



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Final Examination
Sample Paper

Science

Common Level

Time: 2 hours

360 marks

Examination number

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Centre stamp

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Instructions

There are two sections in this examination paper.

Section A	150 marks	10 questions
Section B	210 marks	6 questions

Answer **all** parts of **all** questions.

You may ask the superintendent for a copy of the *Formulae and Tables* booklet. You must return it at the end of the examination. You are not allowed to bring your own copy into the examination.

Not all the questions carry equal marks. The number of marks for each question is stated at the top of the question.

You should spend about 50 minutes on Section A and 70 minutes on Section B.

Write your answers in the spaces provided in this booklet. You may lose marks if you do not do so. You are not required to use all of the space provided.

This examination booklet will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

You may only use blue or black pen when writing your answers. Do not use pencil.

There is extra space at the end of Section A and at the back of the booklet. Label any extra work clearly with the question number and part.



Question 1

15 marks

All biological organisms are made up of cells.

- (a) Name the instrument shown in the picture on the right, which is used to examine cells.

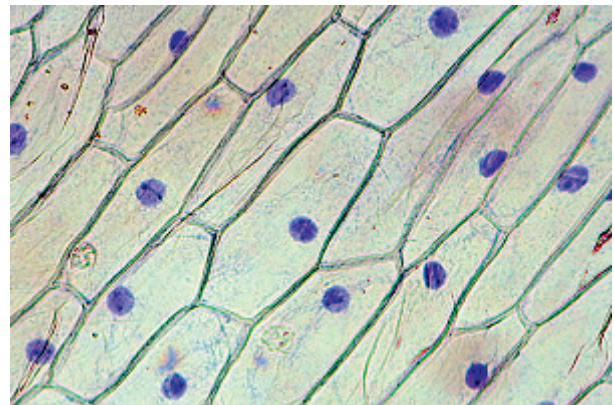
- (b) Name the labelled part of the instrument, which makes the cells look bigger.



- (c) The picture below shows cells from an onion, which are typical plant cells.

In the box, write the name of any one part of the cell.

Draw an arrow from the box to the part of the cell you have named.



- (d) State the function of the part of the cell you have chosen.



Question 2

15 marks

Complete the table below for the instruments shown.

In each case, state what physical quantity the instrument measures.
Also state the unit used for that measurement.

(Some parts of the table are already completed for you.)



Metre stick



Stopwatch



Graduated cylinder



Thermometer



Newton meter



Ohmmeter

Instrument	Quantity measured	Unit
Metre stick		
Stopwatch		
Graduated cylinder		
Thermometer		
Newton meter		Newton (N)
Ohmmeter	Resistance	Ohm (Ω)



Question 3

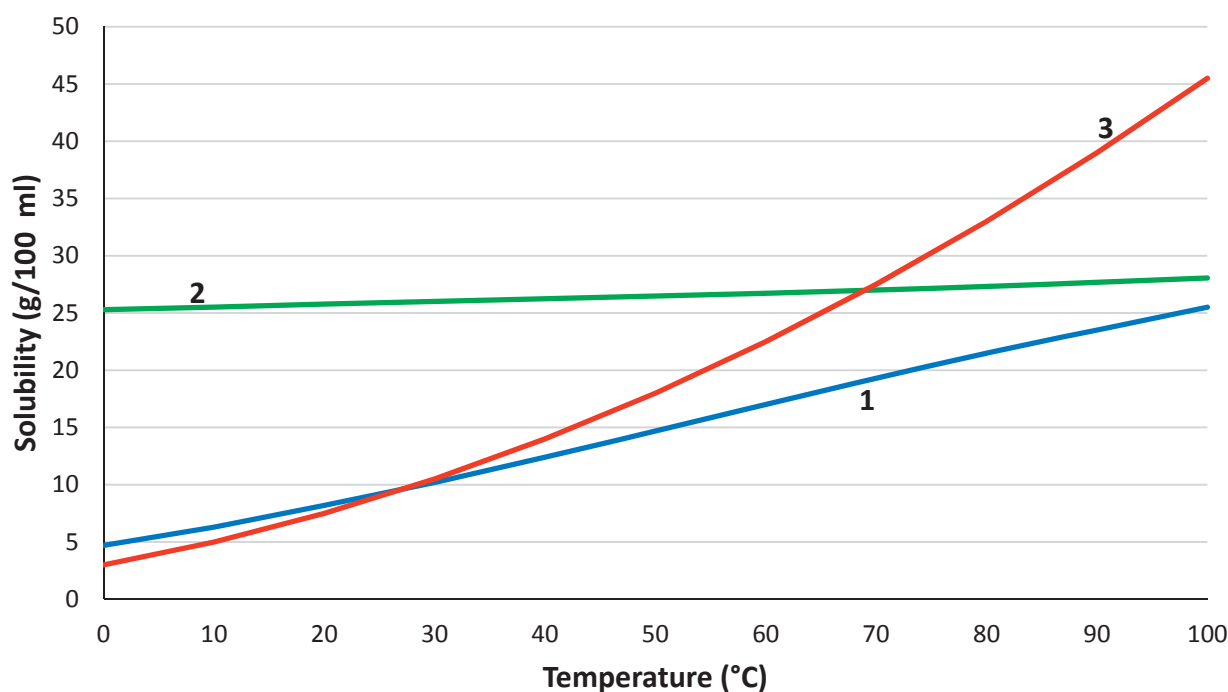
15 marks

A group of students investigated how solubility in water changes with temperature for solid compounds **1**, **2** and **3**. The graph below shows the results obtained.

