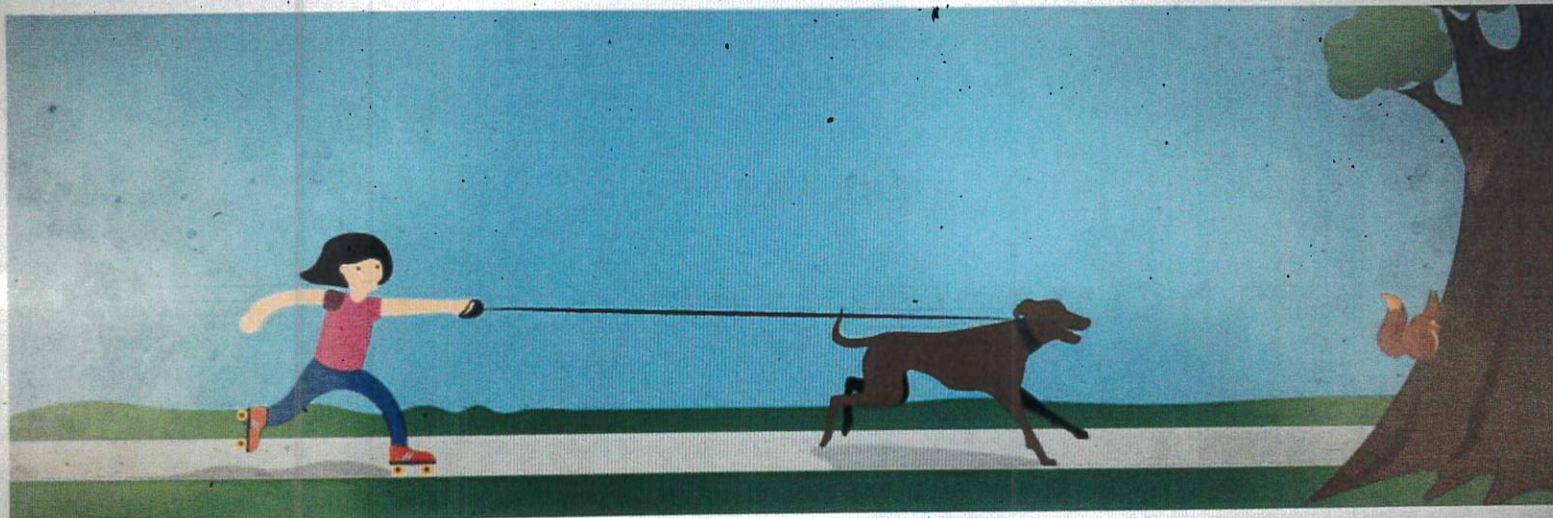


Integrated Science e-Assessment

Nov 2020

Question 1a (1 mark)

A force is a push or a pull that acts on an object. Forces can cause a change in the motion of an object or a change in its shape. The girl in the image below is walking a dog.



- Select
- Normal
- Weight
- Tension
- Drag
- Select

Select the force that is acting on the dog's leash in the picture above.



Question 1b (3 marks)

The girl and the dog have stopped for a break when the dog sees a squirrel. The dog pulls the girl from rest and starts chasing the squirrel. The dog pulls the girl with a constant velocity of 4ms^{-1} for 2 seconds. **Calculate** the dog's acceleration using the formula sheet.

B**I** x_2 x^2

≡

≡

 Ω Σ

Styles



Question 1c (2 marks)

On a different day, the girl takes two dogs for a walk. The two dogs are pulling in opposite directions with equal force as shown below.



©

Outline the girl's motion.

B *I* | ← → | x_2 x^2 | \int $\frac{d}{dt}$ | Ω Σ | Styles | ↕


Question 1d (2 marks)


Newton's first law of motion states that:

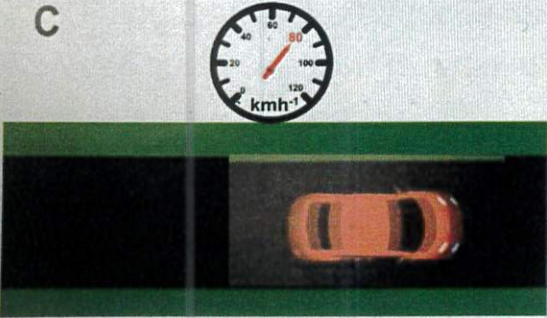
An object at rest will stay at rest and an object in motion at a constant speed in a certain direction will continue moving in the same way until an external force acts on it.


Select the animation below that shows an example of Newton's first law of motion. **Justify** your answer.

Select v
Select
A
B
C
D

A 

B 

C 

D 

Question 2 (9 marks)

Question 2a (1 mark)

Energy released by cellular respiration is used in muscle contractions whenever we take part in physical activity. An incomplete word equation for respiration is given below. **Select** terms to complete the equation.

