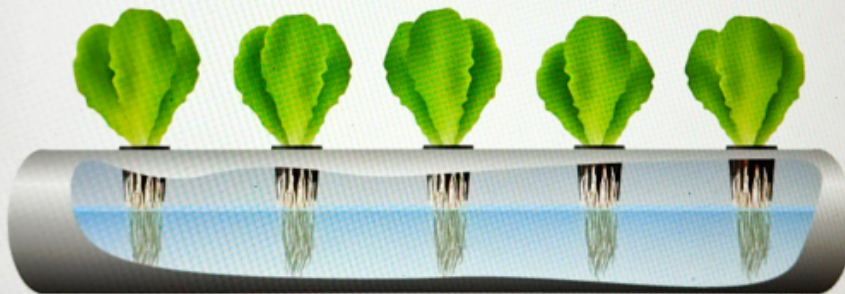


Question 1 (10 marks)

To colonize Mars, we need to find a way to grow food. Soil is heavy and takes up too much space on a rocket so scientists have been experimenting with growing plants in space using as little soil as possible. Using methods like hydroponics, plants can be grown using a nutrient-rich solution rather than soil.



©



**Question 1a** (2 marks)

**State** the products of photosynthesis by completing the word equation below.

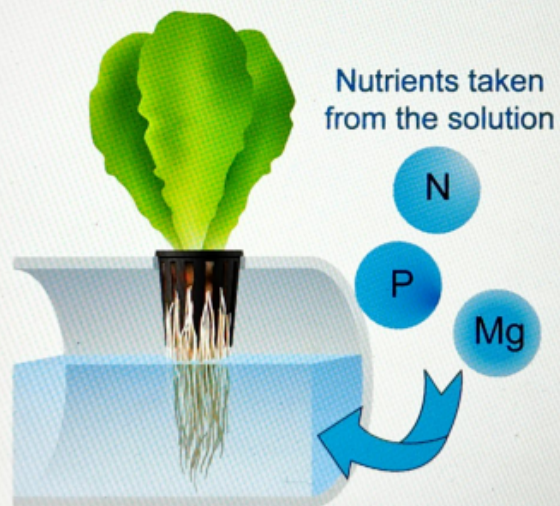
carbon dioxide + water →  +






Question 1b (1 mark)

Plants need nutrients such as phosphorus, magnesium and nitrogen to be able to grow.



**Classify** the nutrients shown as compounds, elements or mixtures.

Select 

- Select
- Compounds
- Elements
- Mixtures



**Question 1c** (2 marks)

**Suggest** why plants do not need soil to grow.

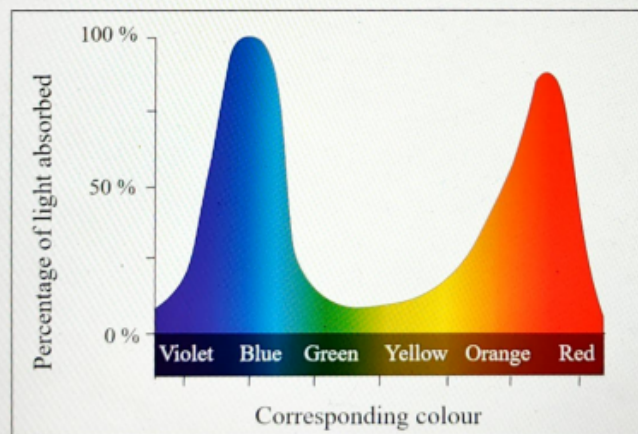






**Question 1d** (2 marks)

Plants need to absorb light for growth. The colour of light absorbed by plants depends on the pigments they contain. The graph below shows the colours of light which are absorbed by a plant containing the pigment chlorophyll.



Using the graph, **explain** why different colours of light affect plant growth.



**Question 1e** (3 marks)

One of the first plants to be grown in space was the pea plant. Peas are a good source of protein.

**Explain** how the protein in the peas would be digested in the astronaut's stomach.

**B** *I* Styles

Redo (Ctrl+Y)

Question 2 (8 marks)

Astronauts in space need to wear spacesuits to protect them against extreme weather conditions on spacewalks. In the cold, temperatures can drop to  $-157^{\circ}\text{C}$  and in the heat, temperatures can reach  $120^{\circ}\text{C}$ .

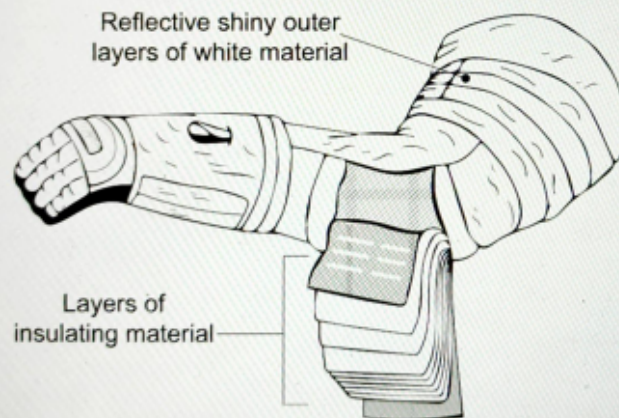


©



Question 2a (1 mark)

The main body of the spacesuit is made of layers of fabric to help astronauts cope with extreme weather conditions.



©

Select the correct term to complete the sentence.

Scroll down to continue

Select the correct term to complete the sentence.

The insulating material in the design of the spacesuit keeps the astronaut **warm** by limiting energy transfer through

- Select
- Select
- conduction.
- convection.
- radiation.



Question 2b (2 marks)

Use your answer from part (a) to **outline** why many thin layers of insulating material are better than one thick layer for keeping the astronaut warm.

