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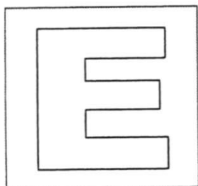
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GAN ENG SENG SCHOOL

End-of-Year Examination 2017



CANDIDATE
NAME

CLASS

INDEX
NUMBER

SCIENCE

Paper 2

10 Oct 2017
Papers 1 & 2: 2 hours

Sec 2 Express

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 **6** 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 **20**.

For Examiner's Use	
Section A	30
Section B	40
Q6	
.....	
.....	
.....	
Total	70

This paper consists of **20** printed pages including of the cover page

SECTION A (30 marks)

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

- 1 (a) Study the table below.

Cindy conducts a research about Particles **A** to **F**.

Particles **A**, **C**, **D** and **F** are atoms.

Particles **B**, **D** and **E** have the same number of electrons.

Particle	Atomic number	Nucleon number	No. of protons	No. of electrons	No. of neutrons
A	7	14			
B	8	16			
C	9	19			
D	10	20			
E	11	23			
F	12	24			

- (i) With the given information about Particles **A** to **F**, complete the table above.

[2]

- (ii) Particle **B** can combine with Particle **E** to form a compound. Draw the 'dot' and 'cross' diagram for the compound using symbols of **B** and **E**.

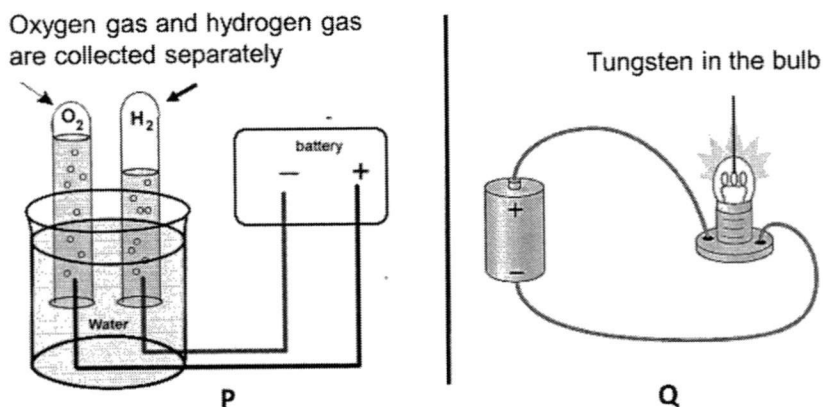
[2]

- 1 (b) Write the chemical equation for the reaction below.

sulfuric acid + iron(III) carbonate $\rightarrow$ iron(III) sulfate + water + carbon dioxide [2]

.....

- (c) The diagram below shows two setups. Setup **P** is electrolysis of water while Setup **Q** is a close circuit involving a battery and a light bulb.



State and explain the type of changes that occurred in **P** and **Q**. [2]

.....

- (d) Methane has a melting point of -182°C and boiling point of -161°C . Using Kinetic Particle Theory, describe and explain the changes to the movement and arrangement of the particles when methane was heated and the temperature was at -182°C . [2]

.....

[Total: 10 marks]

- 2 (a) Compare the chemical digestion of starch and protein in the human digestive system. [2]

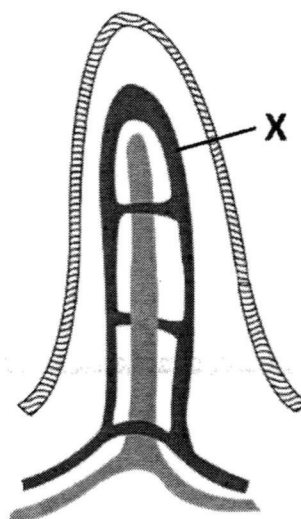
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- (b) The diagram below shows the structure of a villus.



Describe and explain the role of structure X in absorption of nutrients.

