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GAN ENG SENG SCHOOL
End-of-Year Examination 2016

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE
Paper 1 Multiple Choice

Sec 2 Express

11 Oct 2016
Papers 1 & 2: 2 hours

Additional Materials: OTAS

Calculators are allowed in the examination

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the OTAS.

There are **thirty** questions in Section A. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the answer you consider correct and record your choice in soft pencil on the separate OTAS.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Read the instructions on the OTAS very carefully.

You may proceed to answer Paper 2 as soon as you have completed Paper 1.

Any rough working should be done in this booklet.

A copy of the Periodic Table is inserted on page 13.

Total marks
30

This paper consists of 13 printed pages including of the cover page

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Answer **all** the questions with the most suitable option **A**, **B**, **C** or **D**.

1 Which of the following statements is **not** true to describe particles in a liquid?

A The forces of attraction between the particles are moderately strong.
B The particles cannot be compressed.
C The particles can move randomly.
D The particles have very large spaces between them.

2 A uranium atom has an atomic number of 92 and nucleon number of 235. An isotope of this atom has ..... and another isotope of uranium has .....

A 143 neutrons, 146 neutrons
B 146 neutrons, 143 protons
C 95 protons, 92 protons
D 143 protons, 146 neutrons

3 Which statement is correct about an atom of an element?

A The atom can gain 3 electrons to form a positive ion.
B The atom can lose 2 protons to form a negative ion.
C The atom cannot lose electrons if its atomic number is 18.
D The atom is electrically neutral when it becomes an ion.

4 In which one of the following sets do all three particles have the same total number of electrons?

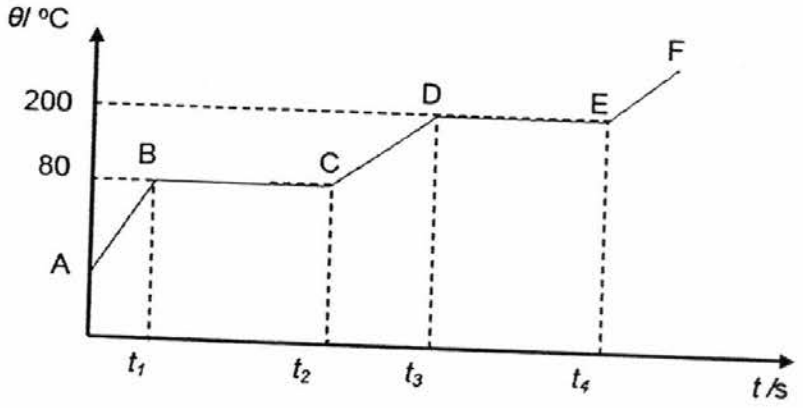
A	Cl^-	Br^-	I^-
B	F^-	Mg^{2+}	Be^{2+}
C	Na^+	Al^{3+}	Ar
D	K^+	Ca^{2+}	Cl^-

5 Which of the following does **not** describe a chemical change?

A Heating sugar to form a black substance.
B Mixing iron filings and sulfur to form a grey mixture with yellow specks.
C Adding vinegar to egg shells or marble chips to produce bubbles of gas.
D Mixing hydrochloric acid with sodium hydroxide to form sodium chloride.

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6 The graph below shows how the temperature of substance **X** varies with time as it is being heated.



Which of these statements below is/are true about the graph?

I) The freezing point of substance **X** is 80°C.
II) The boiling point of substance **X** is 200°C.
III) Steam starts to form at time t_4.
IV) The bonds between substance **X** molecules are stronger at period BC than at DE.

A II, IV
B I, II, III
C I, II, IV
D III, IV

7 A tank of water is left in the open under sunlight. Water evaporates.
Which statement about the evaporation of water is **false**?

A A liquid can evaporate faster when you blow the air above the liquid surface.
B Evaporation of water can take place at any temperature.
C Only the water particles at the top surface of the water tank escape into the atmosphere. The rest of the water below the surface remains as liquid.
D The temperature of the remaining water remains the same.

8 At 30 °C, a substance changes from the state in which its particles changed from a regular arrangement to an irregular arrangement.
Which statement is true?

A The forces of attraction in between the particles change from strong to very strong.
B The freezing point of the substance is 30 °C.
C The motions of particles change from vibration about fixed points to moving freely and rapidly.
D The spaces in between particles change from closely packed to far apart from one another.

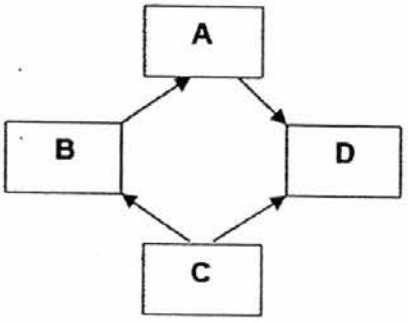
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9 What **must** happen during a chemical reaction?

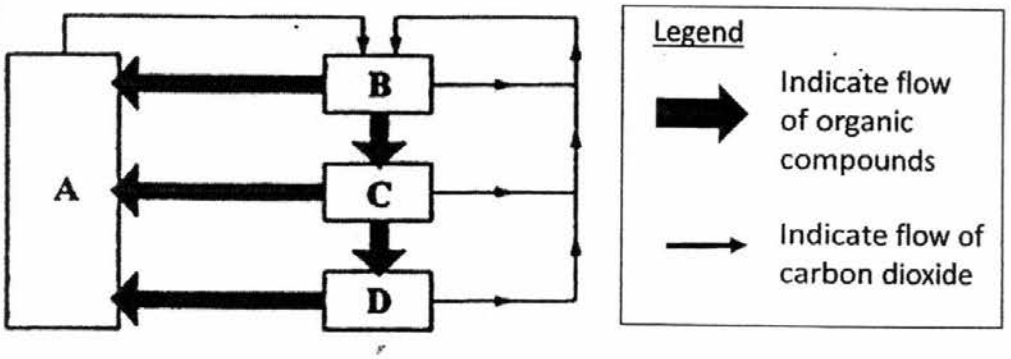
I) New product(s) is/are formed.
II) Heat is released.
III) Colour of the substance changes.
IV) Light is produced.

A I only
B I and III only
C I, II and III only
D I, II, III and IV

10 The diagram below shows a food web in an ecosystem. Which box represents a omnivorous organism?



11 The diagram represents the flow of substances within a balanced ecosystem. The boxes are various trophic levels. Which box represents producers?

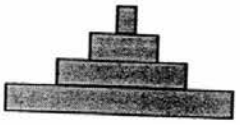
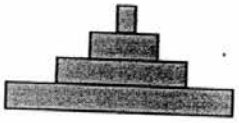
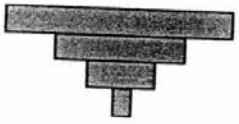


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12 Consider the following food chain below :

Tree → caterpillar → birds → snakes

Which of the following correctly illustrates the pyramid of energy and reason for the change in the amount of energy?

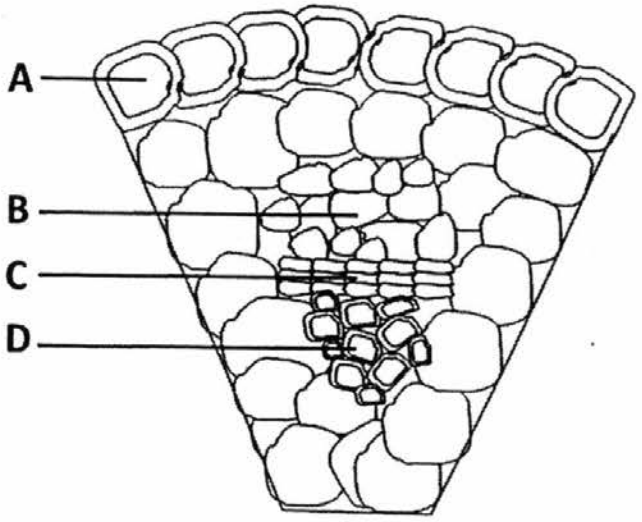
	pyramid of energy	reason for the change in the amount of energy
A		The number of cells in the organisms decreases.
B		Energy is lost to the environment as heat during respiration.
C		Energy is accumulated along the food chain
D		Each consumer is able to store chemical potential energy as it consumes food in its lifetime.