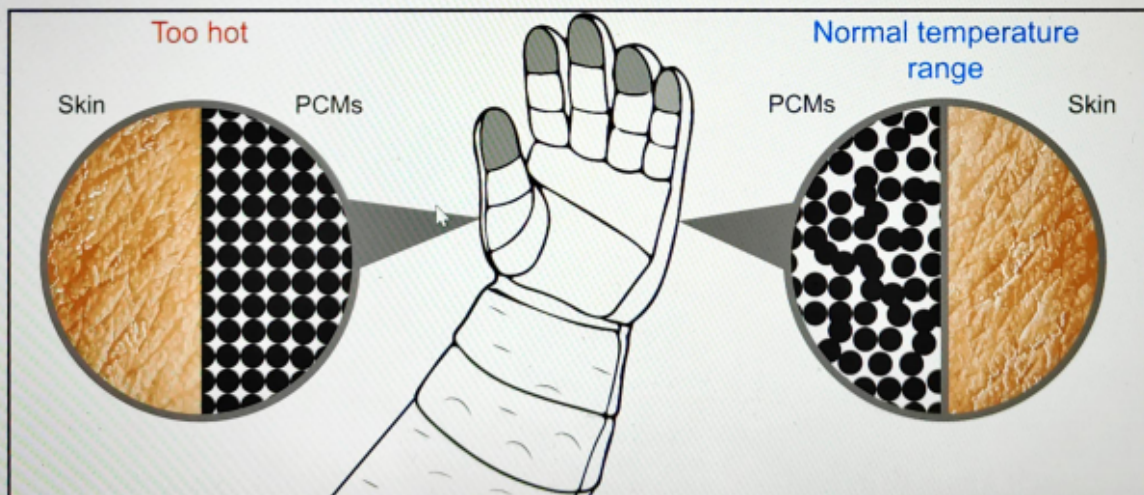




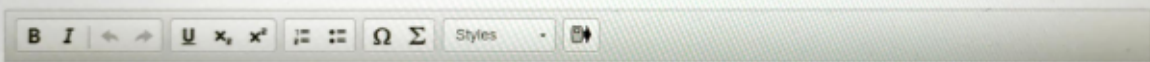


Question 2d (4 marks)

Astronauts' gloves are filled with substances called PCMs (phase change materials) that change from solid to liquid and back depending on the temperature. This helps to keep the astronaut's hand in a normal temperature range.



Use the diagram to **explain** how temperature is decreased by PCMs when an astronaut's body temperature is too high.



I

**Question 3 (10 marks)**

Rockets are used to launch astronauts into space.

**Question 3a (1 mark)**

A rocket getting ready for its launch into space is at rest on a launch pad as shown in the figure below.



**Question 3b (2 marks)**

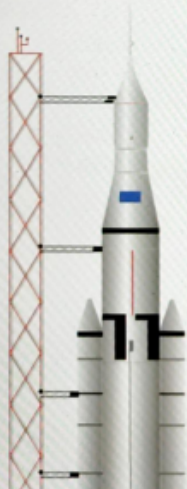
The figure below shows the rocket as it starts to take off. Label the forces acting on the rocket in the diagram below.

Draggable labels: Friction Gravity  
Mass Thrust Weight



Question 3a (1 mark)

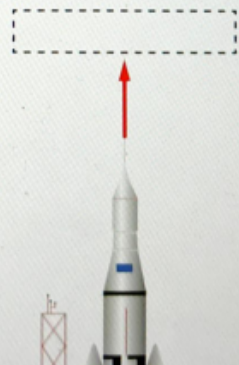
A rocket getting ready for its launch into space is at rest on a launch pad as shown in the figure below.