- (a) Hot water was needed during this investigation.

Name an instrument used to heat water in the laboratory.

- (b) Describe one safety precaution which should be taken when heating water in the laboratory.



- (c) The general trend for solids is that solubility increases with temperature.

Which compound shows the greatest increase in solubility from 0 °C to 100 °C?

- (d) On the graph, circle the point where compound **2** has the same solubility as compound **3**.

- (e) State one advantage of presenting scientific data using a graph.



Question 4

15 marks

The passage below explains how a cell gets the materials it needs for respiration. The names of five parts of the body are missing from the passage.

Here are the missing body parts:

Heart

Veins

Small intestine

Stomach

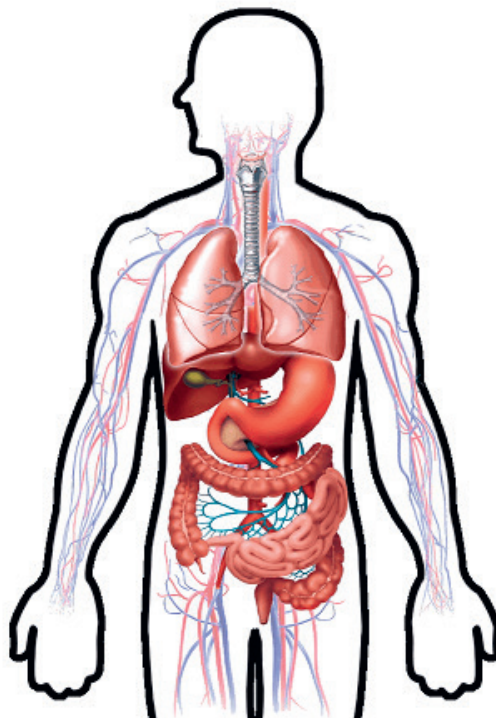
Lungs

In the spaces provided, write the names of the missing body parts.

When we breathe we draw air into our _____ where the oxygen in the air is passed into our blood.

After we swallow food it is first stored in our _____ for a few hours, where some digestion occurs. Then it travels on to our _____ where further digestion happens and glucose and other nutrients are absorbed into our blood.

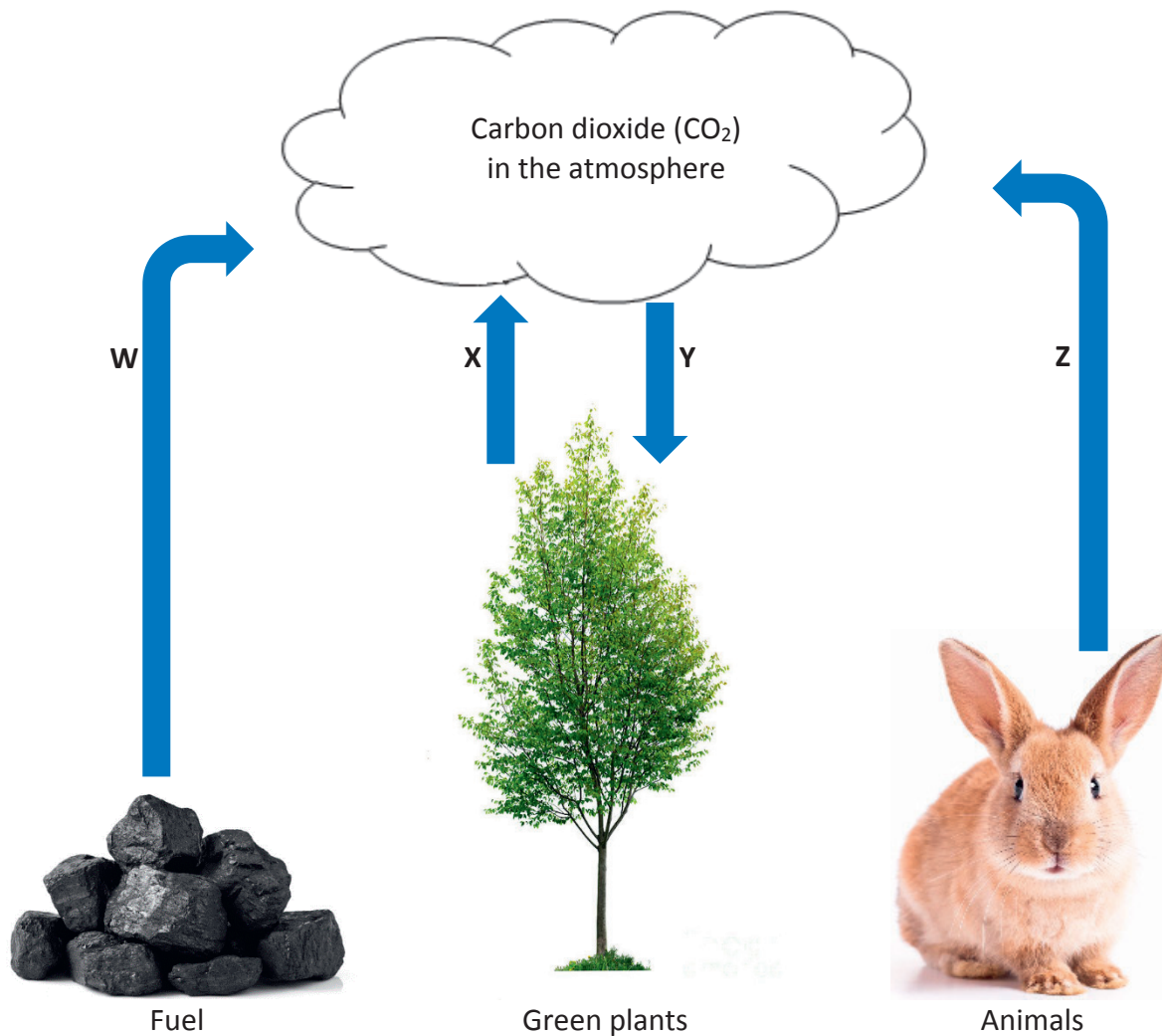
Blood is pumped around the body by our _____. The blood travels through arteries and capillaries to all the cells in our body. The blood then travels back through our _____.



