2019. S26

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Final Examination 2019

Science

Common Level

Monday 10 June Afternoon 2:00 – 4:00

360 marks

Examination number				

Centre stamp

Instructions

Write your examination number in the box on the front cover.

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.

Write your answers in the spaces provided in this booklet. You are not required to use all of the space provided. 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.

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.

Write your answers in blue or black pen. You may use pencil for graphs and diagrams only.

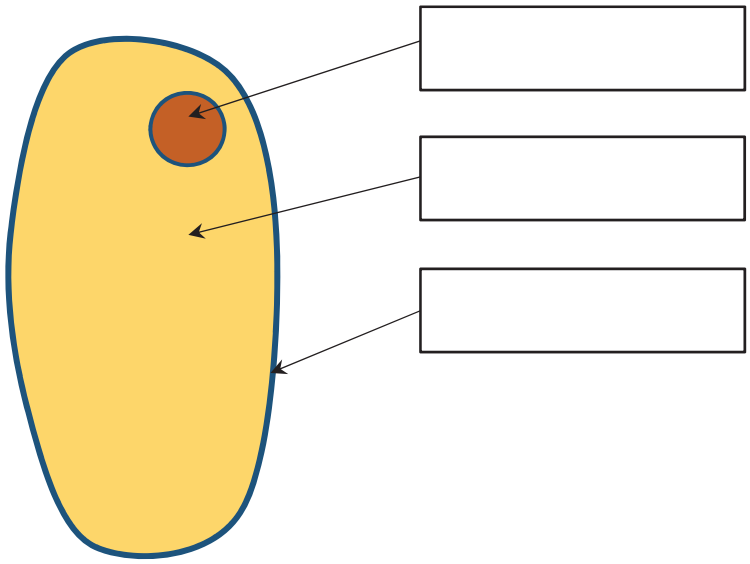
Section A — 150 marks

Question 1 **(15 marks)**

The diagram shows an animal cell.

(a) Use the words listed below to label the parts of the cell.

Cytoplasm **Cell membrane** **Nucleus**



(b) Which of the three named parts controls the activities of the cell?

(c) A student was asked to examine animal cells in the laboratory. Which of the following instruments should the student use? Place a tick (✓) in the correct box.

Telescope ☐

Microscope ☐

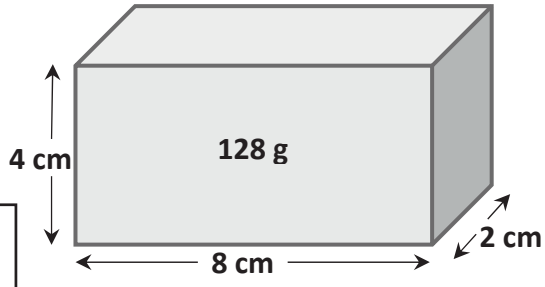
Periscope ☐

Question 2 **(15 marks)**

A student was asked to measure the density of a block.

The dimensions of the block are shown in the diagram.

The mass of the block is 128 g.



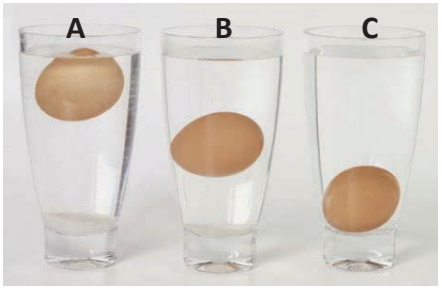
(a) Calculate the volume of the block.

Calculation

(b) Calculate the density of the block. Include the unit for your answer.

Calculation

(c) The photograph below shows three glasses of water labelled **A**, **B** and **C**. An egg was placed into each glass. The photograph was taken when the eggs were stationary.



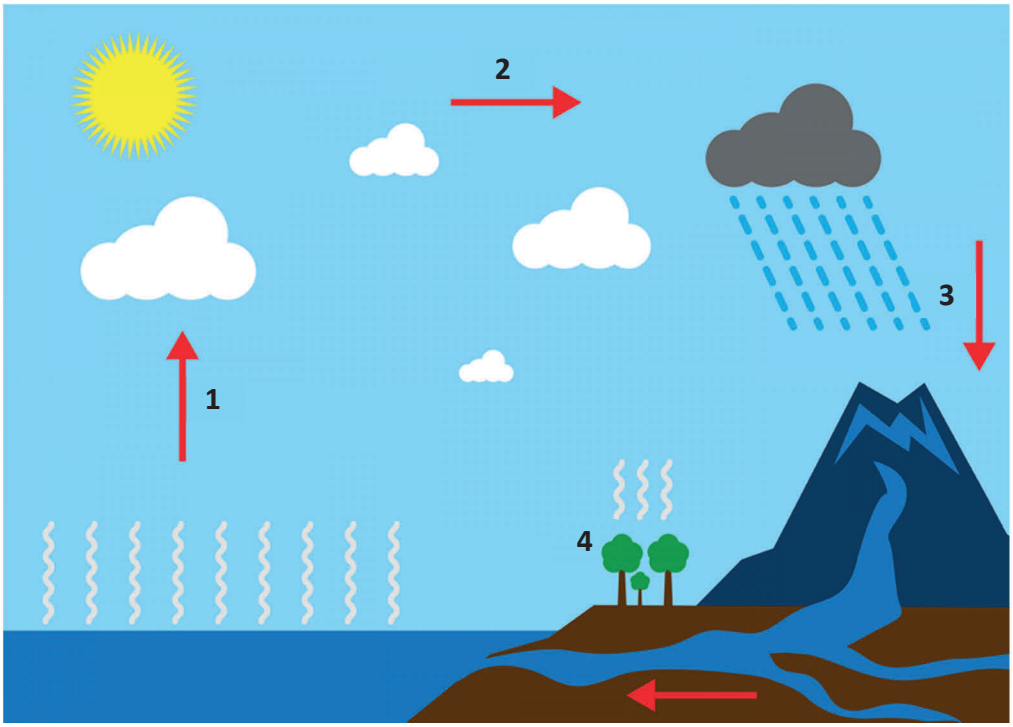
Which glass (**A**, **B** or **C**) contains the egg with the greatest density?