Draggable labels:

Water

Oxygen

Carbon dioxide

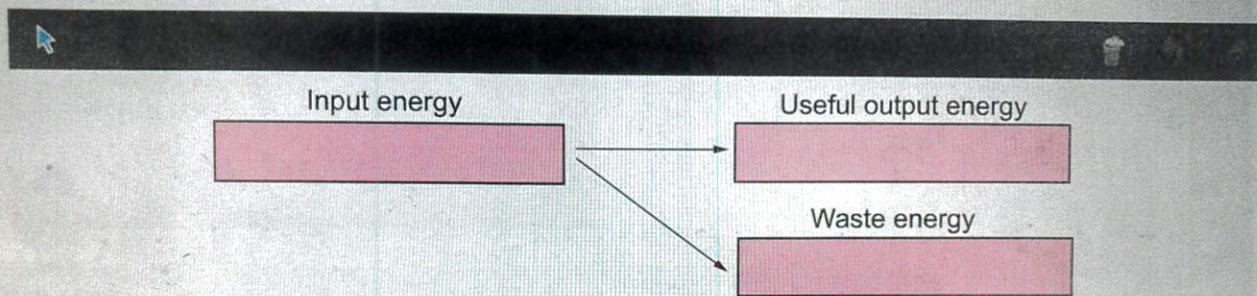


Question 2b (3 marks)

An activity tracker, also known as a fitness tracker, is a device for monitoring and tracking fitness-related variables which can include distance walked or run, heart rate and oxygen concentration in the blood. Activity trackers are used in smart watches that are usually linked to smartphone apps.



The screen above shows that the student walked a total of 3927 steps. **State** the energy transformations during the student's walk.



Question 2c (3 marks)

If each step measures 74.0 cm, state the total distance the student walked during part (b). You should give your answer in kilometres to three significant figures.

B I \leftarrow \rightarrow $\underline{\quad}$ \times $\frac{\quad}{\quad}$ \int \sum Ω Σ Styles \rightarrow

Question 2d (2 marks)

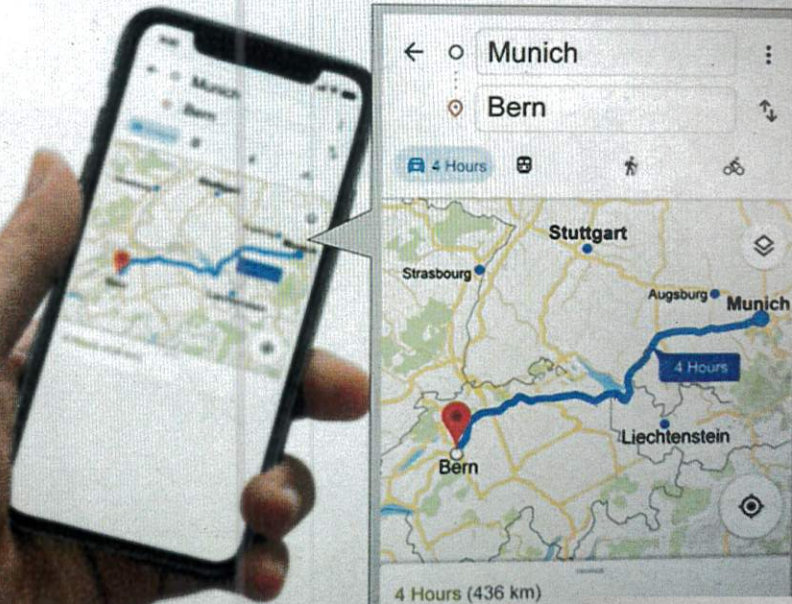
Calculate the speed of the student in part (c) in kilometres per hour, assuming it took 15 minutes to cover the distance travelled.

B I \leftarrow \rightarrow $\underline{\quad}$ \times $\frac{\quad}{\quad}$ \int \sum Ω Σ Styles \rightarrow

Question 3 (8 marks)

Question 3a (1 mark)

All smartphones have a mapping application which gives traffic updates to estimate the time it takes you to travel between different locations.