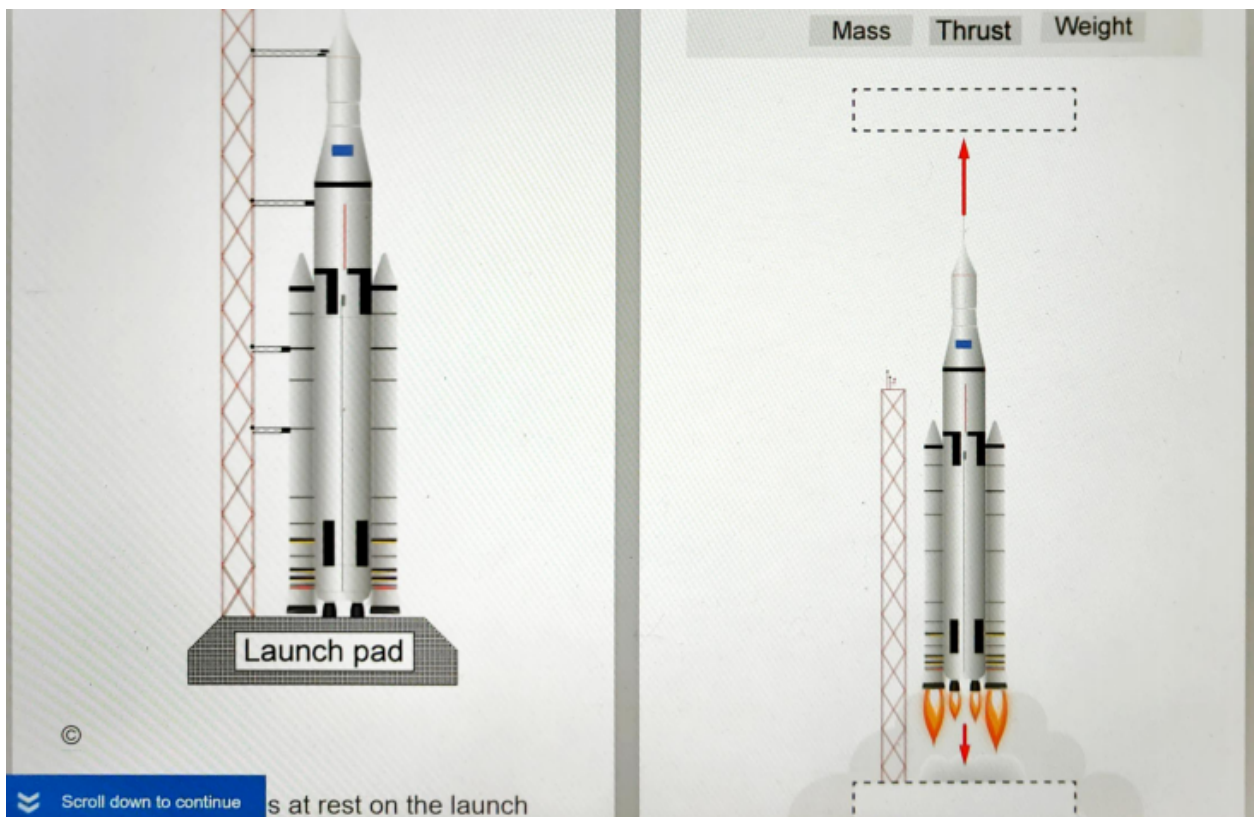


Question 3b (2 marks)

The figure below shows the rocket as it starts to take off. Label the forces acting on the rocket in the diagram below.

Draggable labels: Friction Gravity  
Mass Thrust Weight

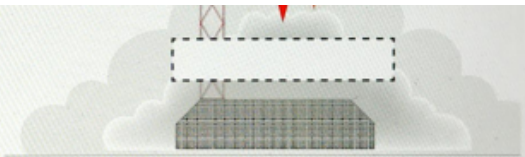
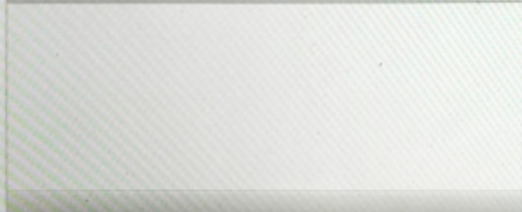





When the rocket is at rest on the launch pad the forces are balanced. **State** what is meant by *the forces are balanced*.

**B** *I* ← → U  $x_0$   $x^a$   $\int$   $\frac{d}{dt}$   $\Omega$   $\Sigma$

Styles -



© 



Question 3c (3 marks)

The total mass of the rocket and fuel is 50 000 kg. The **upwards** force from the engine is 4 000 000 N.

Use the formula sheet to **calculate** the resultant force as the rocket takes off. You should assume the gravitational field strength is  $10 \text{ Nkg}^{-1}$ .

**B I** ← →  x<sub>e</sub> x<sup>2</sup>  ∑ ∑ Ω ∑ Styles

Blank area for the student to write their answer.



Question 3d (3 marks)

Hydrogen is used as a fuel for rockets because of its explosive reaction with oxygen. **Write down** a balanced chemical equation for this reaction.

**B I**  $\leftarrow$   $\rightarrow$      $x_2$   $x^2$   $\text{:=}$   $\text{::}$   $\Omega$   $\Sigma$  Styles  $\cdot$



Question 3e (1 mark)

Use the equation from part (d) to **suggest** why hydrogen is used to launch rockets.

**B** *I* ← → U  $\times$   $\times^2$   $\int$   $\sum$   $\Omega$   $\Sigma$  Styles -



Question 4 (20 marks)

Two MYP students, Alberto and Betty, have just found their great grandmother's cookbook, where she wrote down all of her recipes.

This media is interactive



Click here to turn the page

### Frying the perfect egg

- 1) Place a pan over medium heat.
- 2) Add a small amount of oil.
- 3) Wait 1 minute for the pan and oil to warm up.
- 4) Crack the egg into the pan.
- 5) After a few minutes remove the egg from the pan for a 'perfectly cooked egg'.





Question 4a (1 mark)

Alberto and Betty find a recipe for frying the perfect egg. The recipe is a series of steps which a person follows in order to make a meal. They notice this is very similar to something they see in science class. **Select** the part of a lab report the recipe is most similar to.

Select ▾

- Select
- Hypothesis
- Method
- Conclusion
- Evaluation



Question 4b (2 marks)

Question 4b (2 marks)