Question 5

15 marks

The diagram below shows some of the processes involved in the carbon cycle.



Each of the blue arrows **W**, **X**, **Y** and **Z** represents one of the following three processes:

Respiration

Photosynthesis

Combustion

In the table below, write the name of each process.
(Note that one process appears twice.)

Process	Name
W	
X	
Y	
Z	



Question 6

15 marks

In the diagrams below, circles of different colours are used to represent atoms of different elements.

Complete the table below for the substances shown in diagrams **A** to **E**.

In each case, state whether the diagram represents a solid, a liquid or a gas.

Also state whether the diagram represents an element, a compound or a mixture.

(Some parts of the table are already completed for you.)

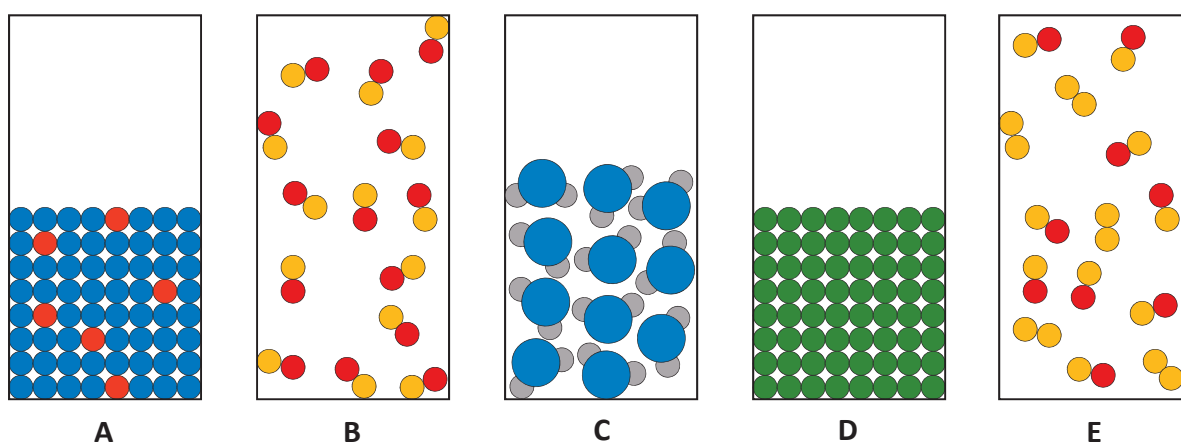


Diagram	Solid, liquid or gas	Element, compound or mixture
A		Mixture
B		
C		
D	Solid	
E		



Question 7

15 marks

The picture below shows a human female sex cell surrounded by human male sex cells.

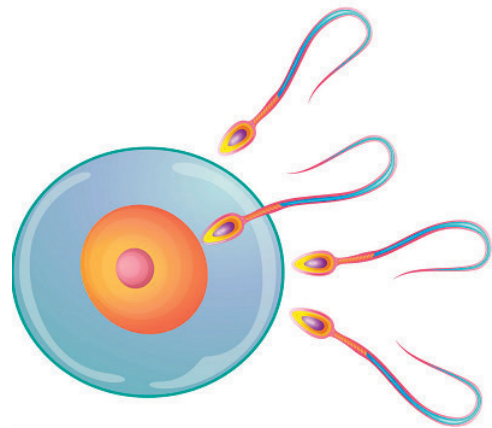
Answer questions **(a)**, **(b)** and **(c)** by putting a tick (✓) in the correct box.
Tick one box only for each question.