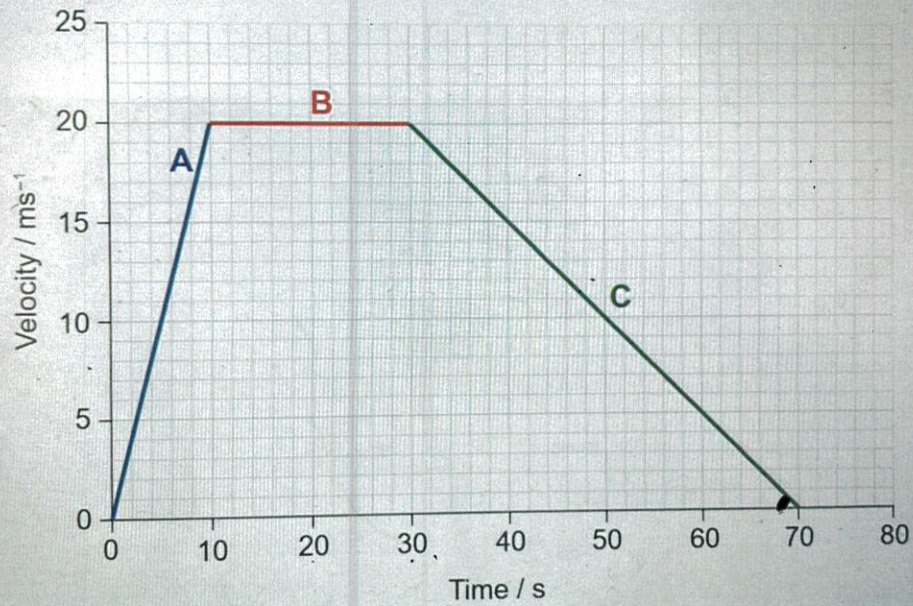
Scroll down to continue

The distance between Munich and Bern is 436 km. Using the map above, **calculate** the speed the map predicts you will be travelling by car. Show your answer in kilometres per hour.

B I \leftarrow \rightarrow U \times_2 \times^2 $\frac{\square}{\square}$ $\frac{\square}{\square}$ Ω Σ Styles \downarrow

Question 3b (1 mark)

The graph below shows the velocity-time graph for part of this journey.



Question 3c (3 marks)

Using information from the graph, **describe** the motion of the car during stage B of the journey.

B *I* | ← → \times \times^2 $\frac{1}{x}$ $\frac{1}{x^2}$ Ω Σ Styles

Question 3d (2 marks)

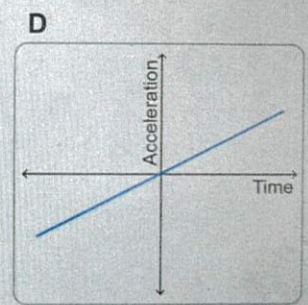
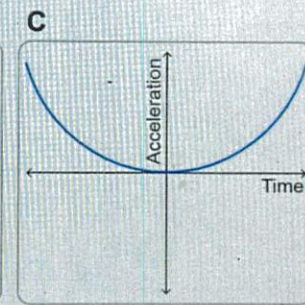
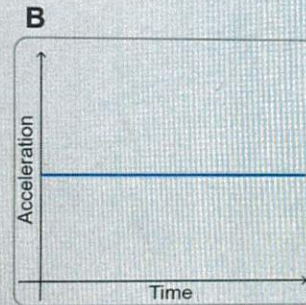
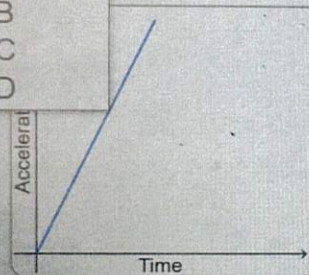
Calculate the distance the car travelled during stage C. You should include an appropriate unit with your answer.

B *I* \leftarrow \rightarrow U \times $\frac{\square}{\square}$ $\frac{\square}{\square}$ Ω Σ Styles \square

Question 3e (1 mark)

The graph in part (b) is a velocity–time graph that shows the motion of the car. A student wants to represent the motion of the car during stage A as an acceleration–time graph. **Select** the sketch that shows the acceleration of the car during stage A.

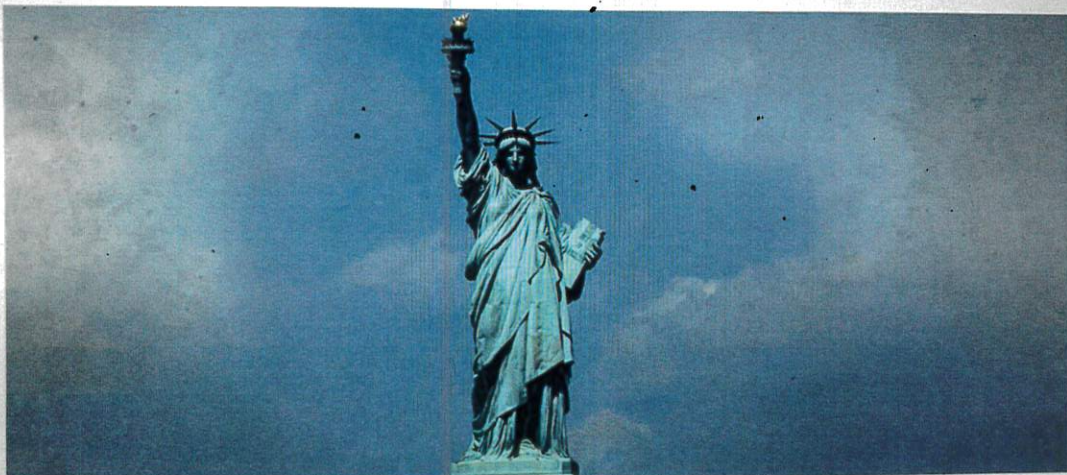
- Select \downarrow
 Select
 A
 B
 C
 D



Question 4 (10 marks)

Question 4a (1 mark)

The Statue of Liberty is an iconic monument in the United States.



The Statue of Liberty is made from hundreds of copper sheets on a framework of steel. When the statue was first built it was the red-orange colour of copper, but as the copper slowly reacted with oxygen in the atmosphere, the red-orange colour changed to the familiar green colour we see today.