13 Which of the following sets of conditions will the rate of transpiration be the highest?

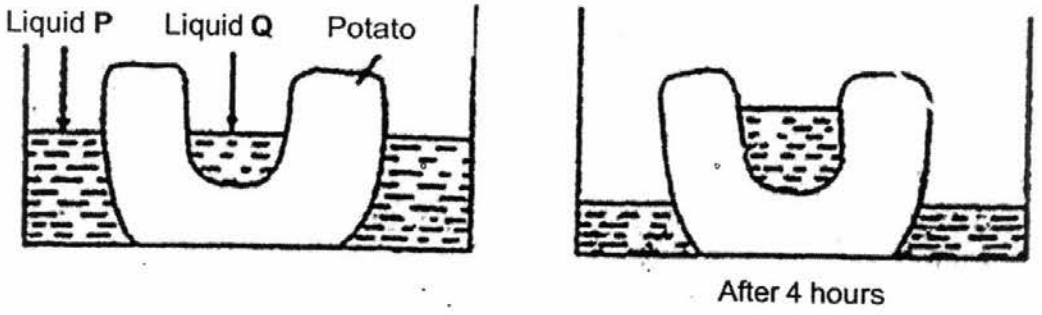
	Wind speed	Temperature	Light Intensity	Humidity
A	Low	Low	Low	High
B	Low	High	High	High
C	High	High	Low	Low
D	High	High	High	Low

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14 A leafy shoot is placed in a beaker containing a solution of a coloured dye.
The diagram shows a part of section of the stem after two days.
Which part is now most coloured by the dye?



15 An experiment was set up as shown below using a peeled potato shaped into a cup.

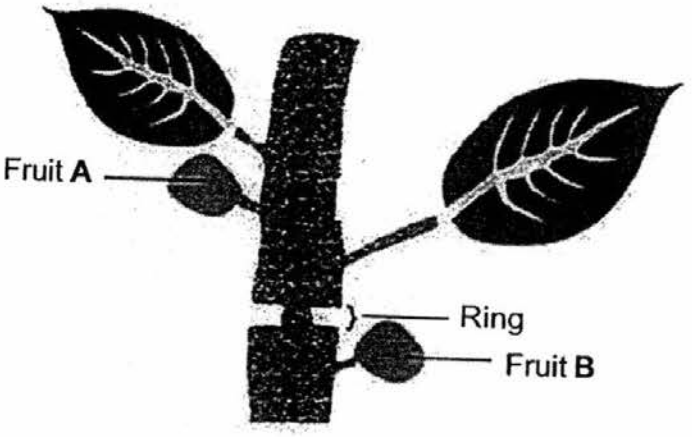


Which of the following can be deduced based on the results after four hours?

A Liquid **P** is a dilute sucrose solution and **Q** is distilled water.
B Liquid **P** is a dilute sucrose solution and **Q** is a concentrated sucrose solution.
C Liquid **P** is a concentrated sucrose solution and **Q** is distilled water.
D Liquid **P** is a concentrated sucrose solution and **Q** is a dilute sucrose solution.

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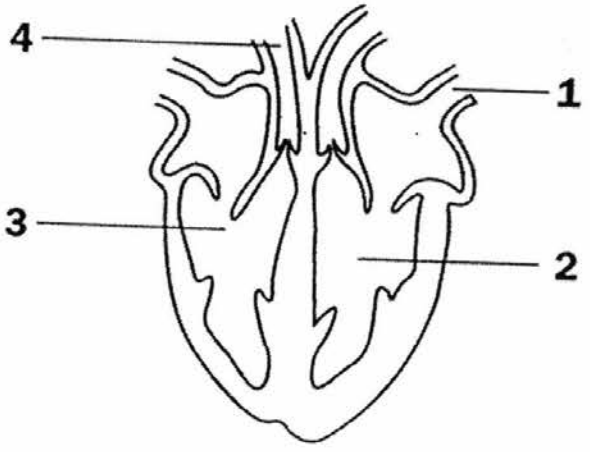
16 The diagram below shows a stem of a potted plant with a ring of bark containing phloem removed. The leaves still remained alive after 10 days.



Which of the following observations made on day 10 about fruit **A** and fruit **B** is correct?

A Fruits **A** and **B** increase in size.
B Fruit **A** increases in size while fruit **B** decreases in size.
C Fruit **A** decreases in size while fruit **B** increases in size.
D Fruit **A** and **B** remain the same size.

17 The diagram below shows a section of the human heart.

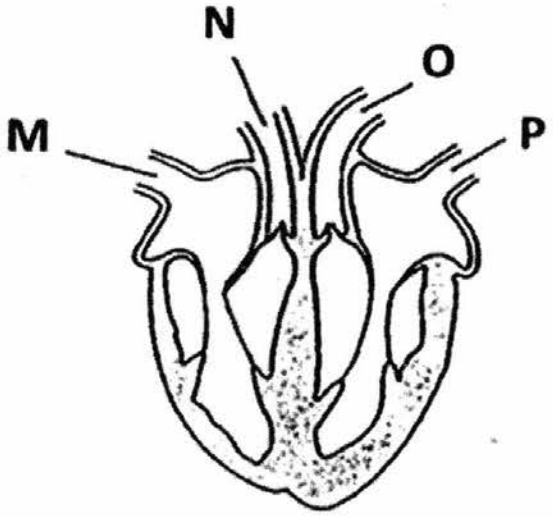


Which of the numbered part(s) of the heart carries/carry oxygenated blood?

A 1
B 4
C 1 & 2
D 3 & 4

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18 The diagram below shows a section through a human heart.



Which one of the following sequences shows the correct sequence of blood flowing through the heart?

A P → O → N → M
B M → N → P → O
C N → M → O → P
D M → N → O → P

19 Carbohydrate digestion mainly happens in ..... .

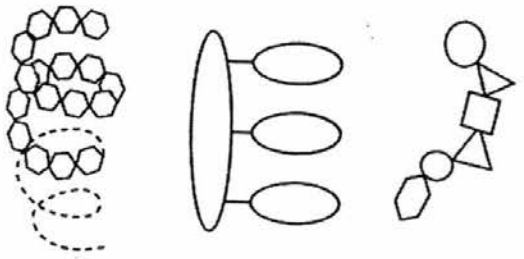
A mouth and stomach
B mouth and small intestine
C stomach and small intestine
D small intestine and large intestine

20 What is assimilation?

A It is the process by which the body removes the excess or unwanted food.
B It is the process by which the body breaks down the food into small diffusible molecules.
C It is the process by which the body takes in food to obtain the nutrients required.
D It is the process by which the body makes use of the small food molecules and converts it to useful materials.

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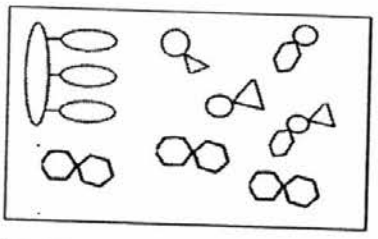
21 The diagram below shows three different types of food molecules before ingestion.



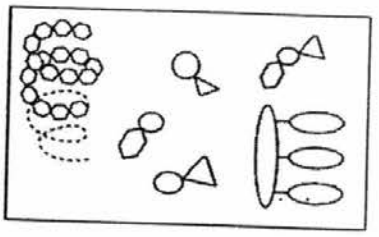
starch fats protein

Which one of the following best shows how these molecules look like in the stomach?

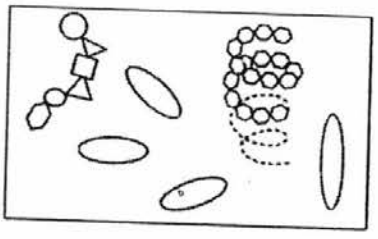
A



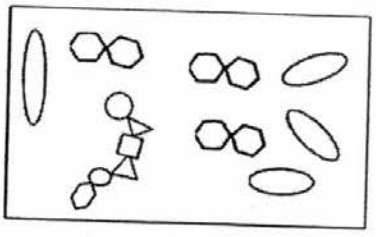
B



C



D



22 Which of the following comparison(s) is/are **false** for the questions regarding photosynthesis, respiration and breathing?