(a) What is the human female sex cell called?

- Sperm
- Egg
- Vagina
- Penis

(b) What is the human male sex cell called?

- Sperm
- Egg
- Vagina
- Penis



(c) Where in the female reproductive system is the female sex cell produced?

- Womb
- Testes
- Vagina
- Ovary

(d) In the diagram, draw a box around the male sex cell that is fertilising the female sex cell.

(e) State one way of reducing the chance that sexual intercourse could result in fertilisation.



Question 8

15 marks

- (a) Match each of the following sub-atomic particles to their descriptions in the table below.

Electron	Neutron	Proton
Description	Particle	
Positively charged		
Negatively charged		
No charge		

- (b) Complete the table below, using the Periodic Table of the elements to predict the ratio of atoms and the chemical formula for each of the compounds listed.

You should refer to page 79 of the *Formulae and Tables* booklet when answering this question.

The first row is completed for you.

Compound	First element	Second element	Ratio	Formula
Water	Hydrogen (H)	Oxygen (O)	2 : 1	H ₂ O
Magnesium chloride	Magnesium (Mg)	Chlorine (Cl)	:	
Ammonia	Nitrogen (N)	Hydrogen (H)	:	

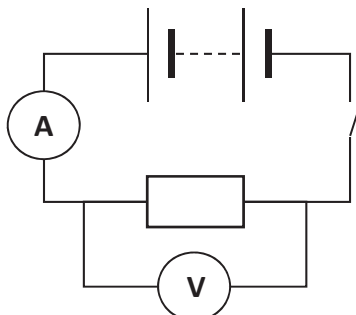


Question 9

15 marks

A student investigated the relationship between the potential difference (voltage) across a resistor and the current flowing through it.

The circuit diagram below shows the arrangement of the apparatus used by the student.



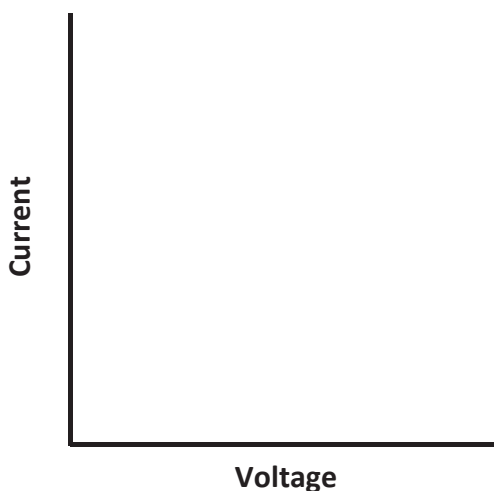
Examine the circuit diagram and answer the questions below.

- (a) The instrument labelled **V** measures voltage. Name instrument **V**.

- (b) The instrument labelled **A** measures current. Name instrument **A**.

- (c) In the circuit diagram above, draw a circle around the symbol for the switch.

- (d) The student found that current is proportional to voltage for this resistor. Using the axes provided, draw a sketch of a graph to show this relationship.



Question 10

15 marks

Read the following article, taken from an online newspaper, and answer the questions that follow.

Space invaders: the alien species that are costing us millions

In 1847 the Japanese knotweed was a medal-winning plant with strong growth and pretty white flowers. Things are very different today, with British house buyers being denied mortgages if this plant is found on a property.



It has also taken hold in Ireland. Japanese knotweed can grow through the smallest crack and grow up to 2 cm a day, extending 7 m horizontally and 3 m deep. It is one of a number of unwanted and sometimes dangerous invasive species that have taken foothold in Ireland.

Invasive species are often present due to human intervention. Some species have been deliberately released, while others, such as the American mink and the giant rhubarb, have escaped from farms and gardens. Others, such as the New Zealand flatworm, arrived accidentally in the soil of imported plants.

Some invasive plants such as the Japanese knotweed die back during winter, exposing the soil and leading to erosion.

irishtimes.com

(a) Name one invasive species found in Ireland.

(b) Describe one way an invasive species could get to Ireland.

(c) In the comments section below this article, an online reader comments that “all species are invasive – that’s nature, that’s evolution”.

Do you agree or disagree with this comment? Explain your answer.



Question 11

30 marks

Citric acid is a chemical found in lemons and some other fruits.

It is a white crystalline solid when pure.

Solid citric acid may be dissolved in water to make a citric acid solution.



- (a) Describe how to make up a solution which contains 5 g of citric acid dissolved in 100 ml of water. As part of your description, name each piece of equipment you would use. (A labelled diagram may help your answer.)

	Labelled diagram



Baking soda is another white solid compound. Its chemical name is sodium hydrogen carbonate. It is often used in making bread and cake.

When baking soda is added to a test tube of citric acid solution, fizzing occurs and a gas is produced.

- (b)** A student holding the test tube notices that it cools down during the reaction.