Select the area of the periodic table where copper is found.

Select

Select

Group 1 – alkali metals

Group 2 – alkaline earth metals

Transition metals

Group 7 – halogens

Give one physical property of copper metal that made it suitable for building.





Question 4c (2-marks)

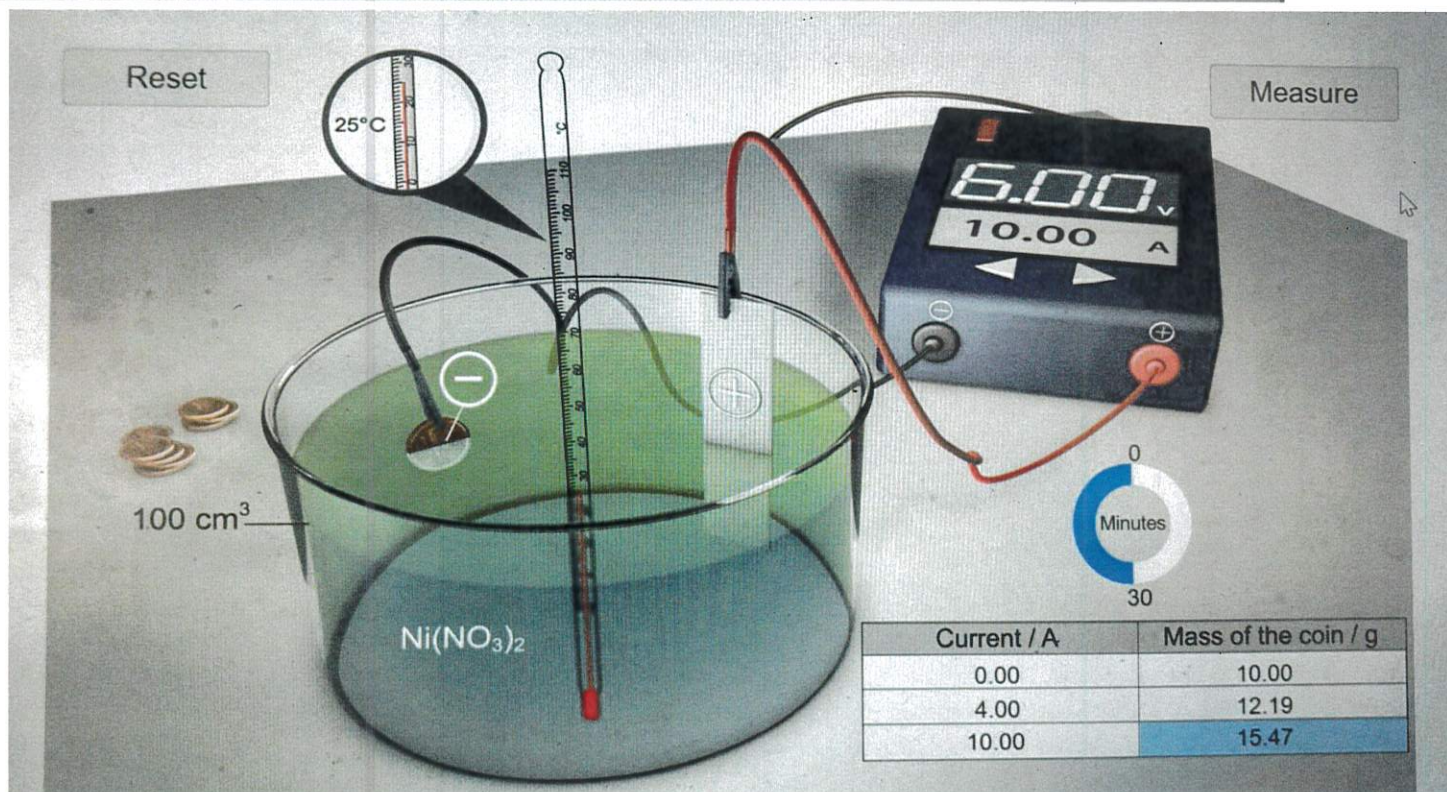
The Statue of Liberty changed colour because the copper metal reacted with oxygen in the atmosphere in a process called corrosion. One of the methods used to prevent corrosion is electroplating. Electroplating is a process that involves coating a thin layer of metal on the surface of another metal using an electric current. This process is commonly used in industry to prevent corrosion or to cover a relatively cheap metal with a more expensive metal, such as silver, gold or zinc. You can see many electroplated objects around you, for example: silver-plated tableware, watches and rings.

The animation below shows how a copper coin can be electroplated.



There are several factors that could affect the mass of the electroplated metal on the coin, for example: current, voltage, concentration of solution, temperature, surface area of metal coin in solution and duration of electroplating.




A student wanted to investigate the electroplating process in her school laboratory. She wanted to coat a copper coin with nickel using a 10 g nickel bar as a source. She wanted to test how changing the current will affect the mass of nickel coating the copper coin. Her equipment is shown below:




Question 4d (2 marks)

Identify the independent and dependent variables in the student's investigation.