Question	Photosynthesis	Respiration	Breathing
I) Where does it take place in?	leaves of plants only	lungs of humans only	lungs of humans only
II) What is the main purpose?	convert light energy to food	release energy from food	gaseous exchange
III) Is oxygen used up?	no	yes	yes
IV) Is carbon dioxide produced?	no	yes	no

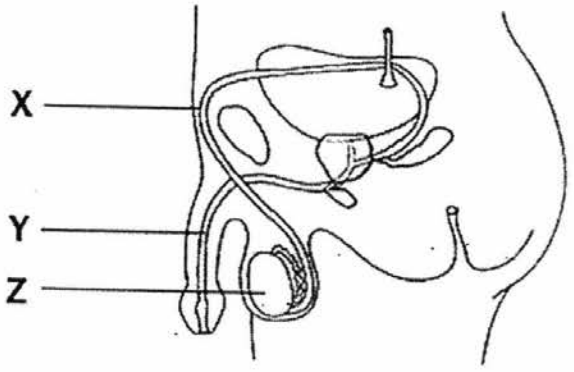
A I & II
B I & III
C II & III
D II & IV

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23 Risk of Human Immunodeficiency Virus (HIV) infection is not reduced by.....

A keeping to one sexual partner.
B sharing food with HIV patients.
C using condom during sexual intercourse.
D avoiding drug abuse, which involves sharing of syringe and needles.

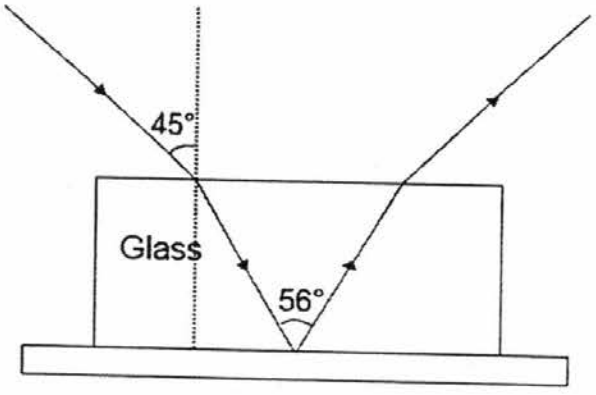
24 The diagram below shows parts of the human male reproductive system.



Which of the following sets of parts correctly match with the functions?

	produces sperm	passage way for sperm	passage way for urine and semen
A	X	Y	Z
B	X	Z	Y
C	Z	X	Y
D	Z	Y	X

25 A piece of glass was placed on top of a polished mirror surface as shown in the figure below.

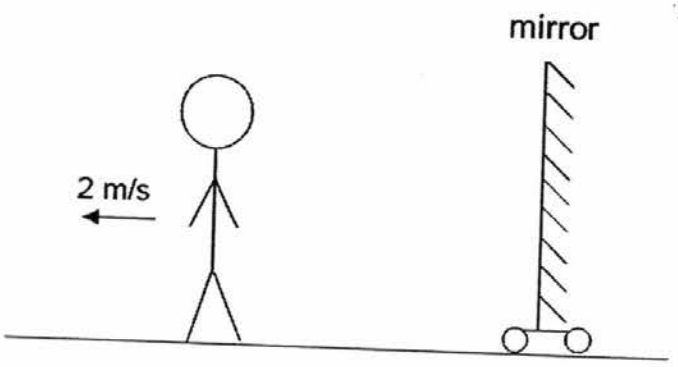


What is the critical angle of glass?

A 28.1°
B 41.6°
C 45.0°
D 58.5°

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26 The diagram below shows a man and a stationary mirror.



A man is walking at a speed of 2 m/s leftward while the mirror is stationary. What is the speed of the man's image during this period?

A 2 m/s rightward
B 4 m/s rightward
C 8 m/s rightward
D stationary

27 In the night under the sodium (yellow lamps), Inspector Alan saw a man appearing in black T-shirt robbing an old woman and ran into a shop. Inspector Alan gave chase and entered the shop which was lit with white lights. Inside the shop, he saw four men in different coloured T-shirts (blue, green, red and yellow) and none of them was wearing black. Inspector Alan knew the culprit straightaway and arrested him.

Who did Inspector Alan arrest?

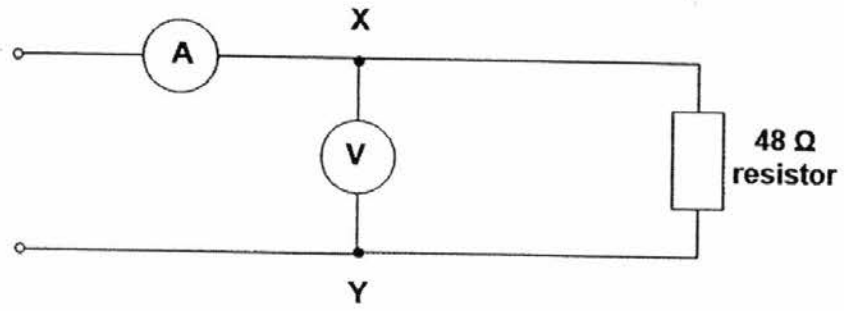
A The man in blue T-shirt.
B The man in green T-shirt.
C The man in red T-shirt.
D The man in yellow T-shirt.

28 Why can birds stand on an overhead transmission line without suffering any harm?

A Their feet have very high resistance.
B Their feet are very good electrical insulators.
C Their bodies can withstand very high current.
D There is no potential difference between their feet.

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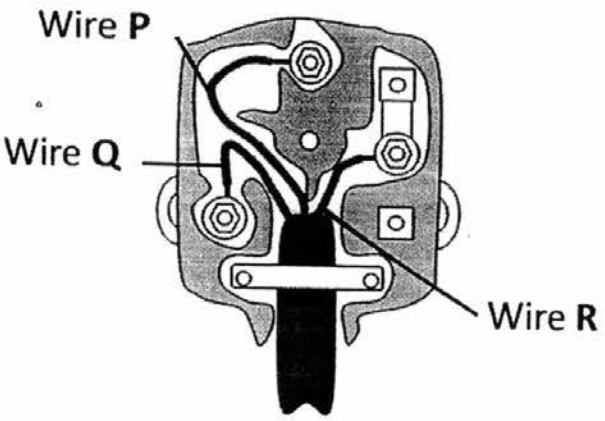
29 The diagram shows an electric circuit.



Which two readings are obtained when a suitable power supply is connected between terminals **X** and **Y**?

	Voltmeter reading / V	Ammeter reading / A
A	6	0.25
B	6	4
C	12	0.25
D	12	4

30 The diagram below shows a three pin plug.



Which of the following statements is **not** correct?

A Wire **P** is the wire that carries current when there is a current leakage.
B Wire **Q** is the wire that enables current to flow through the appliance.
C Wire **R** is the wire that carries current to the appliance.
D Wire **P** is the wire that is not needed when the appliance has a metallic outer casing.

END OF PAPER

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The Periodic Table of the Elements

	Group																	
	I	II									III	IV	V	VI	VII	0
																4 He Helium 2
							1 H Hydrogen 1					11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
7 Li Lithium 3	9 Be Beryllium 4											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
23 Na Sodium 11	24 Mg Magnesium 12											70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25		56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42		Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75		190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79							
Fr Francium 87	226 Ra Radium 88	227 Ac actinium 89 †																

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce Cerium 58	141 Pr Prasodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

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GAN ENG SENG SCHOOL
End-of-Year Examination 2016

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE
Paper 2

Sec 2 Express

11 Oct 2016
Papers 1 & 2: 2 hours

Candidates answer on the Question Paper.

Calculators are allowed in the examination

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Section A
Answer **all** questions.

Section B
Answer question **8** and **three other** questions.
In calculations, you should show all the steps in your working, giving your answer at each stage.
Enter the numbers of the Section B questions you have answered on the dotted lines in the grid below.

At the end of the examination, hand in your answers to Paper 1 and Paper 2 separately.
The number of marks is given in brackets [ ] at the end of each question or part question.

A copy of the Periodic table is inserted on page **18**.

For Examiner's Use	
Section A	30
Section B	40
Q8	
.....	
.....	
.....	
Total	70

This paper consists of **18** printed pages including of the cover page

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SECTION A (30 marks)

Answer **all** the questions in this section.