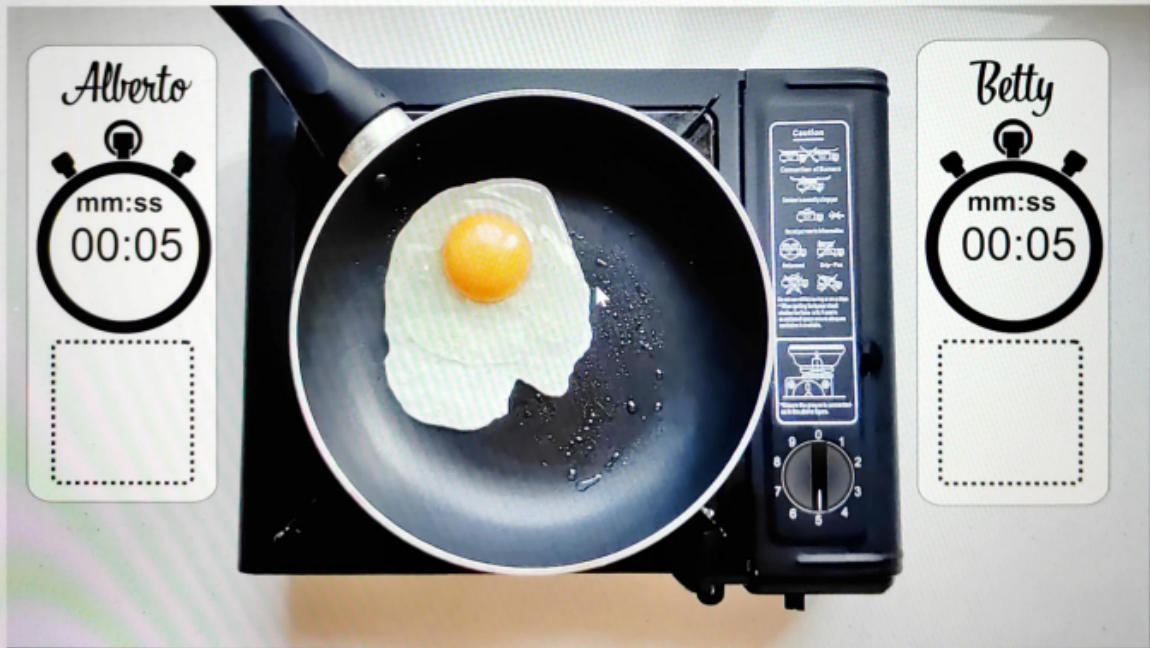
Alberto and Betty decide to fry an egg and time how long it takes to cook.



Scroll down to continue

Question 4b (2 marks)

Alberto and Betty decide to fry an egg and time how long it takes to cook.



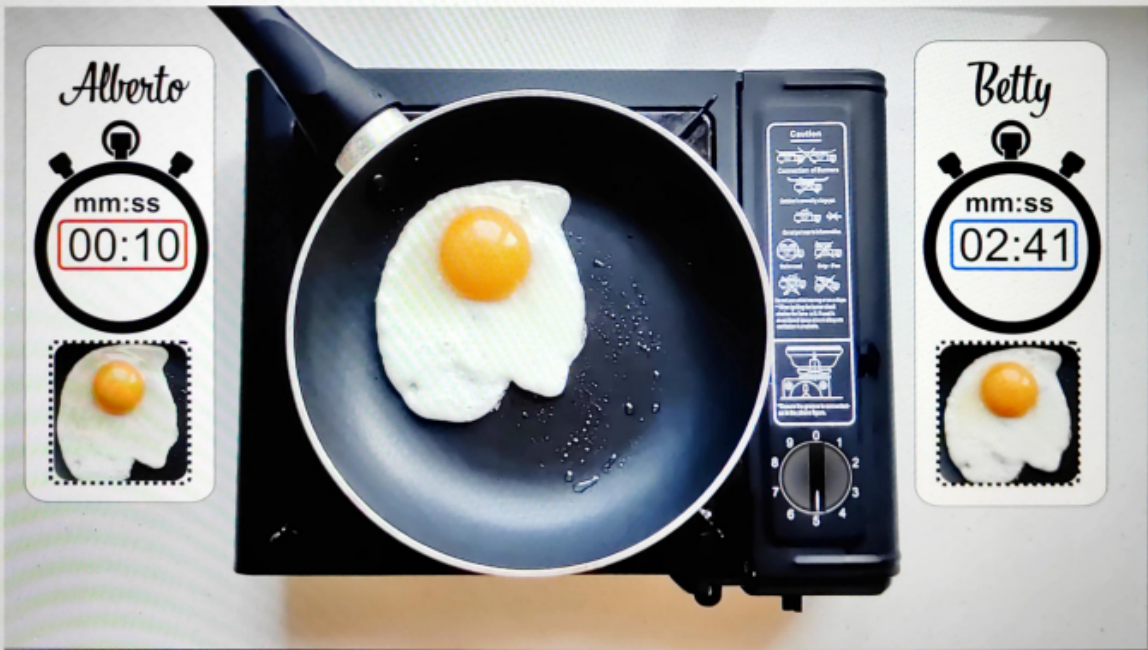
Question 4b (2 marks)

Alberto and Betty decide to fry an egg and time how long it takes to cook.



Question 4b (2 marks)

Alberto and Betty decide to fry an egg and time how long it takes to cook.



**Suggest** why Alberto and Betty have recorded different times.

**B I** | ← → |  x<sub>o</sub> x<sup>o</sup> | ∫ ∑ ∑ Ω Σ | Styles - | 🗑️





Question 4c (2 marks)

State and justify one safety precaution which Alberto and Betty should take.

**B** *I* | ← → | U  $x_2$   $x^2$  |  $\int$   $\sum$  |  $\Omega$   $\Sigma$  | Styles |





**Question 4d** (3 marks)

Alberto and Betty decide to investigate cooking eggs using different temperatures to see how long they take to cook.

**Suggest** a research question for this investigation.

**B** **I**   $x_0$   $x^2$   Styles





Question 4e (2 marks)

Identify two control variables for this investigation.

Control variable 1

**B I**  $\leftarrow$   $\rightarrow$  U  $x_n$   $x^e$   $\int$   $\ddot{=}$   $\Omega$   $\Sigma$  Styles -

Control variable 2

**B I**  $\leftarrow$   $\rightarrow$  U  $x_n$   $x^e$   $\int$   $\ddot{=}$   $\Omega$   $\Sigma$  Styles -




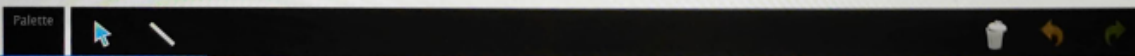
Question 4f (4 marks)


Below are the results of Alberto's and Betty's investigation.