Is this reaction an example of an endothermic or an exothermic reaction? Explain your answer.



This reaction is also an example of an acid-base reaction.

When baking soda is added to a test tube of citric acid solution, the chemicals react and the pH of the solution changes.

- (c)** Would you expect the pH of the solution in the test tube to increase or decrease during the reaction? Explain your answer.

- (d)** Describe how you could investigate how pH changes during the reaction.

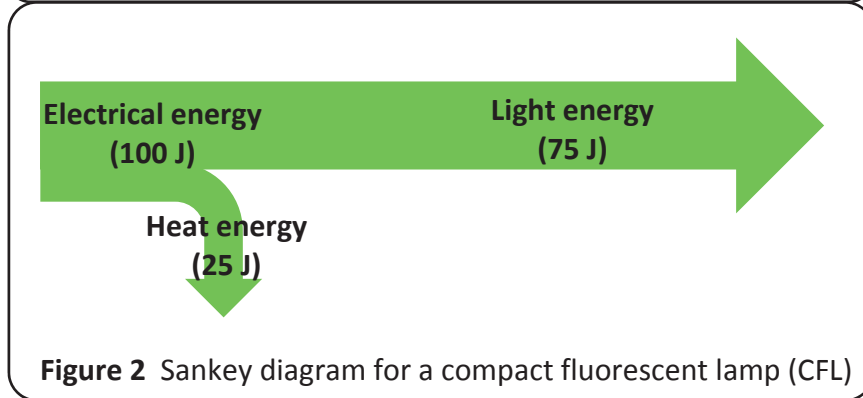
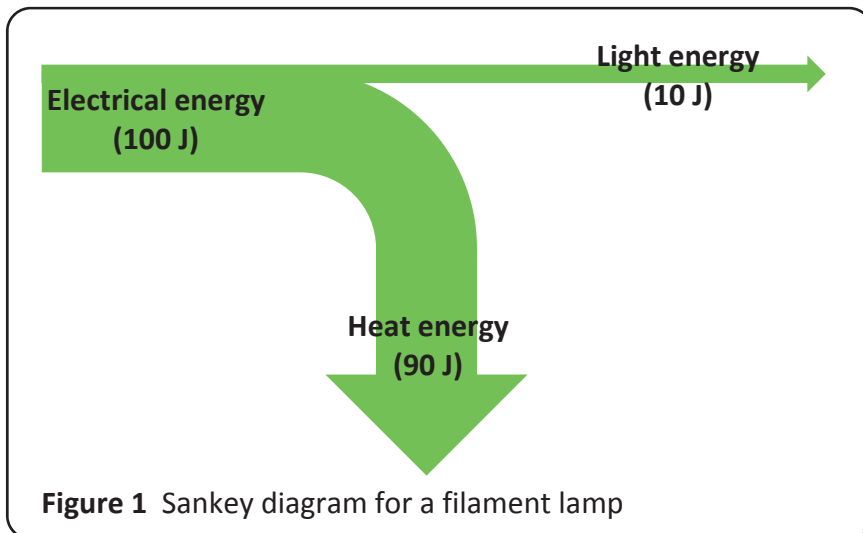


Sankey diagrams are named after H. Riall Sankey, a Tipperary-born engineer, following his 1898 description of the energy efficiency of a steam engine.

Sankey diagrams show the flow of energy to and from a device.

In a Sankey diagram, the width of each arrow represents the energy named.

The Sankey diagrams for a filament lamp and a compact fluorescent lamp (CFL) are shown below.



(a) Examine figures 1 and 2. Which lamp is more efficient? Justify your answer.

(b) Why is it important to improve the energy efficiency of household devices, such as lamps?

(c) A student is asked to investigate and compare the heat energy produced by filament lamps and CFLs.

Apart from the lamps themselves, name a piece of equipment that could be used during this investigation. Explain how this piece of equipment could be used during the investigation.

(d) The energy conversions that happen in a CFL are described in the table below. Complete the table for another device which transforms energy from one form to another and which you designed as part of your studies in science.

Name of the device	Function of the device	Main useful energy conversion	Main loss of energy
Compact fluorescent lamp (CFL)	To provide artificial light	Electrical to light	Electrical to heat

(e) Sketch a Sankey diagram for the device you described in part (d). Label each part of the diagram.

Labelled Sankey diagram

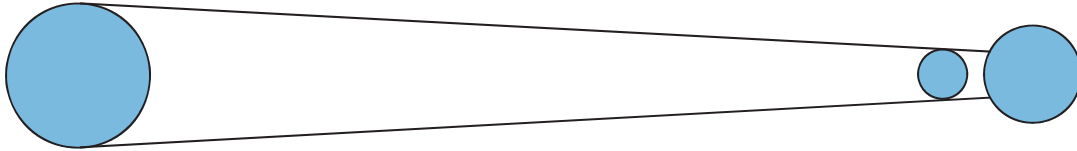


Question 13

30 marks

Solar eclipses can happen a few times each year.