Give a reason for your answer.

Question 3 **(15 marks)**

The diagram below illustrates the water cycle.

Some of the key stages of the water cycle are labelled **1**, **2**, **3** and **4**.



(a) Complete the table below using the numbers **1**, **2**, **3** or **4** to match each of the labelled processes shown in the diagram with the correct description.

Process	1, 2, 3 or 4?
Air currents cause clouds to move onshore	
Water falls to the Earth as precipitation	
Heat from the Sun converts liquid water into water vapour	
Plants lose water through the process of transpiration	

(b) In 2018 Ireland experienced low rainfall throughout the year. This led to water shortages and restrictions on water use.

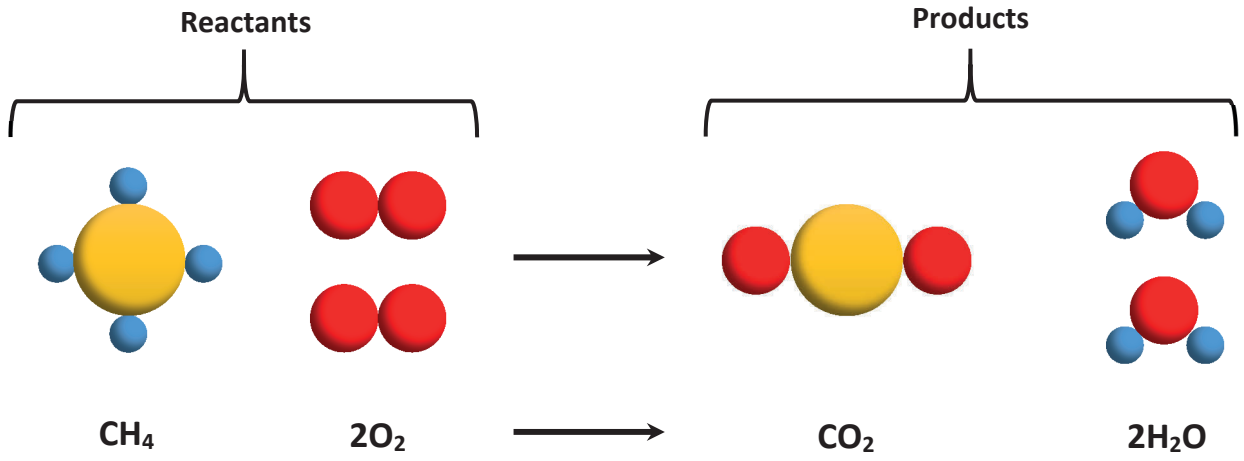
Describe one way in which water usage in a home could be reduced.

Question 4 **(15 marks)**

Natural gas contains methane (CH_4). Methane is a fuel.

Methane burns in oxygen to produce carbon dioxide and water.

The diagram below represents the reaction.



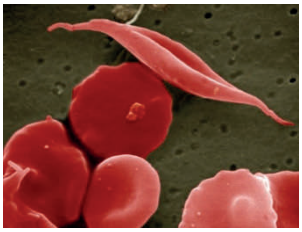
(a) Count the number of each type of atom in the products to complete the table below.

Element	Type of atom	Number of atoms in reactants	Number of atoms in products
Carbon		**1**	
Hydrogen		**4**	
Oxygen		**4**	

(b) Mass is conserved during this reaction. What evidence is there for this?

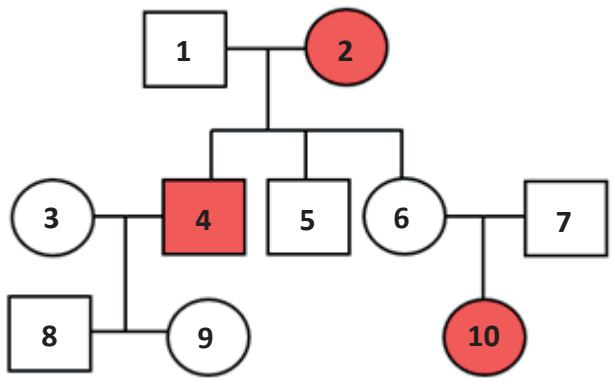
(c) The burning of methane is an example of a chemical change.
Describe one difference between a physical change and a chemical change.

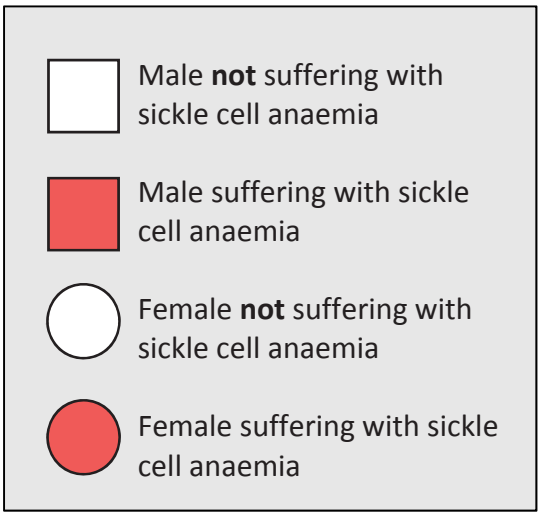
Question 5 **(15 marks)**



Sickle cell anaemia is an inherited human disease. It causes the body to produce red blood cells that have an irregular shape. The gene for the disease is passed on from generation to generation.