1 A student cut five similar-sized pieces of potato and weighed each one. He placed each piece of potato in a different concentration of sugar solution for 60 minutes. He then re-weighed each piece of potato. His results were shown in the table in the table below.

concentration of sugar (%)	mass of potato (g)		Percentage change in mass (%)
	start	end	
0.0	6.37	7.16	+12.4
0.2	6.12	6.58	+7.5
0.4	6.27	6.42	+2.4
0.6	6.26	6.10	–2.6
0.8	6.33	5.85	–7.6

(a) Name the process that caused the change seen in the change of mass of each piece of potato.

..... [1]

(b) Explain for the difference in percentage change in mass of the potato pieces placed in 0.4 % sugar solution and 0.6 % sugar solution.

.....

.....

.....

..... [2]

(c) Suggest the concentration of sugar of the potato strips before the experiment.

..... [1]

[Total: 4 marks]

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2 Over a period of several months, a student recorded some activities of the wild life in a particular habitat. The following observations appeared in her notebook.

I. Young shoots of bean plants covered with aphids sucking food substances from the stems.
II. A hawk, which usually catches mice, swoop to take a small yellow bird near a bean plant. Noticed that this species of small yellow bird often visit the bean field to eat aphids and blue butterflies.
III. A species of butterfly visiting flowers of bean plants to collect its nectar.
IV. A species of mouse is often seen nibbling at bean seeds.
V. Spider's web is seen constructed between two bean plants with a ladybird caught in it.
VI. Ladybirds are seen to feed on aphids.
VII. Bacteria colonies are seen in the rotting body of a mouse.

Based on the above observations, construct a complete food web in the space given below.

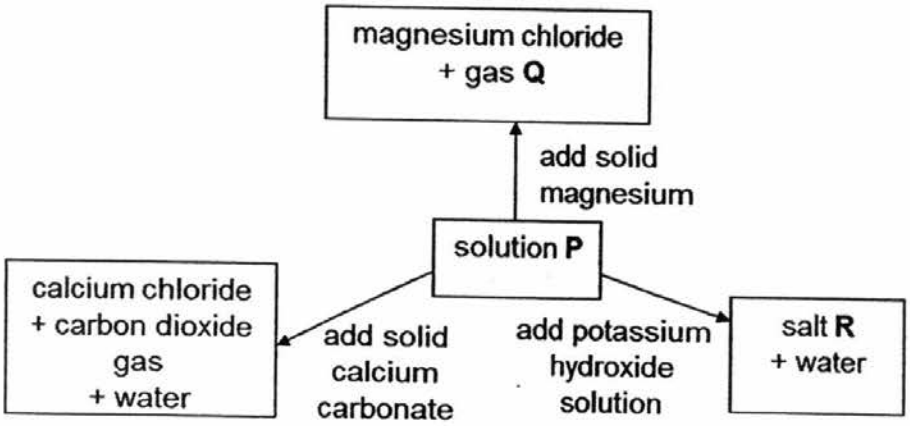
[4]

[Total: 4 marks]

SA2 Gan Eng Seng School

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3 The figure below shows some chemical reactions involving solution **P**.



State the name of the unknown substances:

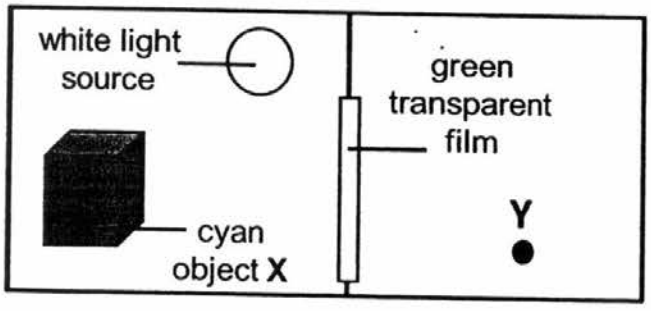
(a) solution **P**: ..... [1]

(b) gas **Q**: ..... [1]

(c) salt **R**: ..... [1]

[Total: 3 marks]

4 The set up below shows a cyan object under white light. A transparent coloured film is also placed at the position as shown in the set-up. The white light source is the only light source in the set-up. All the walls of the set up are black in colour.



(a) State the colour of object **X** as seen from position **Y**. Explain your answer.

.....

.....

.....

..... [3]

[Total: 3 marks]

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5 The table below shows the electronic configurations of atoms of the six elements **U** to **Z**. The letters are not the symbols of the elements.
(The letters can be used once, more than once, or not at all.)

Element	Electronic Configuration
U	2.1
V	2.2
W	2.5
X	2.8.7
Y	2.8.8
Z	2.8.8.1

Using **only** the letters given in the table above, identify

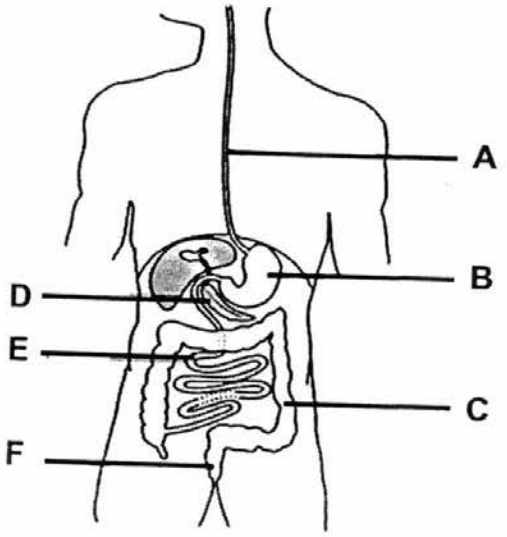
(a) two elements in the same period of the Periodic Table. ..... [1]

(b) an element which forms a negatively charged ion. ..... [1]

(c) a noble gas. ..... [1]

[Total: 3 marks]

6 The figure below shows the human digestive system.



(a) Using the letters **A** to **F**, state one region which

(i) digests only proteins. .....

(ii) absorbs water. .....

(iii) does not produce enzyme. .....

(iv) stores faeces. .....

[2]

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6 (b) Explain how digestion is affected when the bile duct is blocked.

.....

.....

.....

.....

..... [3]

(c) A disease in cows causes the inner wall of the small intestine to become smooth and flat. Infected cows rapidly lose weight and usually die. Explain why this change to the intestinal wall causes the cows to die.

.....

.....

..... [2]

[Total: 7 marks]

7 (a) You are given two cells of 1.5 V each, some connecting wires, 2 ammeters, 1 voltmeter, a switch and 2 light bulbs that will only light up when the potential difference across each light bulb is 3.0 V. Complete a circuit diagram in the space below connecting all the electrical components given to enable you to calculate the resistance of each light bulb.

[4]

(b) The first light bulb has a voltmeter reading of 3.0 V and an ammeter reading of 20 mA. Calculate the resistance of the light bulb.

..... [2]

[Total: 6 marks]

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SECTION B (40 marks)

Answer **Q8** and any 3 other questions in this section.

8 **(a)** The word equation given below represents the burning of magnesium in air. A shiny greyish solid was observed before the reaction but a black solid is observed after the reaction.

magnesium + oxygen → magnesium oxide

(i) Construct the chemical equation for the reaction above.

..... [2]

(ii) Briefly describe an experiment to confirm if the above reaction is exothermic. Explain how the observation confirm that the above reaction is exothermic.

.....

.....

.....

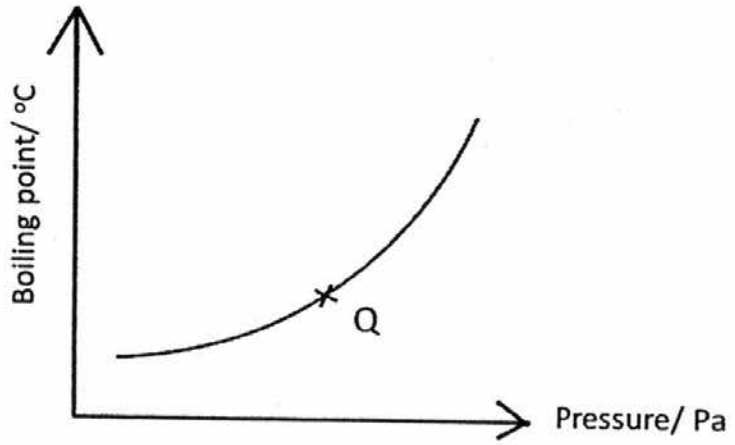
..... [2]

(iii) Lithium can react with oxygen to form lithium oxide. Draw a dot and cross diagram of lithium oxide. Show all electrons.