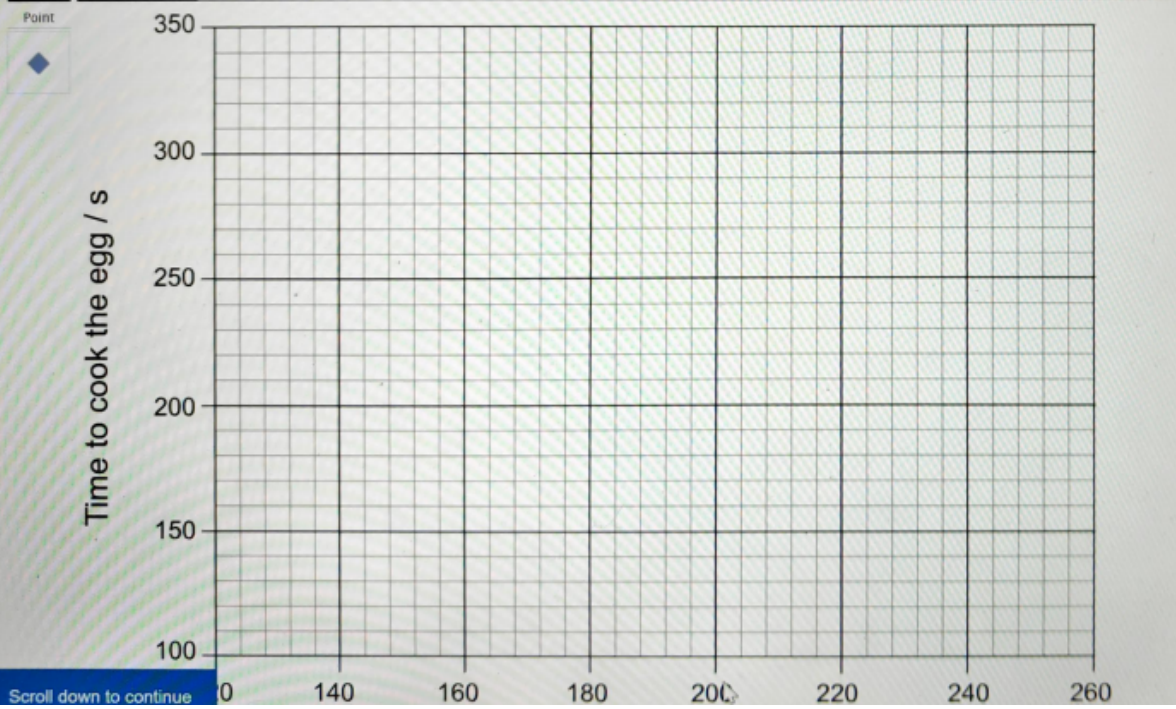
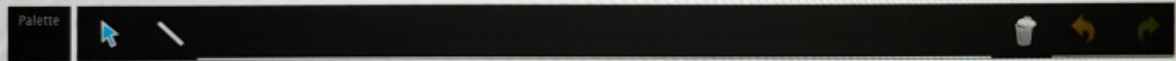
Cooking temperature / °C	Time to cook the egg / s
140	345
160	297
180	219
200	151
220	131
240	118

**Plot** the data from the table on the graph below and **label** the x axis. You should add a line of best fit to your graph.

Click the icon  in the palette and click to place on the graph.



Click the icon  in the palette and click to place on the graph.



Scroll down to continue



Question 4g (1 mark)

Use your graph from part (f) to **predict** how long it would take to cook the egg if the cooking temperature were  $150^{\circ}\text{C}$ .

**B** *I* ← → U  $\times$   $\times^2$   $\frac{1}{x}$   $\frac{1}{x^2}$   $\Omega$   $\Sigma$  Styles



Question 4h (2 marks)

Use kinetic theory of particles to **explain** why if the cooking temperature increases, the time to cook the egg decreases.

**B** *I* | ← → U  $x_1$   $x^2$  |  $\int$   $\sum$   $\Omega$   $\Sigma$  Styles -





Question 4i (3 marks)

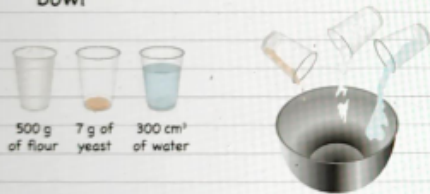
**Describe** how Alberto and Betty could increase the reliability of their **data**. **Justify** your answer.

**B I**  Styles -

Question 5 (19 marks)

Alberto and Betty find a recipe for making bread.

1) Put 500 g of flour, 7 g of yeast and 300 cm<sup>3</sup> of water in a large mixing bowl



2) Mix for around 10 minutes



3) Place the dough in a bowl in a warm place for 1 hour to rise

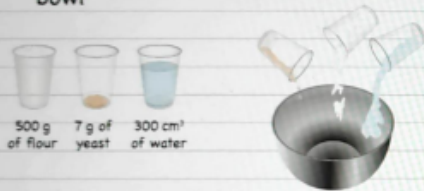
4) Place the dough into a tin



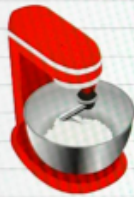
5) Place in a 200°C oven for 20 minutes to bake



1) Put 500 g of flour, 7 g of yeast and 300 cm<sup>3</sup> of water in a large mixing bowl



2) Mix for around 10 minutes



3) Place the dough in a bowl in a warm place for 1 hour to rise



4) Place the dough into a tin



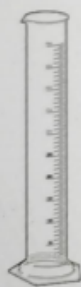
5) Place in a 200°C oven for 20 minutes to bake



Alberto and Betty are in their MYP science class and want to investigate the increase in volume of the dough. Betty remembers that the yeast reacts with the carbohydrates in the dough to produce carbon dioxide, which causes the dough to rise.