Examine the pattern of inheritance for sickle cell anaemia shown in the family tree below and answer the questions that follow.





(a) Square **1** and circle **2** are a married couple. How many children did this couple have?

(b) Some non-sufferers may be carriers of the disease. This means that they have inherited the sickle cell gene, but they don't suffer from the disease. What evidence is there from the diagram that persons **6** and **7** are both carriers?

(c) Suffering from sickle cell anaemia is an example of a genetically controlled characteristic. Classify the characteristics below as being either genetically controlled or **not** genetically controlled by placing a tick (✓) in the correct column in each case.

Characteristic	Genetically controlled	Not genetically controlled
Eye colour		
How to cycle a bike		

(d) Answer the following question by placing a tick (✓) in the correct box.

The function of red blood cells is to

Fight infection ☐ Clot blood ☐ Carry oxygen ☐

Question 6 **(15 marks)**

A student carried out an experiment to investigate the reaction between an acid and a base.

A pH indicator and a thermometer were used to monitor changes in pH and temperature during the reaction.

(a) Name a pH indicator the student could have used during this investigation.

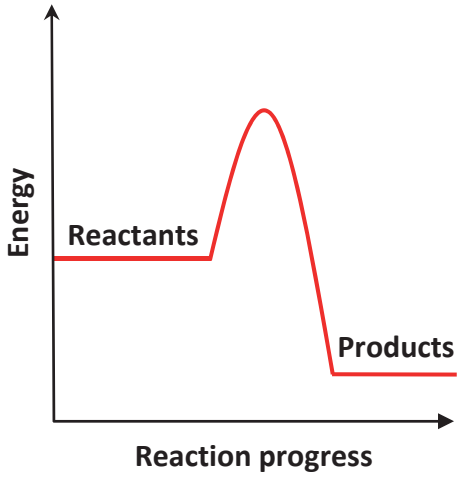
(b) What colour is this indicator when placed in acid?

(c) When an acid and a base react, they neutralise each other to produce a neutral solution. On the pH scale, what number represents a neutral solution?

(d) The student noted a rise in temperature as the acid-base reaction took place. Is this an example of an endothermic or an exothermic reaction?

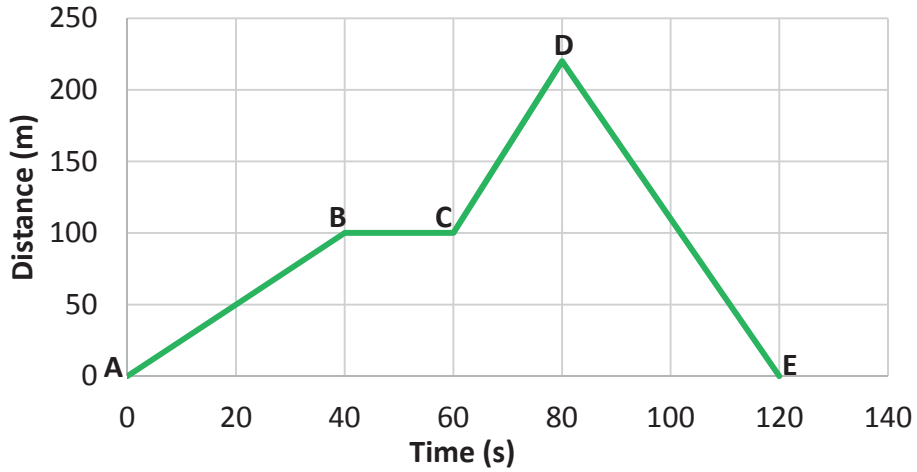
(e) The diagram shows an energy profile diagram for the reaction between an acid and a base.

On the diagram, show the activation energy for this reaction.



Question 7 **(15 marks)**

The graph below represents the journey of a cyclist.



(a) Name an instrument that could be used to measure the time taken for the journey.

(b) Calculate the average speed of the cyclist as he travelled from point **A** to point **B**.

Calculation

(c) Describe the cyclist's motion between points **B** and **C** of his journey.

(d) The cyclist's speed as he travelled from point **A** to point **B** was less than his speed as he travelled from point **C** to point **D**. What evidence is there in the graph to support this?

(e) Describe what the cyclist did at point **D**.

Question 8 **(15 marks)**

Global warming can cause the melting of ice sheets and glaciers, which is partly responsible for rising sea levels.

(a) Name a human activity which has led to global warming.

(b) State a consequence of rising sea levels on coastal areas.

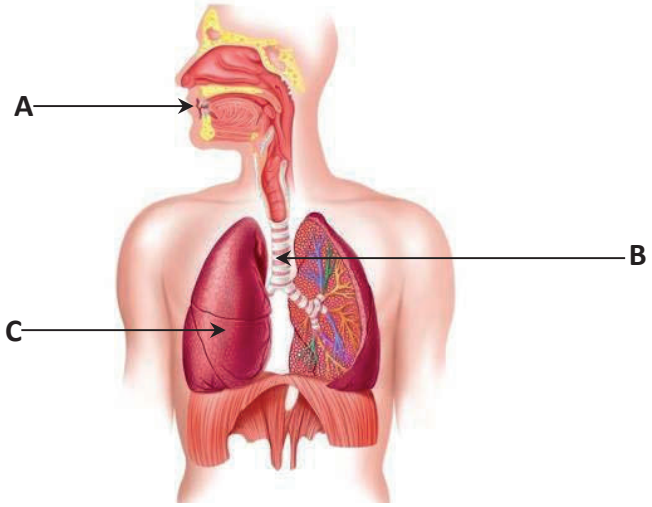
(c) Ice sheets are the natural habitat of animals such as polar bears. State one adaptation of polar bears that makes them suited to this habitat.