[2]

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8 **(b)** The graph below shows how the boiling point of water changes with pressure.



(i) Determine the state(s) of water at point **Q**.

Q: ..... [1]

(ii) From the graph, deduce the relationship between the boiling point of water and pressure.

.....

..... [1]

(iii) With reference to the graph, explain how pressure cooker works.

.....

.....

.....

..... [2]

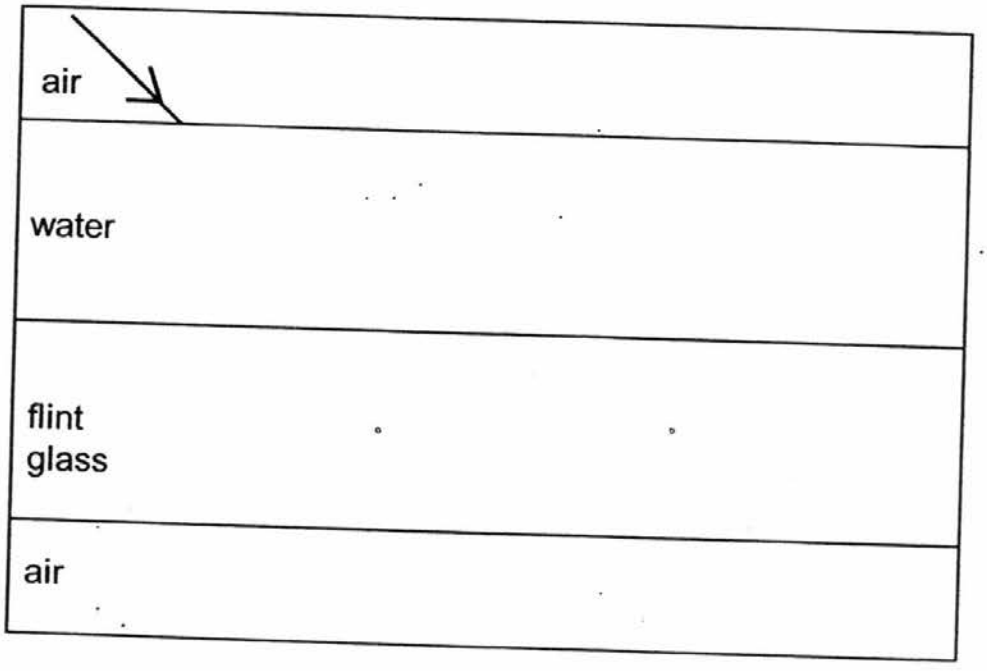
[Total: 10 marks]

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9 The list below shows the refractive indices of the various optical media.

Optical medium	Refractive index
air	1.00
water	1.33
crown glass	1.52
flint glass	1.61
diamond	2.42

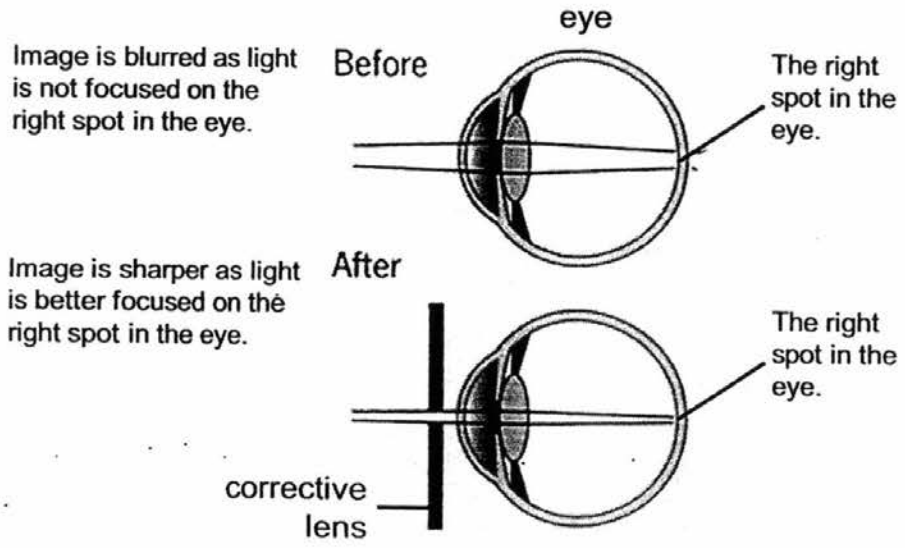
(a) Complete the diagram below to show how a light ray would travel through all four layers of optical media. You **do not** need to provide an accurate drawing or indicate the value of every angle of incidence and angle of refraction. The incident ray has been drawn.



[3]

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9 (b) Glass is the material that is often used to make corrective lenses in spectacles. The diagram below shows that corrective lenses work by refracting light in order to help the eye to focus light more effectively.



State the better choice of glass (crown glass or flint glass) to be used to make such corrective lens that is more effective in focusing light onto the right spot in the eye. Explain your answer.

.....

.....

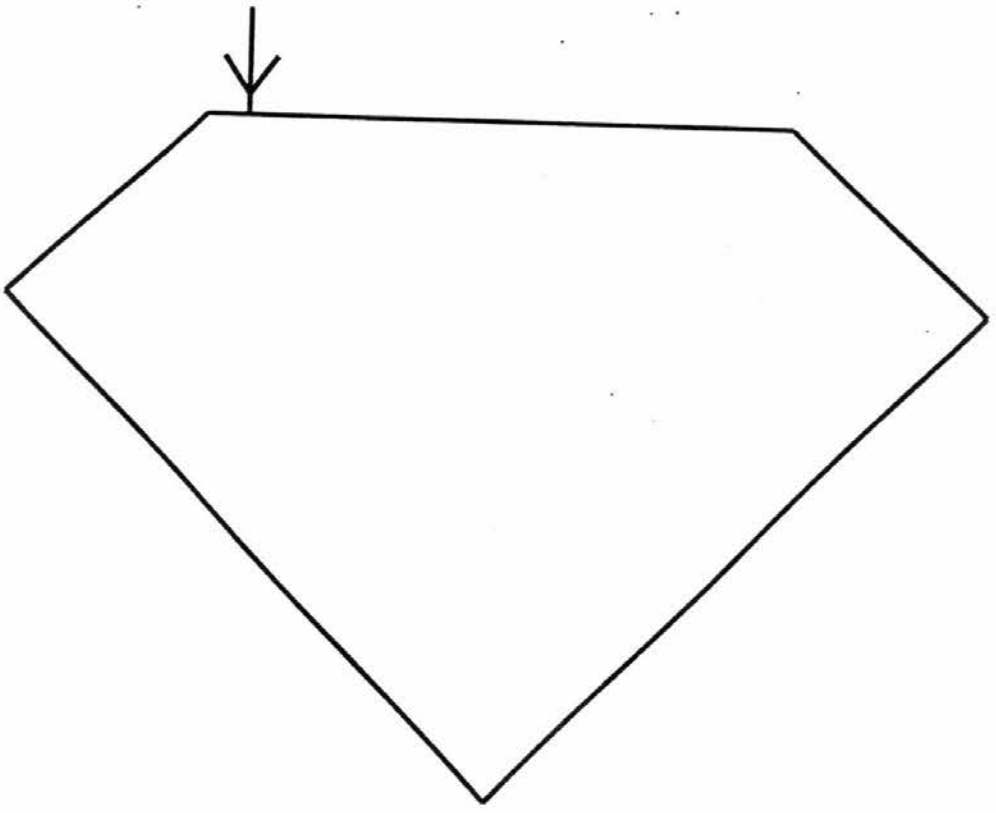
..... [2]

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9 **(c)** Calculate the critical angle of diamond.

critical angle of diamond = ... [2]

(d) Complete the diagram accurately (to scale) to show the <u>exact</u> path of the light ray as it enters the diamond. Indicate the value of every angle of angle of incidence and angle of refraction / reflection. You may need to use a protractor for this question.