Independent variable

B I |   | **U** x_0 x^2 | \int \sum | Ω Σ | Styles | 

Dependent variable

B I |   | **U** x_0 x^2 | \int \sum | Ω Σ | Styles | 

(10 points)

There are many control variables in this experiment. For each of the control variables, **predict** the effect on the mass of nickel coating the coin. Use scientific knowledge and **understanding** to **justify** your answer.

If the time of one trial was too short

Effect on mass

Rich text editor toolbar with icons for bold, italic, text color, background color, bulleted list, numbered list, link, unlink, and a "Styles" dropdown menu.

Justification

Rich text editor toolbar with icons for bold, italic, text color, background color, bulleted list, numbered list, link, unlink, and a "Styles" dropdown menu.

If the temperature of one trial was too high

Effect on mass

Rich text editor toolbar with icons for bold, italic, text color, background color, bulleted list, numbered list, link, unlink, and a "Styles" dropdown menu.

Justification

Rich text editor toolbar with icons for bold, italic, text color, background color, bulleted list, numbered list, link, unlink, and a "Styles" dropdown menu.

12 (2 marks)

The student continued her investigation by processing and interpreting her data to determine the mass of nickel coating the coin.

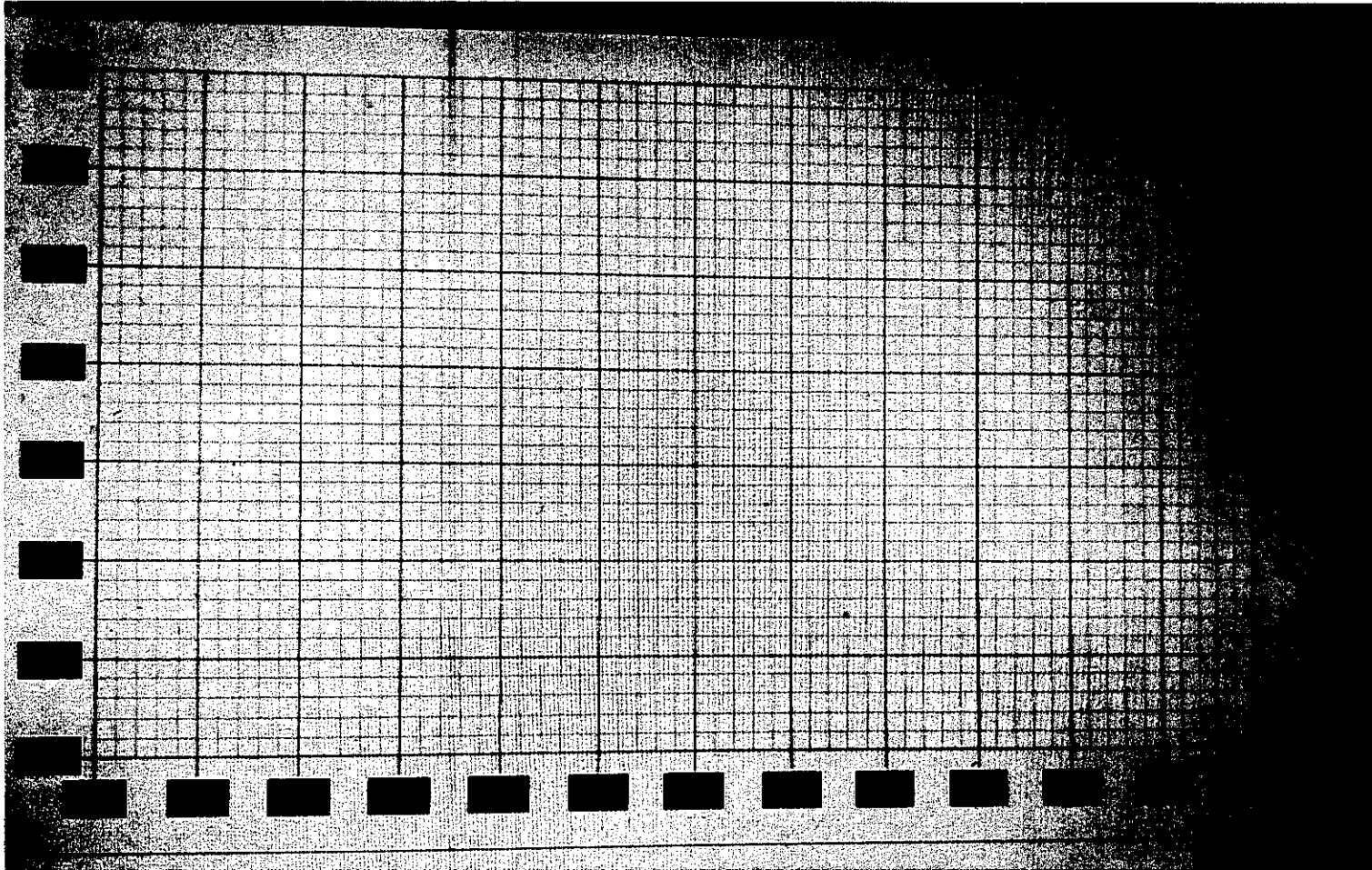
and data is shown in the table below:

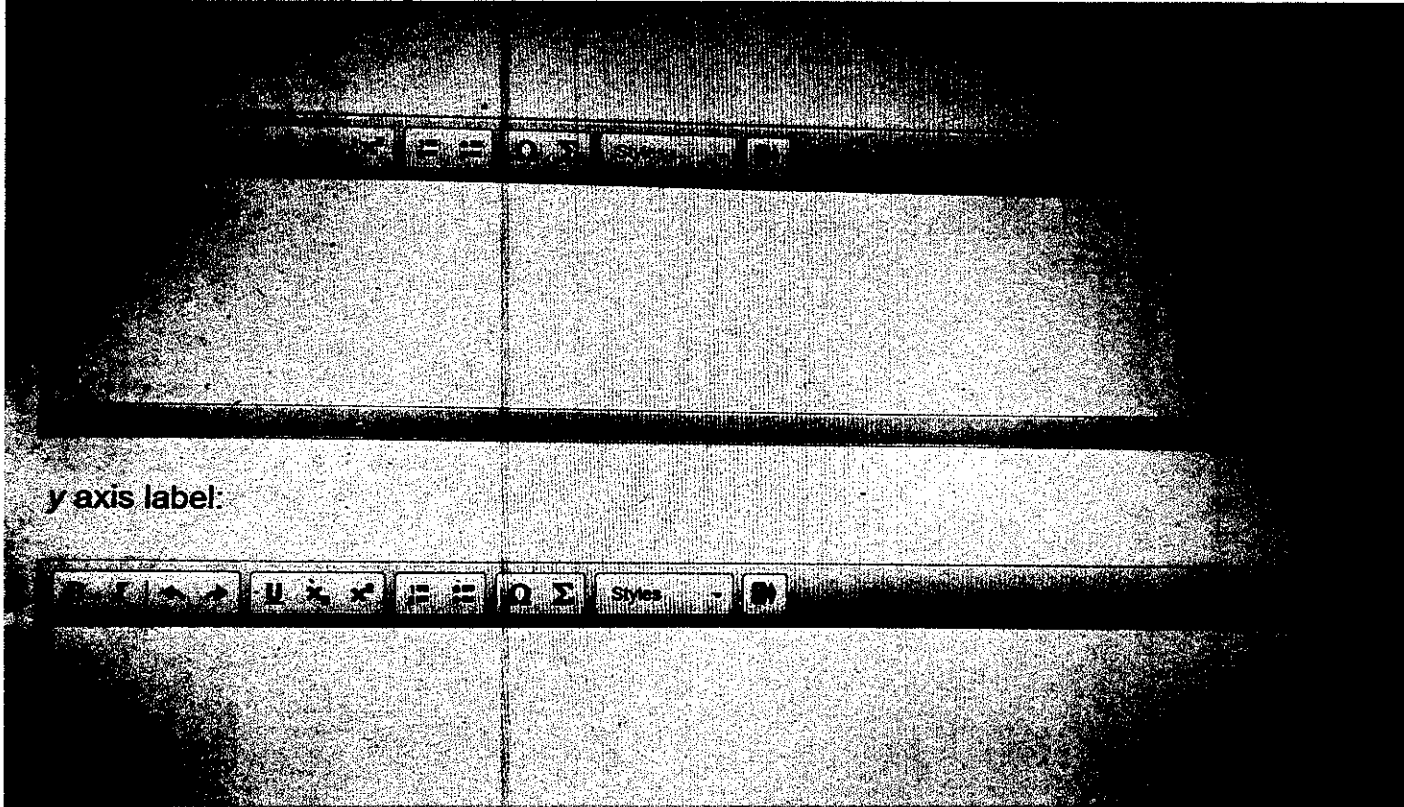
Current / A	Mass of nickel coating the coin / g		
	Trial 1	Trial 2	Trial 3
0.00	0.0	0.0	0.0
2.00	1.1	1.1	1.0
4.00	2.2	2.1	2.2
6.00	3.3	3.3	3.1
8.00	4.4	7.6	4.5
10.00	5.5	5.4	5.4
12.00	6.6	6.4	6.3

complete. Calculate the missing average and show your working in the response box below.

Σ

Present the average data from part (a) in a graph. Add labels for the axes and
underneath the graph.