(d) Would you expect the population of polar bears to increase or decrease as ice sheets melt?

(e) When solid ice changes state to become liquid water, this is called melting. What name is given to the change of state when liquid water becomes solid ice?

Question 9 **(15 marks)**

The diagram shows the human respiratory system.



(a) Complete the table below by matching the words to the letters in the diagram.

Lung **Trachea** **Liver** **Oesophagus** **Mouth**

Letter	Part of respiratory system
A	
B	
C	

(b) Describe what happens in the respiratory system when a person breathes in.

Question 10 **(15 marks)**

Answer questions **(a)** and **(b)** by placing a tick (✓) in the correct box.

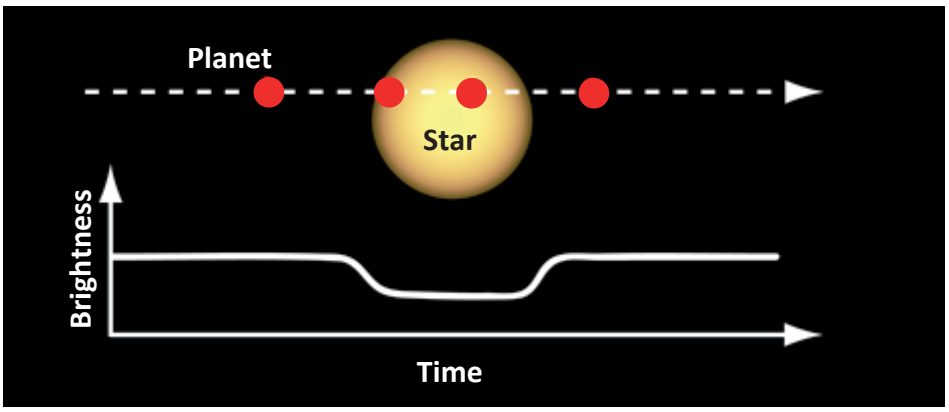
(a) A star and all of the objects that orbit it is called a

Moon ☐ Solar system ☐ Galaxy ☐

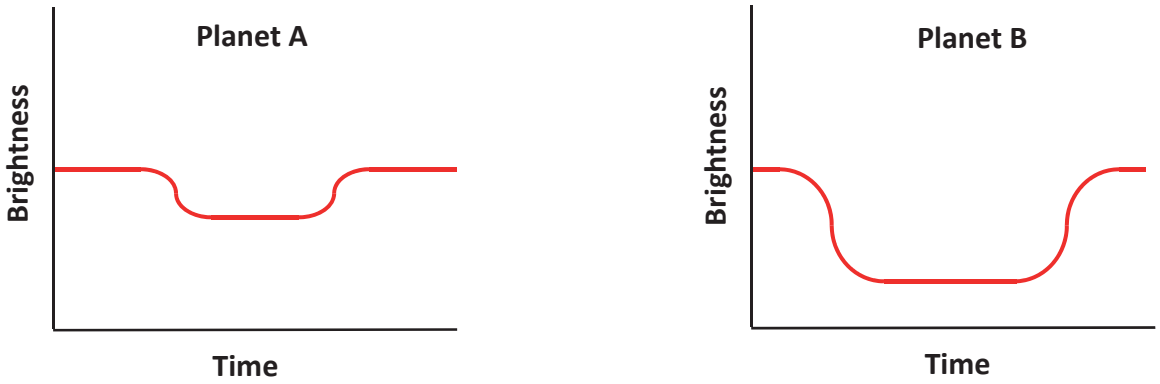
(b) A system of billions of stars is called a

Moon ☐ Solar system ☐ Galaxy ☐

(c) The image below shows a planet passing in front of a star. This partial eclipse is called a transit. The brightness of the light detected from the star decreases as the planet transits the star and blocks its light.



The graphs below show how the brightness of a star changed over time as two planets, **A** and **B**, transited the same star.



Which planet, **A** or **B**, took the shortest time to transit the star?

Which planet, **A** or **B**, is the largest? Give a reason for your answer.

Additional writing space for **Section A**.
Label all work clearly with the question number and part.

Section B — 210 marks

Question 11 **(30 marks)**

Sodium chloride (table salt) is a white crystalline solid.

Water is a solvent with a boiling point of 100 °C.

Sodium chloride can dissolve in water.

A student was asked to investigate what effect adding salt has on the boiling point of water.

(a) Write a suitable hypothesis for this investigation.

(b) What is meant by the boiling point of a substance?

(c) The laboratory instrument used to measure the mass of the salt is shown in the photograph.

Identify this instrument.

(d) In the space below, draw a labelled diagram of the arrangement of the apparatus used to determine the boiling point of water.

Labelled diagram

The student collected the following data for the boiling point of the solutions made when various masses of salt were dissolved in 60 cm^3 of water.

Mass of salt (g)	Boiling point (°C)					Average boiling point (°C)
0	100	101	100	100	102	100.6
2	101	104	101	100	103	101.8
4	103	105	104	106	107	
6	106	108	107	107	108	107.2
8	108	110	109	111	110	109.6

(e) Calculate the average boiling point when 4 g of salt was dissolved in 60 cm^3 of water.