**Design** a method that they could use to investigate how the mass of yeast affects the final volume of the dough.

You are able to use the following equipment.



500 cm<sup>3</sup>  
measuring  
cylinder



250 cm<sup>3</sup>  
measuring  
cylinder



100 cm<sup>3</sup>  
measuring  
cylinder



500 cm<sup>3</sup>  
beaker



Electric  
balance

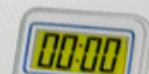


Mixer and  
bowl

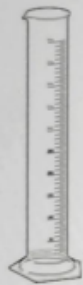


10 kg bag  
of flour

Scroll down to continue



You are able to use the following equipment.



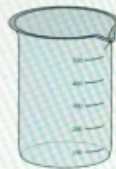
500 cm<sup>3</sup>  
measuring  
cylinder



250 cm<sup>3</sup>  
measuring  
cylinder



100 cm<sup>3</sup>  
measuring  
cylinder



500 cm<sup>3</sup>  
beaker



Electric  
balance



Mixer and  
bowl



10 kg bag  
of flour



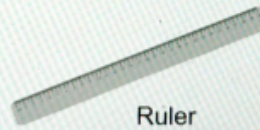
Thermometer



200 g packet  
of yeast



Water



Ruler

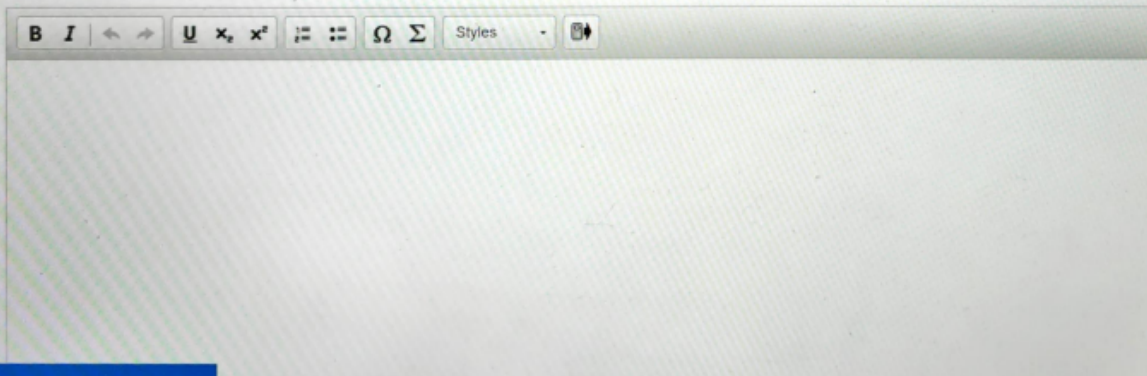


Stopclock

©

In your answer you should include:

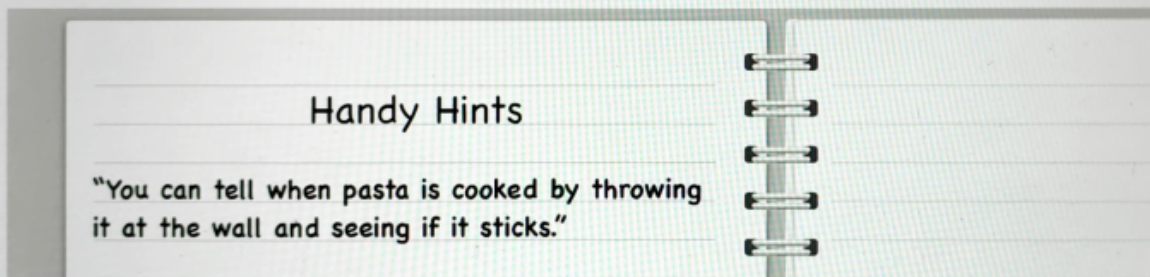
- your hypothesis
- the independent, dependent and control variables
- a list of equipment you will use
- a description of the method you will use to collect sufficient data and make suitable measurements.





Question 6 (8 marks)

The image below shows a section from the cookbook.