- (a) The diagram below shows a simple model of a solar eclipse (an eclipse of the Sun). In the diagram, write the letter **X** for Earth, **Y** for Moon and **Z** for Sun.



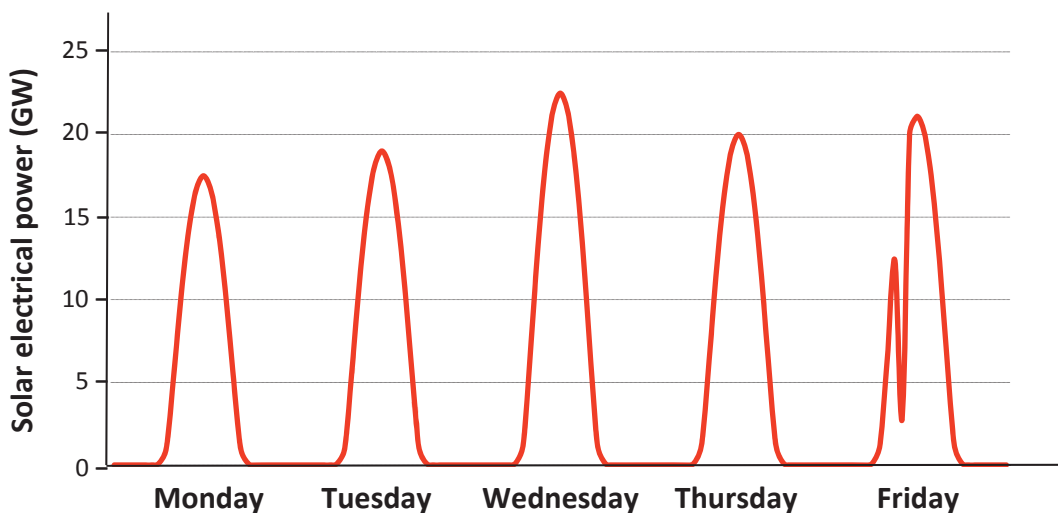
- (b) Two weeks before or after a solar eclipse sometimes there is a lunar eclipse (an eclipse of the Moon). Draw a labelled diagram to show a model of a lunar eclipse.

Labelled diagram

A large empty rectangular box with a black border, intended for drawing a model of a lunar eclipse. The text 'Labelled diagram' is written in the top left corner of the box.

A solar eclipse in March 2015 affected the solar electrical power produced in the German electricity grid.

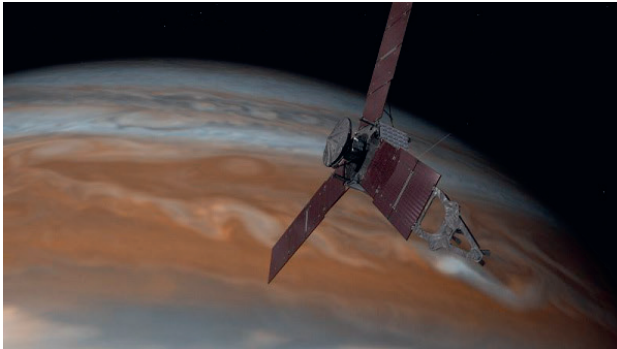
The graph below shows the solar electrical power produced from Monday to Friday during the week of the solar eclipse.



(c) On which day of the week did the solar eclipse occur? Justify your answer.

(d) Which was the brightest day of the week? Justify your answer.

(e)



The Sun can also provide power for modern spacecraft. The Juno mission to Jupiter uses solar energy to produce electricity.

Previous long-distance space missions used nuclear power to produce electricity.

State one advantage of using solar energy rather than nuclear energy during space exploration.

(f) JunoCam, a camera on the Juno probe, is powered by Juno’s solar panels.

Calculate the electrical power (P) generated by JunoCam when it uses a current of 0.5 A flowing across a potential difference (voltage) of 12 V.

Calculation

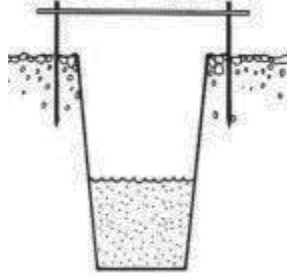



Question 14

30 marks

A group of students carried out a habitat study.

- (a) Use some of the words in the list to name the pieces of equipment shown below, which can be used in a habitat study.

Beating tray	Pooter	Net	Pitfall trap
Picture		Name	
			
			

- (b) The students also used a quadrat during their habitat study.

What shape is a quadrat? Describe how the students might have used the quadrat.

In one part of the habitat, the students used the quadrat 30 times and found that a certain species was present on 18 occasions. Calculate the percentage frequency of that species.

Calculation



The students were given permission to remove some green plants from the habitat to take back to their school laboratory. They did this in order to investigate factors that affect photosynthesis.

- (c)** Imagine that you are one of the students. You have been asked to carry out an experiment to investigate how any one factor affects photosynthesis.

Name one factor which could affect photosynthesis and which you might investigate.