Calculation

(f) Suggest a reason why the student repeated the investigation five times for each mass of salt used.

(g) Does the data support the hypothesis you wrote in part **(a)**? Explain your answer.

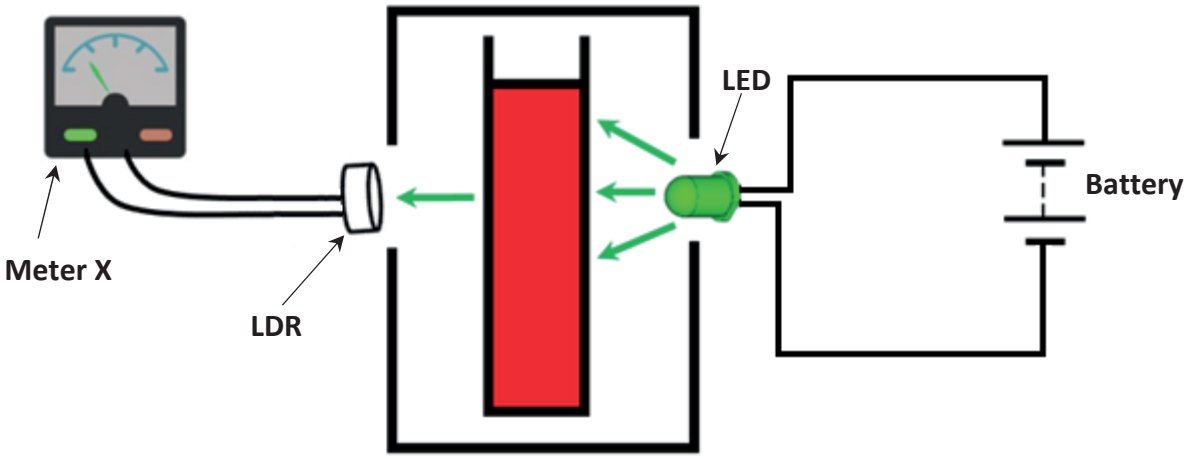
Question 12 **(30 marks)**

When green light is shone into a red solution, such as blood, some of the light is absorbed, some is reflected and some passes straight through.

A student set up the apparatus shown below to investigate the relationship between the concentration of a red solution and how much green light passes through it.

On one side of the test tube of red solution, green light was emitted from a light emitting diode (LED).

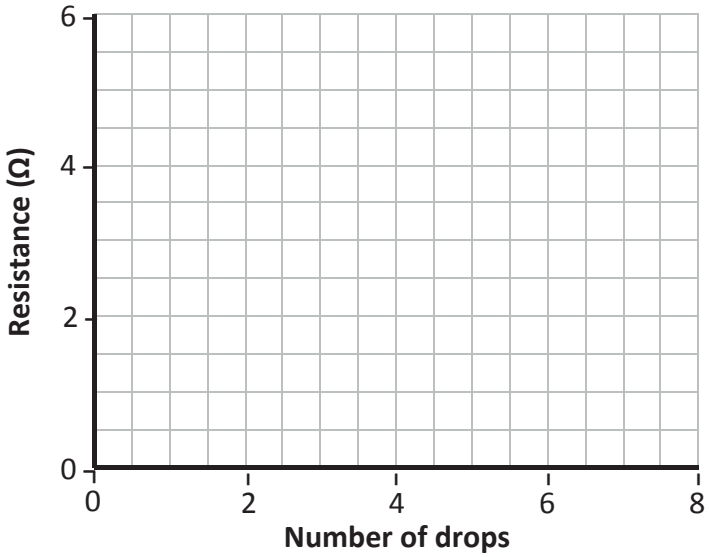
On the other side of the test tube, a light dependent resistor (LDR) was used to detect how much green light passed through the solution.



The student made different concentrations of a solution of red food dye by varying the number of drops of dye added to 20 cm^3 of water. The resistance of the LDR was then determined using meter **X**. The following results were obtained.

Number of drops of food colouring	0	1	2	3	4	5	6	7	8
Resistance (Ω)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0

(a) In the space below, draw a graph of the results obtained.



(b) State one conclusion which is supported by the results.

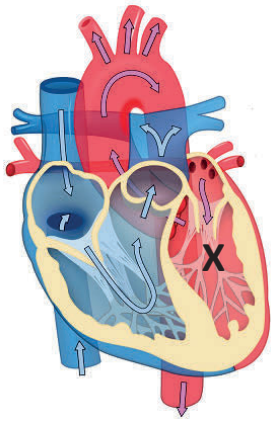
(c) Name meter **X**, which was used to determine the resistance of the LDR.

(d) Name a piece of equipment the student could have used to accurately measure 20 cm^3 of water.

(e) A smart watch uses a green LED to measure a person's pulse by shining green light into the red blood in the person's wrist.

Describe one other technological application of physics that is used in everyday life.

(f) The chamber of the heart marked **X** pumps blood around the body and generates a pulse.



Name chamber **X**.

Explain why some of the tubes connected to the heart are coloured red and some of them are coloured blue.

Question 13 **(30 marks)**

Electrical energy is one of the most important types of energy that we use in our daily lives. An electrical appliance has a power rating which tells you how much electricity it uses.

The table below shows the power rating of some common household appliances and the forms of energy that are produced in the appliances.

Appliance	Power rating (W)	Forms of energy produced	Current used (A)
Coffee maker	1380	Heat, Sound	6
Television	115	Heat, Light, Sound	0.5
Kitchen blender	345	Heat, Kinetic, Sound	1.5
Dishwasher	2300	Heat, Kinetic, Sound	10

(a) Which appliance listed in the table uses the most electrical energy?