[3]

[Total: 10 marks]

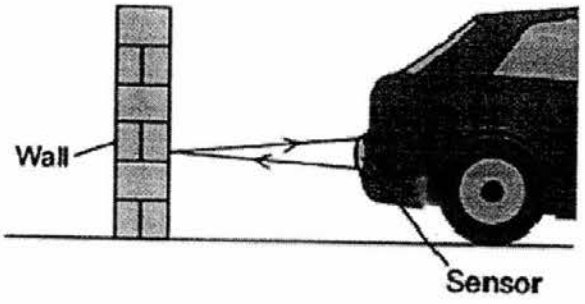
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10 (a) Some cars have parking sensors that use ultrasound. Ultrasound waves are sound waves with frequencies above the range of human hearing.

(i) Circle the ultrasound frequency.

5000 Hz 10 000 Hz 30 000 Hz [1]

(ii) The diagram shows a sensor on the back of a car. The parking sensors emit and detect ultrasound waves when the car is put into reverse gear. When the ultrasound waves hit an obstacle, the waves bounce back to the car.



The time between emitting the ultrasound waves and receiving them back at the car is 0.004 s. Given the speed of ultrasound waves in air is 330 m/s, calculate the distance between the wall and the back of the car.

distance = ... [2]

(b) Explain why a sound wave cannot travel through vacuum.

.....

.....

.....

.....

..... [2]

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10 (c) The speed of ultrasound waves in water is 1500 m/s while the speed of ultrasound waves in solid is 5500 m/s. Explain why ultrasound has different speeds in air, water and solid.

.....

.....

.....

.....

.....

.....

.....

..... [3]

(d) Describe one useful application of sound and one scenario that sound is disruptive.

.....

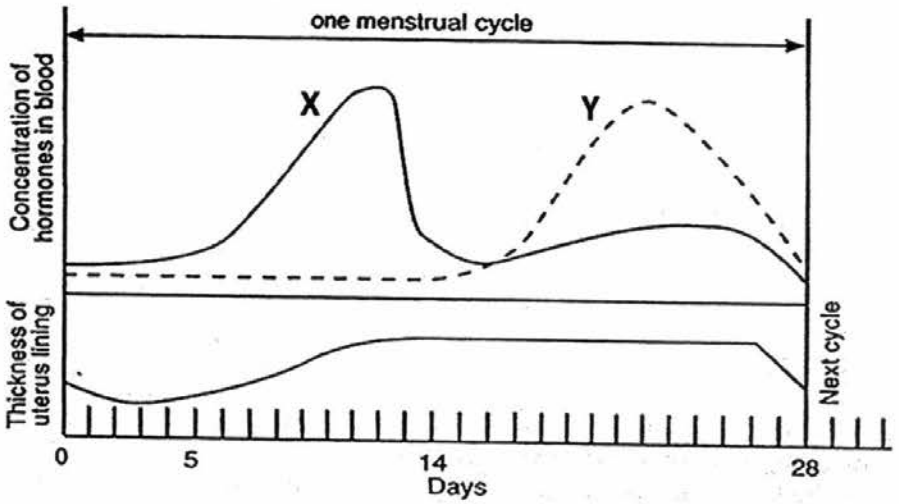
.....

..... [2]

[Total: 10 marks]

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11 (a) The figure below shows the main events that occur during a menstrual cycle.



The two female sex hormones that are involved in the menstrual cycle are oestrogen and progesterone. Progesterone is released to maintain the thickness of the uterus lining. Oestrogen is released to repair the uterus lining.

(i) Identify hormone **X** and **Y**.

X: ..... **Y**: ..... [2]

(ii) The release of hormone **Y** is triggered by a biological event. Suggest the name of the biological event.

..... [1]

(iii) Suggest and explain how the concentration of hormone **Y** after day 22 would be different if the woman gets pregnant.

.....

.....

..... [2]

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11 (b) Compare the structure of the egg cell and the sperm cell with reference to their functions.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Explain the term 'contraception' using spermicide as the example.

.....

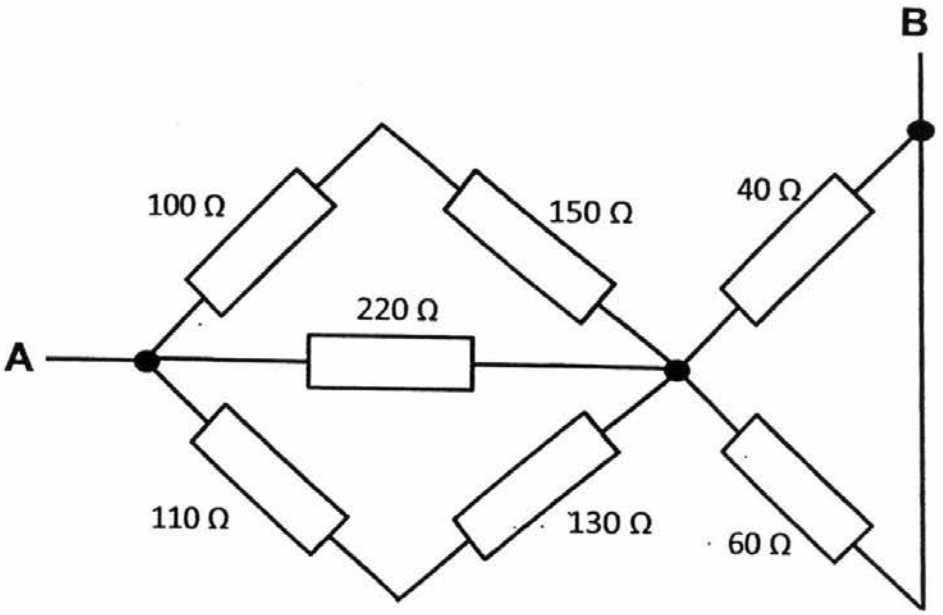
.....

..... [1]

[Total: 10 marks]

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12 (a) Calculate the effective resistance between point **A** and **B** of the circuit shown below.



..... [4]

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12 (b) The label below shows the specifications of a battery pack.

Capacity: 5000 mAh Input: 5 V, 1 A Output 1: 5 V, 1A Output 2: 5V, 500 mA Caution: 1. Do not dispose in fire or water. 2. Never attempt to disassemble or reassemble.

(i) Calculate the power needed to charge the battery pack.

..... [2]

(ii) Calculate the electrical energy needed to charge the battery pack for 3 hours.

..... [2]

(iii) Given that 1 KWh is equal to 3.6 MJ and the cost of electricity is 20 cents per kWh.
Calculate the cost of charging the battery pack for 3 hours.

..... [2]

[Total: 10 marks]

END OF PAPER

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The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac actinium 89 †															

*58-71 Lanthanoid series

†90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

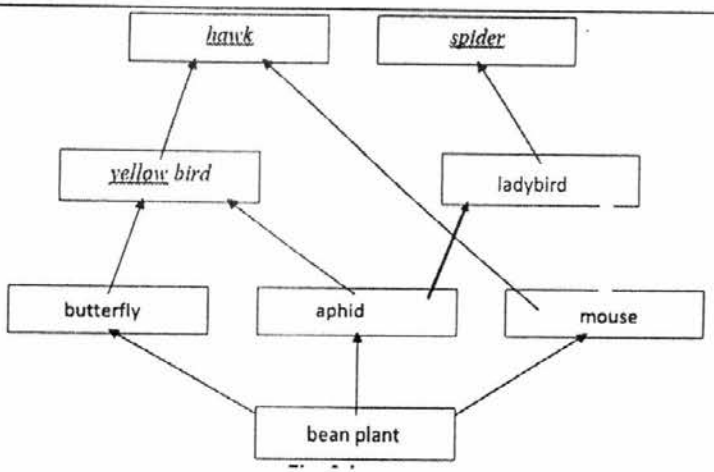
The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

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Paper 1					
1	D	11	B	21	A
2	A	12	B	22	B
3	C	13	D	23	B
4	D	14	D	24	C
5	B	15	B	25	B
6	C	16	B	26	A
7	D	17	C	27	A
8	B	18	B	28	D
9	A	19	B	29	C
10	D	20	D	30	D