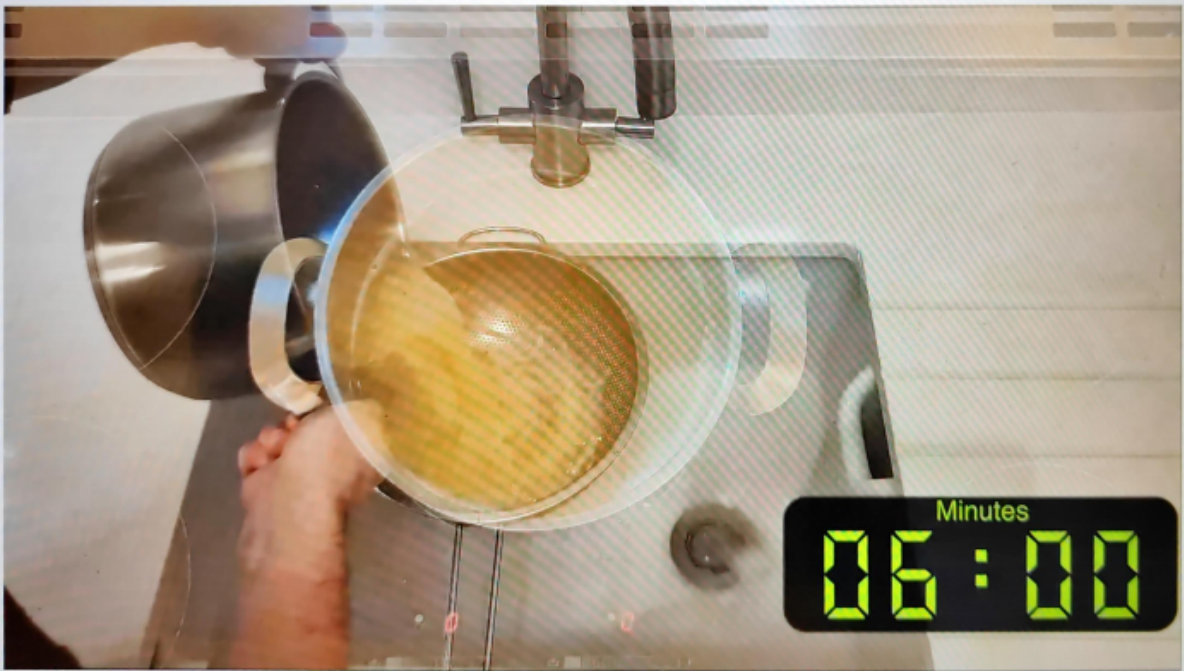
Alberto and Betty realized that this statement is similar to a scientific hypothesis so they decided to test it. They cooked pasta for different lengths of time, threw it at the wall and timed how long it stuck there.

to test it. They cooked pasta for different lengths of time, threw it at the wall and timed how long it stuck there.





It stuck there.









Question 6a (2 marks)

Identify a major source of error with their method and suggest one way they could improve it.

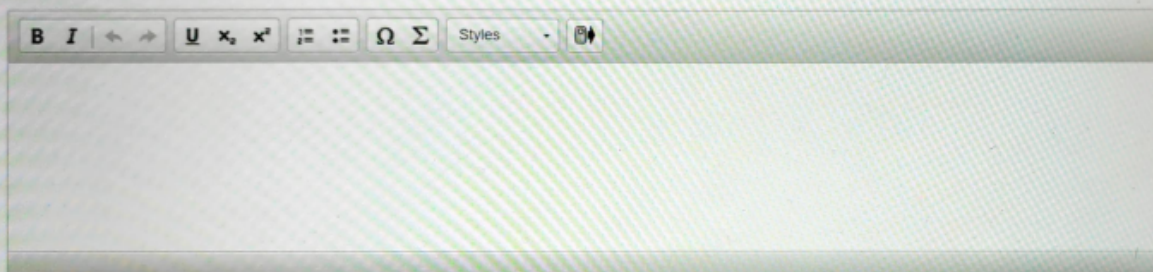
**B** *I* | ← → |    $x_0$   $x^d$  |  $\int$   $\sum$  |  $\Omega$   $\Sigma$  | Styles - |

Question 6b (2 marks)

Below are the results from the experiment.

Time pasta is cooked for / min	Time pasta sticks to the wall / s			
	Trial 1	Trial 2	Trial 3	Average
2	0	0	0	0
4	3	4	2	3
6	4	5	6	5
8	19	15	18	
10	59	58	60	59
12	60	60	59	
14	60	60	60	60
16	60	60	60	60

**Calculate** the missing averages and add your data to the table.



The image shows a rich text editor toolbar with the following icons from left to right: Bold (B), Italic (I), text color (A with a color swatch), background color (A with a color swatch), Underline (U), subscript (x<sub>2</sub>), superscript (x<sup>2</sup>), bulleted list (three horizontal lines with a dot), numbered list (three horizontal lines with numbers), link (Ω), unlink (Σ), a dropdown menu labeled "Styles", and a full-screen icon.

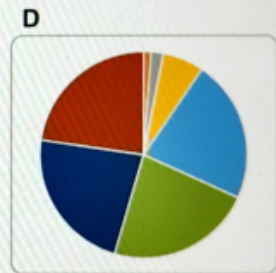
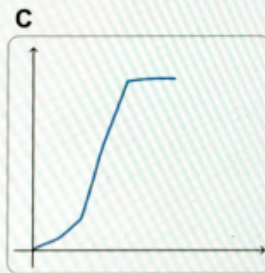
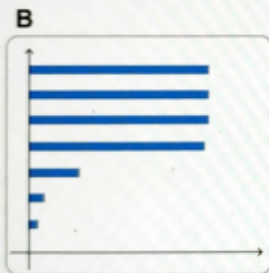
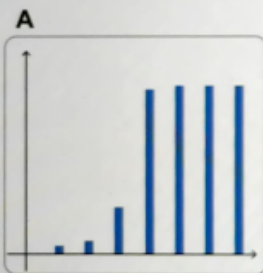




Question 6c (1 mark)

Select the most suitable graph to present the average data.

Select ▾





**Question 6d** (3 marks)

The cookbook says that the pasta will be cooked in 10–12 minutes, but after 12 minutes it will be overcooked.

Using the table in part (b), **discuss** the validity of the statement.

**B** **I**   $x_0$   $x^2$    $\Omega$   $\Sigma$  Styles



Question 7 (10 marks)

We are so reliant on electricity that scientists are constantly researching more efficient ways that it can be used.

Video

Transcript

Electricity is a natural phenomenon that occurs throughout nature.

Electricity is used by all modern societies to improve quality of life. Transportation, hospital equipment, business systems, communication and residential uses such as running appliances and lighting are all dependent upon electricity. Electricity has an enormous impact on our lives.

Its absence threatens the stability of even the most advanced cities and countries.