(b) Select one of the appliances from the table above and name a useful form of energy produced when the appliance is being used.

Name of appliance:

Useful form of energy:

For the appliance you have selected, name an unwanted form of energy produced.

For the appliance you have selected, calculate the voltage applied across the appliance. Include the unit for your answer.

Calculation

(c) What pattern, if any, exists between the power rating of the appliance and the current used?

Sustainability issues arise from the generation and consumption of electricity.

(d) What do you understand by the term sustainability?

(e) Suggest one way in which we can reduce how much electrical energy we use.

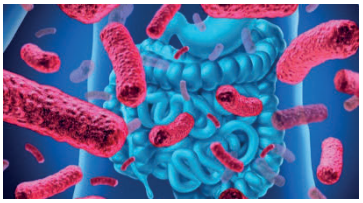
(f) Electrical energy can be produced using renewable and non-renewable sources.
Identify **two** renewable sources of energy from the list below by placing a tick (✓) in each of the correct boxes.

Oil	☐
Solar	☐
Natural gas	☐
Wind	☐

Question 14 **(30 marks)**

Read the article below, adapted from an Irish newspaper, and answer the questions that follow.

UCC Study: High fibre foods ease stress effects



Interest has been growing in recent years in the link between gut bacteria and stress-related disorders. Researchers at University College Cork (UCC) have shown that micro-organisms in the gut (intestines) are really important for our brain health.

Bacteria in the gut produce fatty acids which are a source of nutrition for cells in this part of the body. Foods such as grains and vegetables contain high levels of fibre and will stimulate gut bacteria to produce these fatty acids.

The UCC study involved feeding mice the fatty acids normally produced by gut bacteria and then subjecting them to stress. Using behavioural tests, the mice were assessed for anxiety and depressive-like behaviour. The researchers found that there was a decreased level of this type of behaviour when fatty acids were consumed. These results provide new insights into mechanisms related to the impact of the gut bacteria on our brains and behaviour.

The Irish Examiner

(a) Name a type of food that is high in fibre.

(b) The study involved feeding mice fatty acids and then subjecting them to stress. Describe a control experiment which the scientists could have used in this investigation.

(c) What observation did the scientists note about the behaviour of the mice after they had been fed fatty acids?

(d) Do you agree or disagree with the use of animals (such as mice) in scientific research? Explain your answer.

(e) Human health is affected by environmental factors such as stress. Name another environmental factor which has an effect on human health.

(f) This article highlights a beneficial role of micro-organisms in human health. State another example of how bacteria could have an effect on human health.

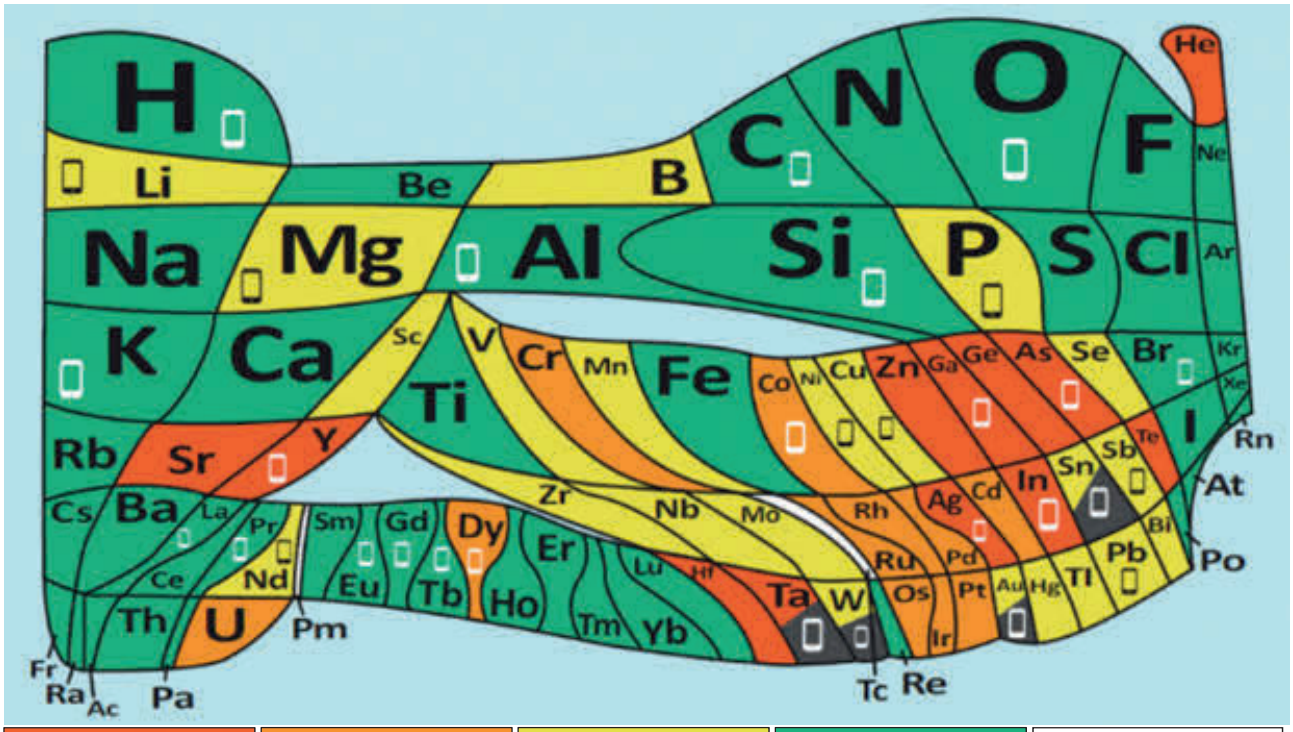
(g) The image shows bacterial cells dividing in order to reproduce. This is an example of asexual reproduction.