Q		Answer	m	remark
1	a	**osmosis**	1	no mark if 'diffusion' or 'active transport' is mentioned along with 'osmosis'.
	b	1. The cell sap of the potato has a **lower water potential** than 0.4% sugar solution, 2. thus the **water move into the cells** of the potato from the sugar solution via osmosis. 3. The cell sap of the potato has a **higher water potential** than 0.6% sugar solution, 4. thus the **water move out of the cells** of the potato into the sugar solution via osmosis. both #1 and #3 point must be correct for 1 mark. both #2 and #4 point must be correct for 1 mark.	2	**Rej:** • move in/out of potato <u>piece</u> / … of <u>sugar solution</u> (the main focus is the movement of water into or out of cells due to water potential gradient) • Mention of "partially permeable membrane" alone is insufficient as the potato is not covered by one single giant membrane. • <u>Sugar</u> / <u>sugar solution</u> enters / leaves … • water <u>concentration</u> / <u>more</u> water No mark for explanation for only either 0.4% or 0.6% sugar solution explanation. The question asked for 'explain the difference'. No mark for answers without reference to the either 0.4% and 0.6% sugar solutions. upper sec: the term 'cell sap' must be used for plant cells. (although not penalised in sec 2)
	c	**0.5%** (accept: 0.4% < x < 0.6%)	1	**Rej:** answers in range or without unit (%) [0.5 can mean 50%]

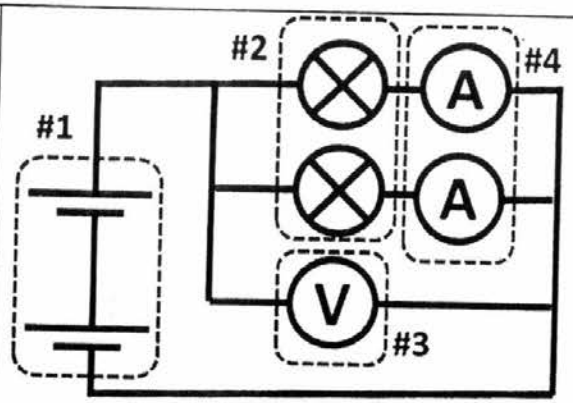
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2	 **each food chain is worth 1 mark. #**		4	**each food chain is worth 1 mark. #** (no mark if food chain is broken) • Bean plant → butterfly → yellow bird → hawk • Bean plant → aphid → yellow bird → hawk • Bean plant → aphid → ladybird → spider • Bean plant → mouse → hawk **-1 mark max** if student included decomposer in food web **-1 mark max** if student split up the bean plant into its parts while still get the rest of the food web correct / name part of bean plant (a part of the organism that is being fed on is not considered as a separate entity in a food web/ chain) **-1 mark for each** extra arrow # no mark for a food chain without / with wrong arrow / double-directional arrow. *note: each organism to be presented as singular (although not penalised in sec 2)
3	a	hydrochloric acid	1	
	b	hydrogen	1	
	c	potassium chloride	1	
4	1. green [1]. 2. Cyan object **reflects green and blue light**. [1] 3. The green coloured transparent film **absorbs the blue light** and allows **green light to pass through**.[1] *		3	#2 **Rej:** Cyan is blue and green; Reflect cyan (light need to be mentioned as colour cannot be reflected, only light can) #3 **Rej:** green light reflected / absorbed and reflected (although some of the green light rays are reflected off the green transparent film, most green light rays passes through film)* many students missed out the "green light to pass through"

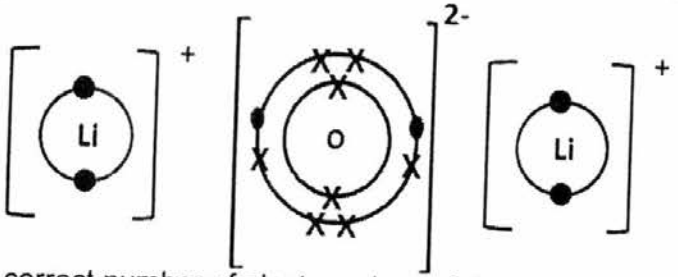
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5	a	U,V, W (any 2) or X, Y	1	No penalty for giving more than 1 correct answer. No mark if one or more of the additional answer is wrong.
	b	X or W	1	
	c	Y	1	
6	a	I. B II. C / E III. A / C / F IV. F (2 correct = 1 mark)	2	No penalty for giving more than 1 correct answer. No mark if one or more of the additional answer is wrong.
	b	1) **Bile** from gall bladder **cannot reach small intestine** [1]. 2a) The **larger fat droplets** will not be broken up into **smaller droplets** / **emulsification** cannot take place / the **surface area to volume ratio** of fat droplets remain **small.** [1] 2b) **Lipase** will **not** be able to break down fats **effectively / fast**. OR **Rate of digestion** of **fats** will **decrease**. [1] OR 3a) Not enough bile to **neutralise the hydrochloric acid** from stomach and there will not be **alkaline** pH for **pancreatic and intestinal enzymes** to work. [1] 3b) **Rate of digestion** of **fats, proteins and carbohydrate** will **decrease**. [1]	3	**1) Rej:** explain that liver produced bile without mentioning the bile is unable to reach the small intestine. (Small intestine concept is important as it shows student understands that fat digestion occurs in small intestine.) **2a) Rej:** • Fats cannot be broken down into smaller molecules (bile is not an enzyme) • Explain how bile works but did not explain the implication of the lack of bile directly. • Function of bile without directly explaining the consequences of the lack of bile. **3a/ 3b) Rej:** take longer time to digest ____ . (The transit time of food substances in the digestive system is fixed. Food cannot stay for infinite time to wait for complete digestion.) **3a Rej:** create slightly alkaline environment (was the initial pH acidic or very alkaline?)
	c	A smooth surface means **less surface area** for **diffusion** of **digested food** molecules through the intestinal wall. [1] **Absorption** of nutrients will be **less efficient / slower** and there will **not be enough / less nutrients** for the cow to stay alive. [1]	2	**Rej:** no absorption/ harder to absorb **Rej:** Explain how villus works but did not explain the implication of the lack of villus directly. No mark given for malnutrition alone as this does not reflect real understanding of the science. **Rej:** insufficient food

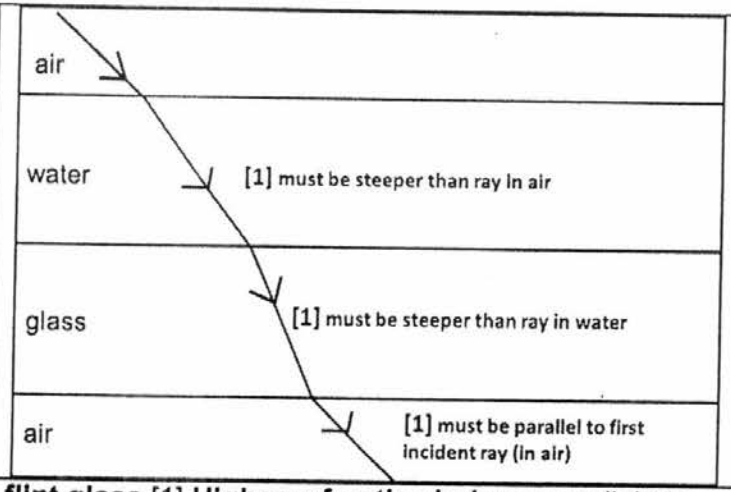
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7	a	 #1: 2 cells in series to provide the sufficient EMF [1] #2: 2 light bulb in parallel [1] #3: both ammeters connected in series to each of the 2 bulbs (accept: 1 ammeter connected in series to the cells, can use $I = I_1 + I_2$) [1] #4: a voltmeter in parallel to the light bulb [1] -1 mark for incomplete circuit (due to gaps / open switch)	4	Most students are able to understand that the ammeter are connected in parallel to the voltmeter while the light bulb are in parallel.
	b	R = V/I = 3.0 V / 0.02 A [1] = 150 Ω [1]	2	Students converted the current wrongly from mA to A.

