, so that we can make informed decisions about how to reduce our impact on the environment and promote a more sustainable future.



Q 7.1 **Define** the greenhouse effect and explain its importance for maintaining the Earth's temperature within a habitable range. D 4

Words: 0

Q 7.2 **Describe** the consequences of global warming resulting from an enhanced greenhouse effect. D 2

Words: 0

Q 7.3 **Evaluate** how can an understanding of the science behind the greenhouse effect and climate change help us to make informed decisions about reducing our impact on the environment and promoting a more sustainable future. D 4

Words: 0

Q 7.4 **Discuss** the long-term impacts of global warming on ecosystems, and how can these impacts affect human societies. D 3

Words: 0

Question 8

The Red Sea-Dead Sea Water Conveyance Project is an example of systems explored to mitigate the human impact on the environment and promote sustainability.

The Dead Sea, located between Jordan, Israel, and the West Bank, is one of the most unique and historically significant bodies of water in the world. However, the Dead Sea is under threat due to human activities, such as the diversion of water from the Jordan River and the extraction of minerals from the sea. In recent years, efforts have been made to protect the Dead Sea and preserve its natural beauty and cultural heritage.

One of the key efforts to protect the Dead Sea is the Red Sea-Dead Sea Water Conveyance Project. This project, which is a joint effort between Jordan, Israel, and the Palestinian Authority, aims to channel water from the Red Sea to the Dead Sea, replenishing the water level and preventing further shrinkage. In addition to providing water to the Dead Sea, the project would also generate renewable energy and create job opportunities in the region.

Another effort to protect the Dead Sea is the establishment of the Dead Sea Biosphere Reserve. This reserve, which was designated by UNESCO in 2016, covers an area of 2,400 square kilometres and encompasses the Dead Sea and its surrounding landscapes. The reserve is home to a diverse array of plant and animal species, some of which are found nowhere else in the world. The reserve also contains important cultural heritage sites, such as the ancient city of Jericho.

To address the issue of mineral extraction from the Dead Sea, the governments of Jordan and Israel have taken steps to regulate and reduce mining activities in the area. In 2019, the Israeli government announced a plan to reduce mining activities in the southern part of the Dead Sea and create a new nature reserve in the area.

Despite these efforts, the Dead Sea still faces many challenges, including water scarcity, pollution, and environmental degradation. Continued efforts are needed to protect this important body of water and preserve its natural and cultural heritage for future generations.

Video 8.1

Video 1

Q 8.1 **Analyse** the benefits and drawbacks of the Red Sea-Dead Sea Water Conveyance Project on the surrounding region. D 3

Words: 0

Q 8.2 **Evaluate** the impact of the Dead Sea Biosphere Reserve on the local ecosystem and the importance of preserving cultural heritage sites. D 3

Words: 0

Q 8.3 **Investigate** the consequences of the diversion of water from the Jordan River on the Dead Sea and propose solutions to mitigate the effects. D 2

Words: 0

Q 8.4 **Design** a plan to promote awareness and encourage local and international cooperation to protect the Dead Sea and its natural and cultural heritage. D 5

Words: 0