Describe one difference between sexual and asexual reproduction.

(h) Over time a bacterial population can evolve. Outline the theory of evolution by natural selection.

Question 15 **(45 marks)**

The Periodic Table was developed by Dmitri Mendeleev. It was published 150 years ago in 1869. To celebrate the International Year of the Periodic Table, The European Chemical Society has designed a new kind of Periodic Table called the '90 Elements that make up everything'.



Availability seriously threatened in the next 100 years	Rising threat to availability	Limited availability; future risk to supply	Plentiful supply	Elements used in a smart phone

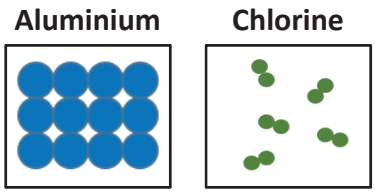
The table has been drawn so that the area occupied by each element indicates how much of that element is in the Earth's crust and atmosphere.

(a) From the table, identify a gas which is a component of the Earth's atmosphere and which is in plentiful supply.

(b) Why should the use of the gas helium (He) in birthday balloons be avoided?

(c) The element indium (In) is used in smart phones. At current usage rates, indium will be used up in 50 years. Suggest one way humans could contribute to sustaining levels of this element for future generations.

The diagrams on the right show the arrangement of particles in the elements aluminium and chlorine at room temperature.



(d) What evidence is there in the diagrams to support the classification of these substances as elements?

(e) Which of these elements is a solid at room temperature? Justify your answer.

(f) Aluminium reacts with chlorine to form the compound aluminium chloride. Use the Periodic Table on page 79 of the *Formulae and Tables* booklet to predict the ratio of aluminium to chlorine in this compound. Hence write the chemical formula for aluminium chloride.

(g) Elements can be classified as metals or non-metals.

The table shows some of the properties of three elements from the Periodic Table.

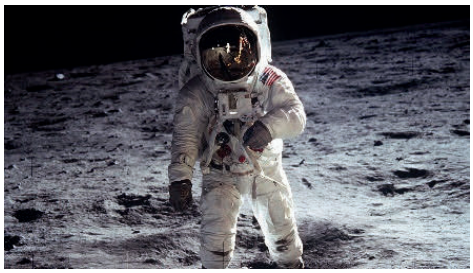
	Melting point (°C)	Boiling point (°C)	Conductor of electricity
Element 1	1538	2862	Yes
Element 2	-7	59	No
Element 3	-101	-34	No

Which element (**1**, **2**, or **3**) is most likely to be a metal? Justify your answer.

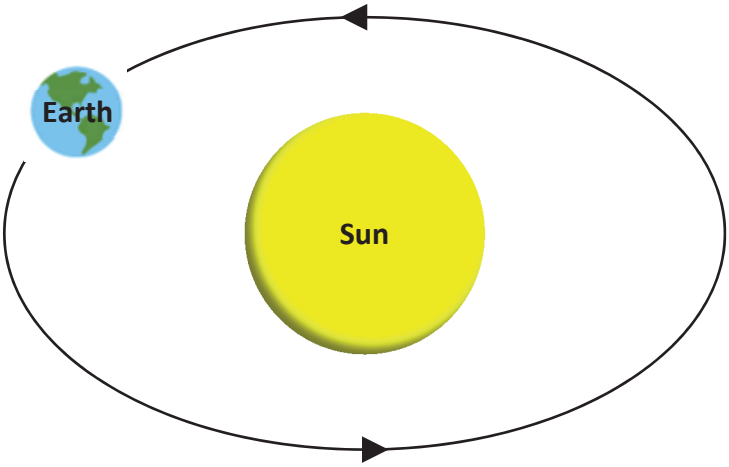
Which element (**1**, **2**, or **3**) is a liquid at room temperature (20 °C)? Justify your answer.

Question 16 **(45 marks)**

2019 marks the 50th anniversary of man's first landing on the Moon. Since then there have been a number of other missions to the Moon.



(a) The diagram below shows the Earth orbiting the Sun. Complete the diagram to show the shape, location and motion of the Moon in the Earth-Sun-Moon system.



(b) At the time of the first landing, the Moon was in a waxing crescent phase as seen from Earth. The images below show different phases of the Moon in sequence, from left to right. Place a tick (✓) in the box beneath the image which shows the Moon in a waxing crescent phase.

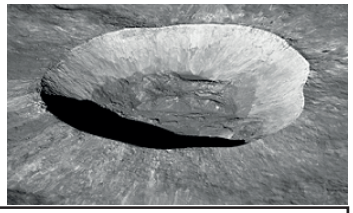
☐ ☐ ☐ ☐

Shade in the image of the Moon on the left to illustrate the next phase of the Moon in the sequence above.

(c) On January 2nd 2019, the Chinese Chang'e-4 lander touched down on the far side or 'dark side' of the Moon.