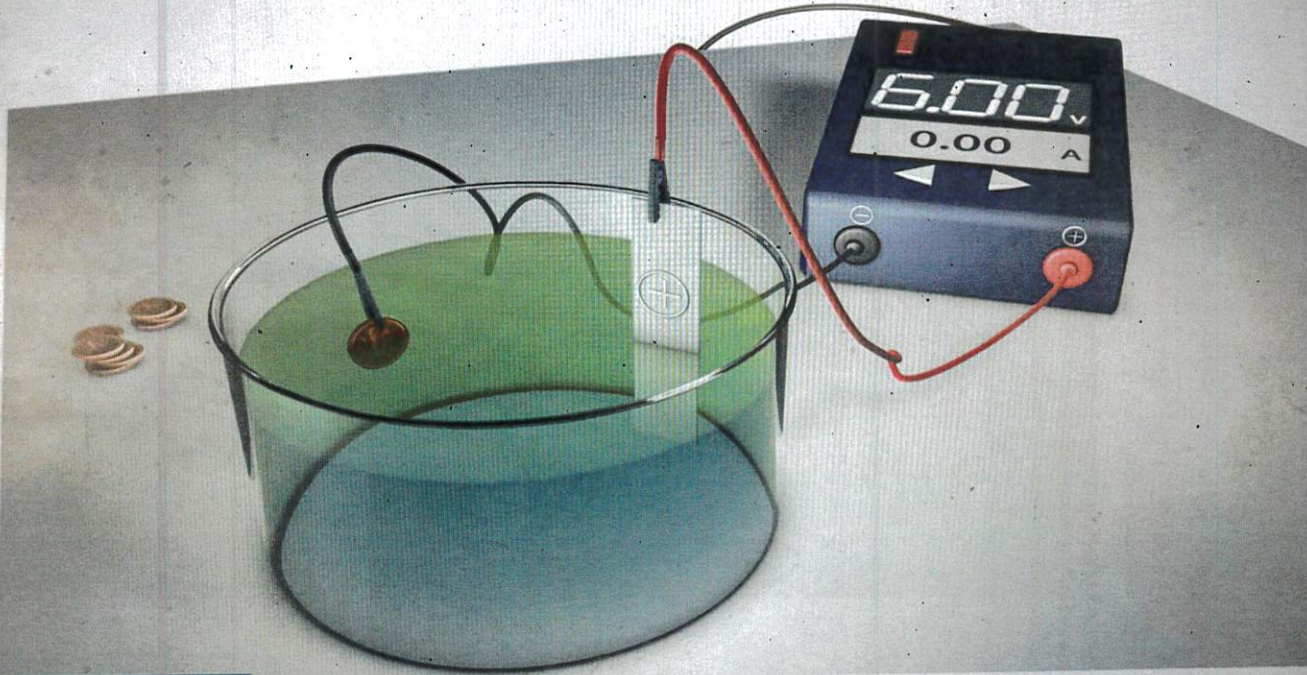


There is an anomalous data point on the graph. Identify the trial where it occurred. Suggest a possible cause of the error.



Question 6 (18 marks)

You want to extend the student's investigation by changing a different variable: concentration. You are provided with the following materials to perform this investigation.



Scroll down to continue

... of nickel coating the coin. You will use three different concentrations: 0.01 mol dm^{-3} , 0.05 mol dm^{-3} and 0.10 mol dm^{-3} .

In your answer you should include:

- the independent, dependent variables and two control variables
- a hypothesis for your investigation (if, then, because)
- how the independent variable will be manipulated to collect sufficient data
- any additional equipment you will require
- a description of your method including details of how you will set up the equipment and how you will measure the mass of the coin
- a safety precaution for your experiment.



The reactivity series lists metals in order of increasing reactivity starting with the least reactive metals at the bottom. The most reactive metals will corrode most quickly.

Increasing reactivity



K
Na
Mg
Zn
Fe
Ni
Sn
Pb
Cu

Question 7a (1 mark)

State the name of the most reactive metal in the reactivity series.

B I ← → U x₂ x² ∴ ∴ Ω Σ

Styles - [icon]

Question 7b (2 marks)

Use the reactivity series to **suggest** the best metal to coat lead to prevent its corrosion. **Justify** your answer.

B I ← → U x₂ x² ∴ ∴ Ω Σ

Styles - [icon]

Question 7c (2 marks)

A student suggested that it is better to use magnesium rather than nickel to coat zinc. Use the reactivity series to **outline** the validity of their suggestion.

B I ← → U x₂ x² ∴ ∴ Ω Σ

Styles - [icon]

Question 7d (2 marks)

Suggest why potassium is usually found as a compound in nature.