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List two factors which you would keep constant (fixed) during the experiment to ensure that it is a fair test.

- (d)** Write a suitable hypothesis for this experiment.

- (e)** Draw a labelled diagram of the setup of your experiment.

Labelled diagram

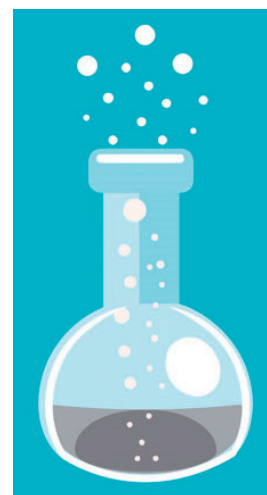


Question 15

45 marks

Some chemical reactions proceed quickly while some proceed at a slower rate.

During your studies, you investigated the effect of a number of variables on the rate of production of a common gas.



- (a) Name a common gas that could be produced in the laboratory.

- (b) Draw a labelled diagram of how this gas could be produced. Include labels for any equipment and chemicals used.

Labelled diagram

A large empty rectangular box with a black border, intended for drawing a labelled diagram of a gas production setup.

- (c) Explain how you tested this gas to confirm its identity. Include the result of the test.



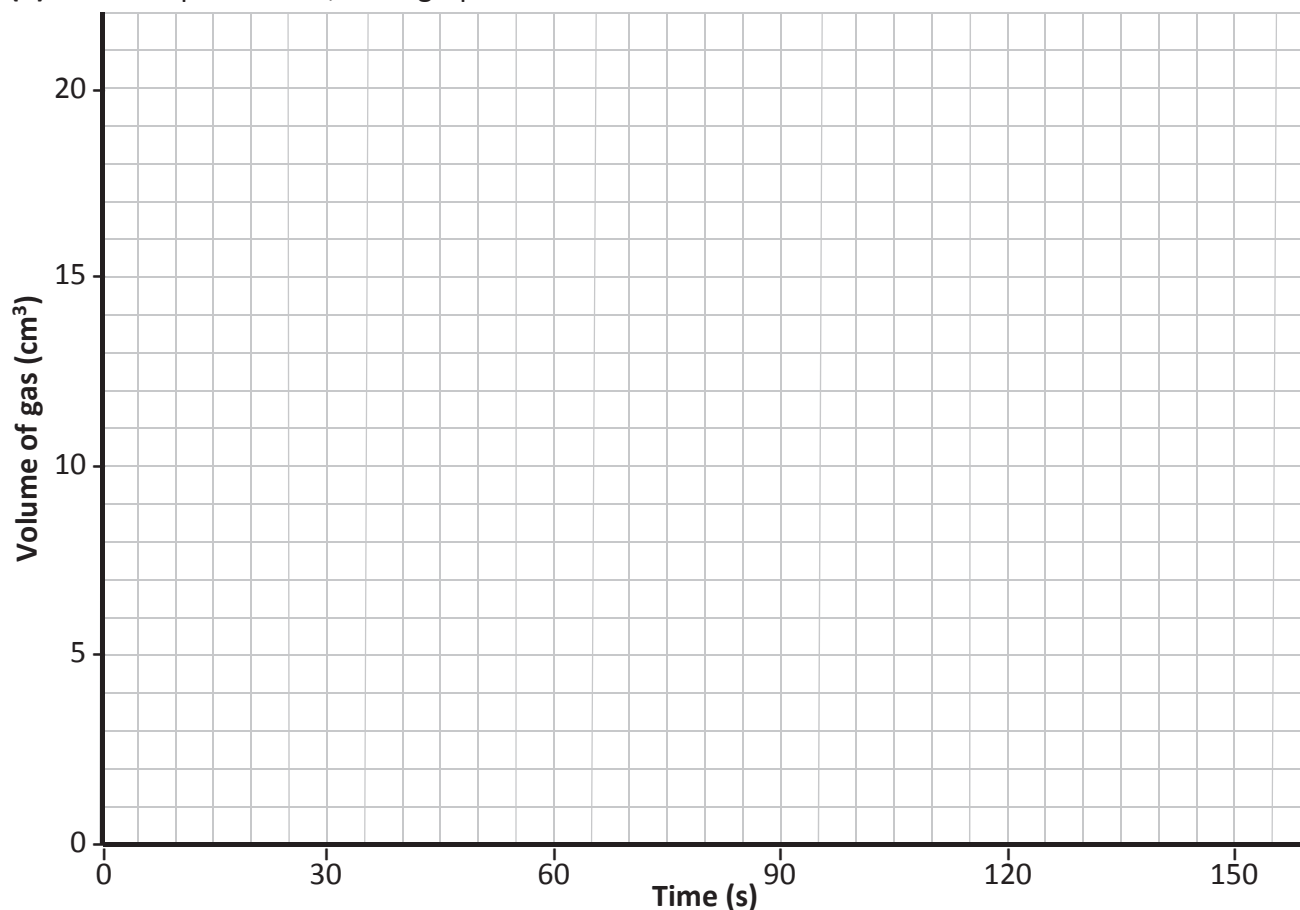
A student carried out an experiment to investigate the effect of temperature on the rate of production of a certain gas. The first reaction happened at 20 °C and the second one at 30 °C.