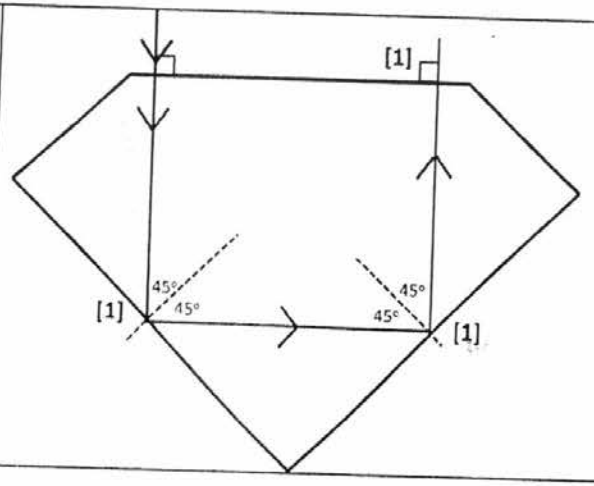
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8	ai	$2Mg + O_2 \rightarrow 2MgO$ • correct chemical formulae [1]; Balanced equation [1]	2	Students unable to balance the chemical equation as they are not able to write down the correct chemical formula. E.g. oxygen is O_2.
	aii	Set up **a boiling tube** with **water** and **thermometer**. Place **magnesium under the boiling tube** and light it up with a flame. [1] The **temperature of water will increase** to show that combustion **releases heat** in the process. [1]	2	Poorly done. Unable to relate the increase in temperature in surrounding to exothermic reaction.
	aiii	 correct number of electrons in each ion [1] correct charge of each ion [1] -1 m for symbols other than dot and cross used	2	Most students are able to draw the ionic bonding.
	bi	Q: Liquid and gas	1	Most students only indicate liquid or gas. Unable to recognise that there are two states present.
	bii	The boiling point of water **increases** as pressure increases.	1	Most students are able to indicate the relationship between pressure and boiling point.
	biii	The **pressure** in the pressure cooker **increases** and the **boiling point of water increases**. [1] Food can be **cooked faster** at **higher temperature**. [1]	2	Most students are able to indicate the increase in pressure causes increase in boiling point but most did not mention that the food can be cooked faster.

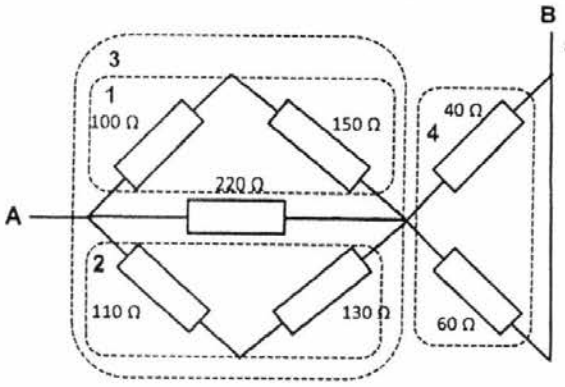
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9	a		3	For the last light ray in air, allow ±2° deviation from the first incident ray(in air) No arrows at all, or wrong direction of arrow(-1m)
	b	**flint glass** [1] **Higher refractive index** cause light to be **bent more towards the normal** and causes the light to focus better. [1]	2	Accept also **refracts more** instead of **bent further.** Accept **refracted angle is larger.** Accept **optically denser** instead of higher refractive index. Note: students who did not indicate bending with reference to normal are marked correct. But in sec 3, students MUST indicate direction of bending with reference to the NORMAL
	c	n = 1/ sin c [1] c = $\sin^{-1}$ (1/2.42) = 24.4° [1]	2	Some students mix up c and n.

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9	d		3	Marking scheme changed • Shape of path in general matches (U shape) **with** arrows correctly drawn. If no arrows drawn then no mark given [1m] • Angles (incident/reflected ray) equal and correct (Allow ±1° tolerance between incident and reflected ray values) [1m] **ALL** Angles are **labelled** correctly[1m] e.g. If angle labelled 45° but actual measured is 42°, then no marks. (Allow ±1° between actual measured and labelled value)
10	ai	30 000 Hz	1	
	aii	distance = speed x time taken for sound to reach the wall from car = 330 m/s x (0.004 s x 0.5) [1] = 0.66 m [1]	2	Most common mistake is not dividing the distance by 2 [0 marks] Another issue is the non-use of SI units (metres).
	b	• Vacuum has **no particles**. [1] • **No collision** of particles to allow **energy** to be **transferred** from the first particle to the next particle. [1]	2	Most used matter, instead of particles. Most describe the transfer of energy as vibrations {accepted}
	c	• Sound travels as **one particle collides with the adjacent particle** and **energy is transferred** from the first particle to the next particle. [1] • **Solid** particles are **very closely packed** while **water** particles are **closely packed** and **air** particles are **far apart** from each other. [1] • **Energy can be transferred** from a **solid** particle to the next **very rapidly**, energy can be transferred from a **water** particle to the next **less rapidly** while energy can be transferred from an **air** particle to the next **slowly**. [1]	3	Most are able to describe the differences between the spaces from solid to liquid and the effect the space has on the speed of transfer of sound. Yet almost all are unable to explain how sound travels [point 1]
	d	Useful: car horn to warn others of danger. [1] Disruptive: sound pollution from airplanes. [1]	2	

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11	ai	Hormone X: Oestrogen [1] Hormone Y: Progesterone [1]	2	Mix up of hormones despite information in the question
	aii	ovulation	1	Most stated puberty/pregnancy Both unaccepted as ovulation is the trigger of the rise of progesterone.
	aiii	Concentration of hormone Y would **remain at high level** after day 22 and **instead of decreasing**. [1] This is to **maintain** the thickness of **uterine lining** for **implantation** of the embryo. [1]	2	Some students state decreasing since there is no more period after pregnancy. This is incorrect as it does not explain the hormone level correctly.
	b	Both sperm and egg has a **nucleus** [1] to **contain chromosomes**. [1] Sperm has a **tail** but an egg **does not**. [1] Sperm **is motile** and can travel from **vagina to oviduct** but the egg **is not motile**. [1]	4	Most mention the tail (flagellum) found in sperm which renders it motile. A significant number failed to mention nucleus and chromosomes, but chose to state the difference in sizes. This does not relate to function. (unaccepted) A few mentioned enzymes in the acrosome for digesting the wall of the ovum (accepted)
	c	Spermicide **kills sperm cells** and **prevent the fusion of sperm and egg**, thus **preventing pregnancy**.	1	Some students mention spermicides prevent pregnancy but failed to mention the killing of sperms (unaccepted)
12	a		4	Weak in identifying the 3 branches of (100 Ω +150 Ω), 220 Ω and (110 Ω+130 Ω) in parallel. Also some students wrongly identified 40 Ω and 60 Ω to be in series

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		$R_1 = 100 + 150 = 250\ \Omega$ $R_2 = 110 + 130 = 240\ \Omega$ [1] $1/R_3 = 1/R_1 + 1/R_2 + 1/220\ \Omega$ $R_3 = 1/(1/250 + 1/240 + 1/220) = 78.665\ \Omega$ = (3.s.f.) [1] $1/R_4 = 1/40 + 1/60$ $R_4 = 1/(1/40 + 1/60) = 24\ \Omega$ [1] $R_{AB} = R_3 + R_4 = 78.7\ \Omega + 24\ \Omega = 102.7\ \Omega = 103\Omega$ (3.s.f.) [1] (- 1 mark once only if the answers lacks unit)		
	bi	P = IV = 1 A x 5 V [1] = 5 W [1]	2	Some students could not identify the correct values to substitute into formula
	bii	E = Pt = 5 W x (3 x 60 x 60 s) [1] = 54 000 J [1] **OR** E = Pt = 0.005 kW x 3 h [1] = 0.015 kWh [1]	2	Allow ECF but only award method mark Some students convert to MJ but only divided 54000 J by 1000 instead of by 1000000.
	biii	cost = E x rate = 54 000 J x (20 ¢ / 3.6 x 1000 000 J) [1] = 0.3 ¢ [1] **OR** cost = E x rate = 0.015 kWh x 20 ¢ [1] = 0.3 ¢ [1]	2	Allow ECF but only award method mark Common mistake is wrong conversion of J to kWh

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