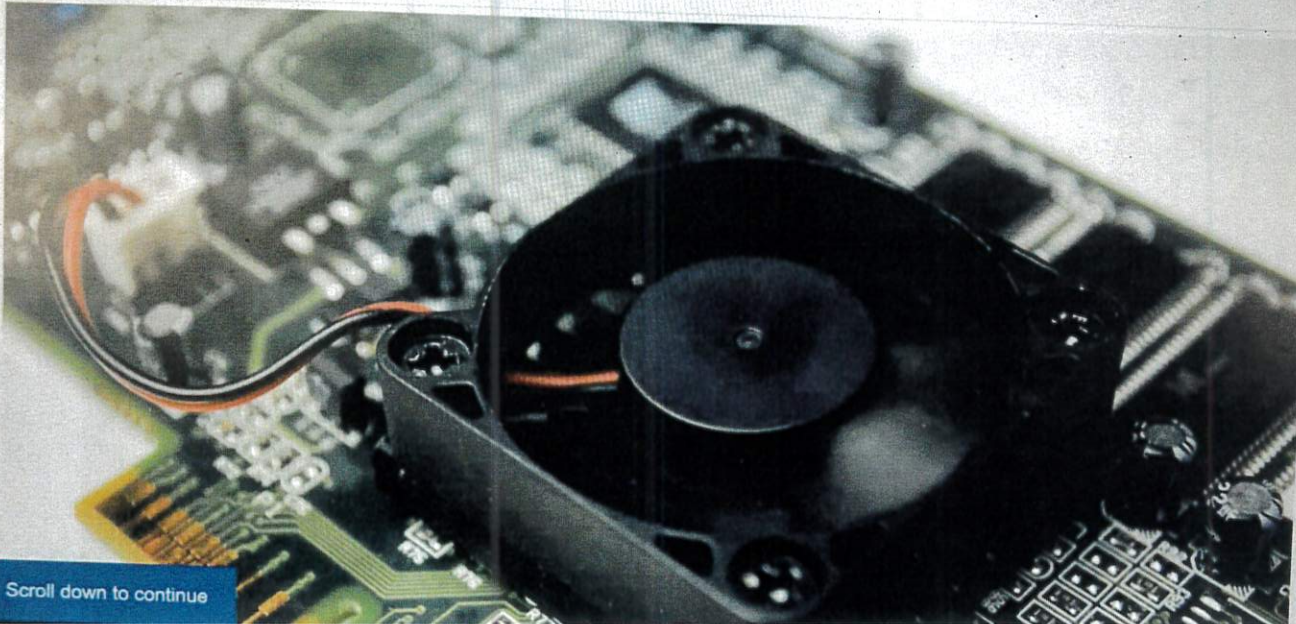
B I ← → U x₂ x² ∴ ∴ Ω Σ

Styles - [icon]

Question 8 (18 marks)

Plastics are materials that are used in millions of items all around the world.

Video Transcript



Scroll down to continue

See next page for video transcript

Plastics are versatile materials that are used in millions of items all around the world. In 2018, over 3 billion tonnes of plastics were made with a total export value of 72.7 billion US dollars. They are used because they are very strong and long-lasting, but these properties are the cause of a major environmental problem.

When plastic items reach the end of their useful life, 55 % are discarded, 20 % are recycled and the remaining 25 % of plastic waste is burnt. Much of this discarded plastic ends up in our oceans.

Once in the ocean, the plastic waste can affect marine life in different ways. It can harm marine animals by blocking their gills, it can be swallowed, or it can become tangled around marine animals.

Traditionally, discarded plastics have been left to break down in landfill sites or they are incinerated. When plastics are burned they release dangerous chemicals such as hydrochloric acid, sulfur dioxide and heavy metals as well as other pollutants.

Currently, scientists are researching solutions to deal with plastic waste. One of the proposed solutions is to use a certain microorganism that can break down complex molecules such as plastics into simpler compounds. This breakdown process would take many hundreds of years if no microorganisms were used.

The simpler compounds such as carbon dioxide, water and methane can be captured and used through the carbon cycle.

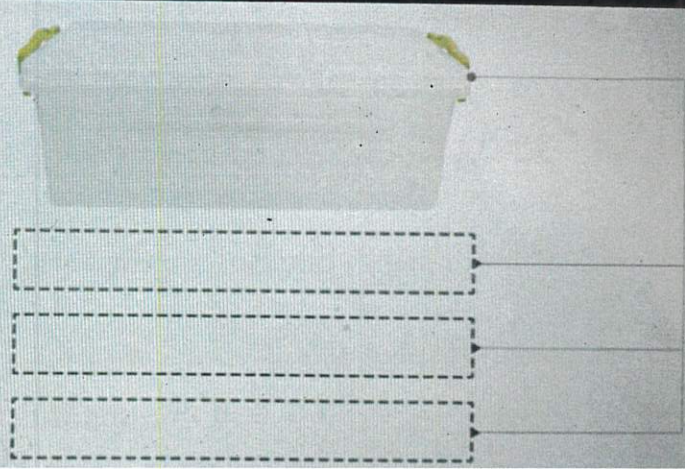
The small use of microorganisms would take place under safe conditions. The plastic waste would be added to a waste plastic collection site and are provided with the nutrients and conditions required for them to grow.

Question 8a (1 mark)

Select three properties of plastic that make it suitable for use as a food container.

Draggable labels:

- Strong
- Flexible
- Lightweight
- Toxic
- Water resistant
- Conductor



Question 8b (2 marks)

Using information from the video, **outline** the positive impact of plastic production on a country's economy.

B I | ← → | U x₂ x² | ≡ ≡≡ | Ω Σ | Styles | 📄

(15 marks)

Once plastic is discarded, it takes many hundreds of years to break down. Microorganisms might offer a faster process to increase the rate of breakdown.

Discuss and evaluate the environmental and economic implications of the industrial use of microorganisms to break down plastics. In your answer you should include:

- why plastic pollution is a problem that needs to be solved
- advantages to the environment of the use of microorganisms to break down plastics
- disadvantages to the environment of the use of microorganisms to break down plastics
- economic considerations
- a concluding appraisal comparing this method to the traditional method of burning plastic