In both cases the gas produced was passed through water as it was collected. This was to ensure that the gas was always at room temperature (a constant) when its volume was measured.

The student recorded the following results:

Time (s)	Volume of gas (cm ³) for reaction at 20 °C	Volume of gas (cm ³) for reaction at 30 °C
0	0	0
30	7	10
60	13	16
90	17	19
120	19	20
150	20	20

(d) In the space below, draw graphs for both sets of results.



(e) State two conclusions the student could have drawn from the results.



Question 16

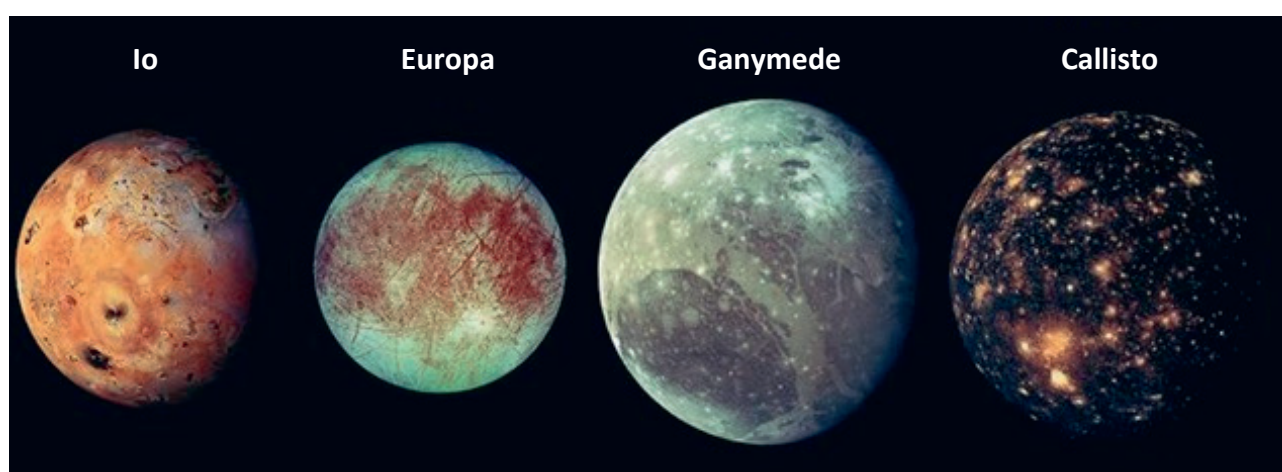
45 marks

The planet Jupiter is the largest planet in our solar system and is described as a “gas giant”. Jupiter has four large moons and many smaller ones.

These large moons were discovered in 1610 by Italian scientist Galileo Galilei.

Data about the size and density of the four large moons of Jupiter are given in the table below.

Moon of Jupiter	Diameter (km)	Density (g/cm ³)
Io	3640	3.53
Europa	3120	3.01
Ganymede	5270	1.94
Callisto	4820	1.83



Data about the size and density of some other objects in our solar system are given in the table below.

Object	Diameter (km)	Density (g/cm ³)
Mercury	4880	5.43
Earth	12700	5.51
Earth’s Moon	3470	3.34
Mars	6780	3.93
Jupiter	140000	1.33
The Sun	139000000	1.41

The densities of four materials commonly found in planets and moons are given in the table on the right.

Material	Density (g/cm ³)
Water	1.0
Granite	2.8
Basalt	3.0
Iron	8.0



- (a)** A solid of mass 12 g has a volume of 1.5 cm³.

Calculate the density of the material.

Hence identify the material as either water, granite, basalt or iron.

Calculation
Material: _____

- (b)** Granite and basalt are found in the Earth’s crust. Use the data given in the tables to state whether or not it is likely that all of the Earth is made of these rocks. Justify your answer.

- (c)** Use the data given for Jupiter and Earth to explain why Jupiter is described as a “gas giant”.

- (d)** Callisto is a moon and Mercury, of similar size, is a planet.
What is the difference between a moon and a planet?



- (e) Galileo’s discovery of the moons of Jupiter changed our understanding of Earth and space. Describe another example of how our scientific understanding changed over time.

- (f) Scientists estimate that our solar system began to form about 4.6 billion years ago. Scientists also estimate that our universe formed 13.8 billion years ago. Describe two things that scientists believe happened during the early formation of the universe – before the formation of solar systems.



Acknowledgements

Images

Images on page 3: homesciencetools.com; microbehunter.com
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Image on page 22: classroomclipart.com
Image on page 24: forcetoknow.com

Texts

Text on page 12: Nesbitt, Jill. *Space invaders: the alien species that are costing us millions*. <<http://www.irishtimes.com/news/science>> (5 March 2018).

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Junior Cycle Final Examination – Common Level

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Sample Paper

Time: 2 hours



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