**Question 7a** (2 marks)

Electricity can be generated from many different sources. **Select** the correct location for the following energy sources.

Draggable labels: Coal Geothermal Natural gas Oil Solar Wind

Renewable	Non-renewable



Question 7b (1 mark)

Suggest one difference between renewable and non-renewable energy sources.

**B** *I* U  $x_x$   $x^2$   $\Omega$   $\Sigma$  Styles

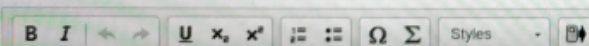


Question 7c (4 marks)

The data in the table below gives information about access to electricity and quality of life indicators in different countries.

Country	Access to electricity / % of population	Quality of life indicators			
		Carbon dioxide emissions / tonnes per person per year	Percentage of 15-year-olds or over who are literate	Life expectancy at birth	% of under 5-year-olds who are malnourished
A	100.0	3.9	100.0	82.7	0.0
B	100.0	6.4	95.1	76.7	8.1
C	100.0	2.0	92.0	75.7	7.0
D	84.5	1.6	69.3	69.4	37.9
E	51.5	1.7	88.3	63.4	22.7
F	32.5	0.2	77.9	65.0	34.5

Use information from the table to **discuss** how access to electricity affects the quality of life.





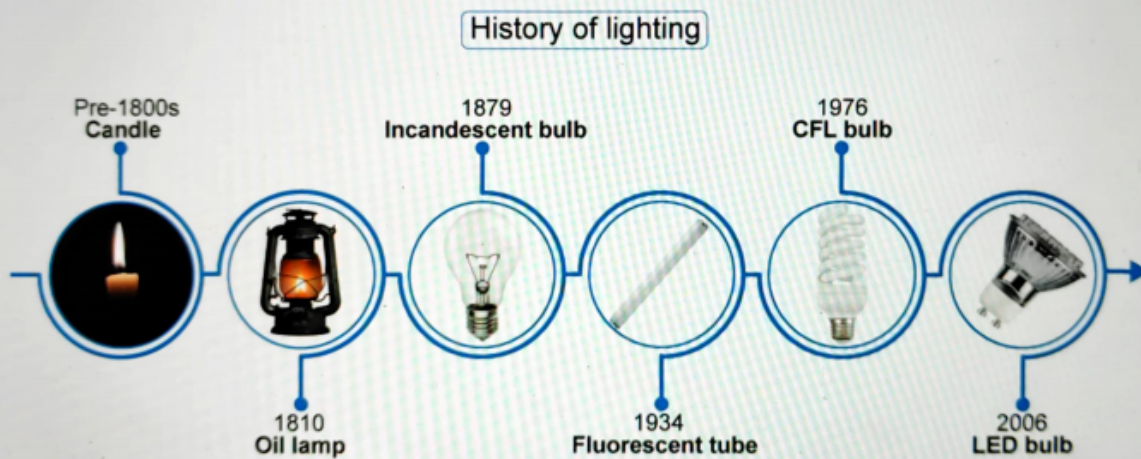
Question 7d (3 marks)

Use the table to **identify** which country is most likely to use the most renewable energy supplies. **Justify** your answer.

Rich text editor toolbar with icons for Bold (B), Italic (I), Undo, Redo, Underline (U), Text color (x), Background color (x), Bulleted list, Numbered list, Link (Ω), Unlink (Σ), Styles, and a Save icon.

Question 8 (15 marks)

The graphic below shows how artificial lighting has developed over time.





Question 8a (1 mark)

The discovery of electricity solved several safety concerns with using candles or oil lamps to provide light.

**Suggest** one safety concern with the use of candles and oil lamps in the home.

**B** *I* | ← → U  $\times$   $\times^*$  ; := ::  $\Omega$   $\Sigma$  Styles -





Question 8b (14 marks)

Recently, some countries have encouraged people to replace incandescent bulbs with LED bulbs to address the problem of increasing electricity demands. The infographic gives some data about incandescent bulbs and LED bulbs with the same brightness.

## HOW DIFFERENT LIGHT BULBS WORK

### Incandescent bulb



These bulbs create light by passing current through a tungsten filament to heat it to 2700 °C. The inert gas prevents the filament from reacting.

### LED bulb



An LED contains a semiconductor that emits light when a current flows through it.

Scroll down to continue

## HOW DIFFERENT LIGHT BULBS WORK

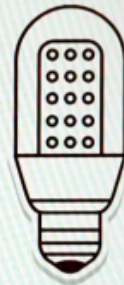
### Incandescent bulb



These bulbs create light by passing current through a tungsten filament to heat it to 2700 °C. The inert gas prevents the filament from reacting.

- Lifetime 1000 hours
- Cost per bulb \$0.50
- Cost to use for 25 000 hours \$177.50
- Efficiency of conversion of electricity to light = 15 %
- Difficult to recycle

### LED bulb



An LED contains a semiconductor that emits light when a current flows through it.

- Lifetime 25 000 hours
- Cost per bulb \$10.00
- Cost to use for 25 000 hours \$36.13
- Efficiency of conversion of electricity to light = 45 %
- No information about whether LED bulbs can be recycled as this is new technology

Using information from the infographic and knowledge from your wider MYP studies, **discuss** and **evaluate** the implications of replacing incandescent bulbs with LED bulbs.

In your answer, you should include:

- an outline of how replacing incandescent bulbs with LED bulbs addresses the problem of increasing electricity demands
- the advantages and disadvantages of replacing incandescent bulbs with LED bulbs from an environmental perspective
- a discussion of the economic impacts on a family budget of replacing incandescent bulbs
- a concluding appraisal justifying your opinion of whether to replace incandescent lights with LEDs.