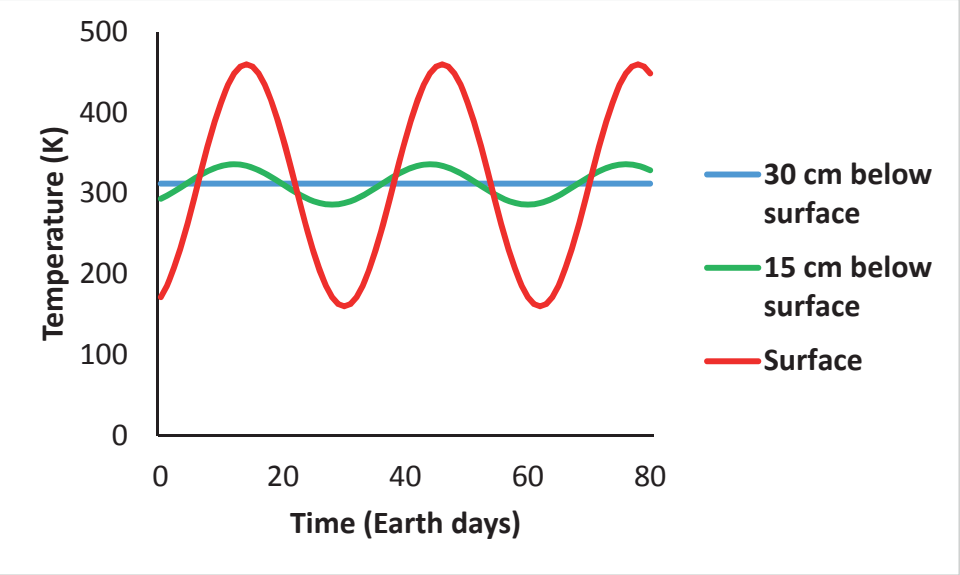
Explain why this side of the Moon is never visible from Earth.

(d) The dark circles visible on the Moon's surface are craters. Craters occur when objects with high speed strike the surface of the Moon. Examples of such objects are asteroids and comets.



What is an asteroid?

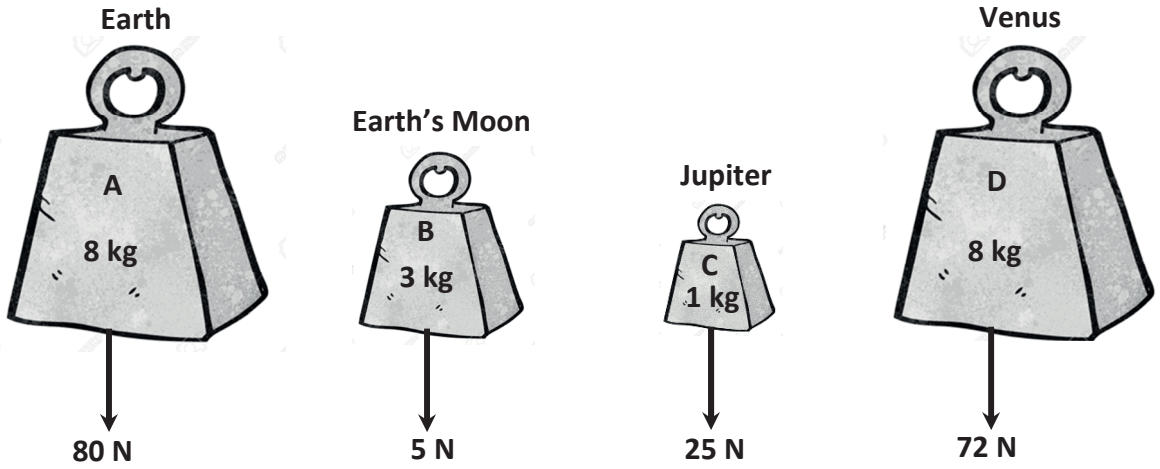
(e) Many investigations were carried out during missions to the Moon. One investigation measured the temperature of the lunar surface at various depths. The graph shows the temperatures measured at different depths over a period of time.



Describe how the temperature on the surface of the Moon (red line) changed with time. Suggest an explanation for this pattern.

Describe the relationship between the depth below the surface of the Moon and the change in temperature. Suggest an explanation for this relationship.

(f) The diagrams show the mass and weight of four objects (**A**, **B**, **C** and **D**) on the Earth, Earth's Moon, Jupiter and Venus.



Which object, **A**, **B**, **C** or **D**, has the smallest mass?

How can you tell that the force of gravity is less on Venus than it is on the Earth?

(g) During the Apollo 15 mission to the Moon in 1971, astronaut David Scott conducted the famous hammer and feather experiment.

The hammer and feather were dropped at the same time from the same height and hit the surface of the Moon at the same time.

A hammer falls much faster on Earth than it does on the Moon. Explain why.

Additional writing space for **Section B**.
Label all work clearly with the question number and part.

Acknowledgements

Images

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Images on page 4:	State Examinations Commission; thoughtco.com
Image on page 5:	printablediagram.com
Image on page 6:	State Examinations Commission
Images on page 7:	wbur.org; State Examinations Commission
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Images on page 14:	swastikchemicals.com; indiamart.com
Image on page 16:	State Examinations Commission
Images on page 17:	discountexplosion.com; bloginonline.com
Image on page 20:	newatlas.com
Image on page 21:	assignmentpoint.com
Image on page 22:	euchems.eu
Image on page 23:	State Examinations Commission
Images on page 24:	time.com; State Examinations Commission; timeanddate.com
Images on page 25	moon.nasa.gov; State Examinations Commission
Images on page 26:	State Examinations Commission; hq.nasa.gov

Texts

Text on page 20:	Ring, Evelyn. *UCC study: High fibre foods ease stress effects*. Irish Examiner. <http://www.irishexaminer.com> (1 August 2018).

Material may have been adapted, for the purpose of assessment, without the authors' prior consent.

Junior Cycle Final Examination – Common Level

Science

Monday 10 June
Afternoon 2:00 – 4:00

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