[2]

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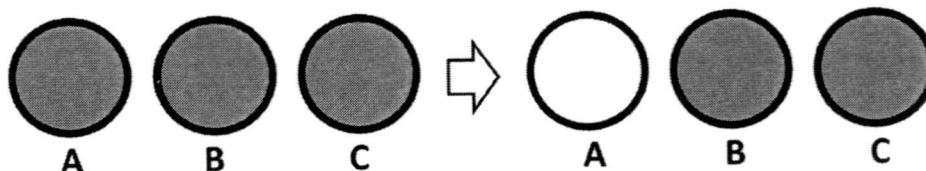
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- 2 (c) Three petri dishes were filled with milk and other substances as shown in the table below. The three dishes and their content were incubated in 37°C for 2 hours. After 2 hours, only dish A's contents has a change of appearance from cloudy to clear but both dish B's and dish C's contents remained cloudy.

Dish A	20 cm ³ of milk + 3 cm ³ of pepsin + 2 cm ³ of dilute hydrochloric acid
Dish B	20 cm ³ of milk + 3 cm ³ of pepsin + 2 cm ³ of water
Dish C	20 cm ³ of milk + 3 cm ³ of water + 2 cm ³ of dilute hydrochloric acid

2 hours of incubation in 37°C



Using the information given above, explain what has happened.

[2]

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[Total: 6 marks]

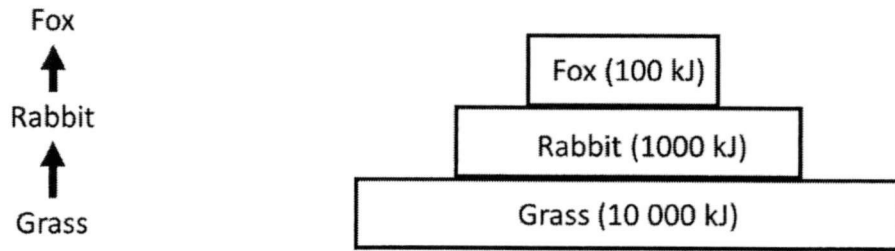
- 3 Draw a circuit diagram which includes the following.

- 3 dry cells connected in series with a variable resistor
- 3 light bulbs connected in parallel to the 3 dry cells and the variable resistor
- an open switch to switch off 2 light bulbs
- a voltmeter to measure the potential difference across the variable resistor

[4]

[Total: 4 marks]

- 4 (a) The diagram below shows a simple food chain and its pyramid of energy.



Explain the reason for the shape of the pyramid of energy.

[2]

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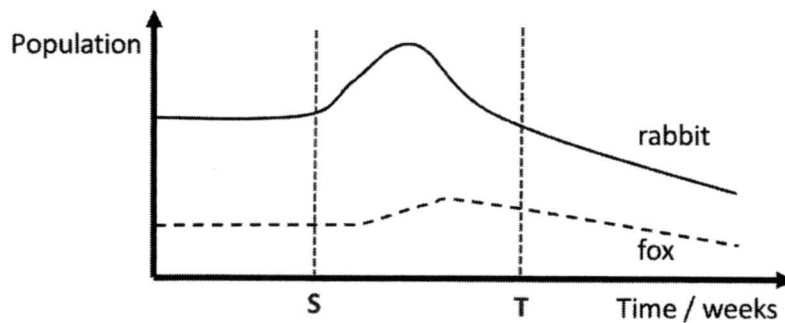
- (b) There is a species of flea that was found to suck the blood of rabbits for food. State the relationship of rabbit with fox and flea.

[1]

Rabbit and fox:

Rabbit and flea:

- (c) The graph below shows how the populations of rabbit and fox changed with time.



Explain what has happened between time **S** and **T**.

[2]

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[Total: 5 marks]

- 5 (a) Ancient hunters would choose to put their ears on the ground to listen for approaching herds of animals instead of listening to their sounds through the air in order to detect these herds of animals fast enough to set up an ambush. Explain why it was so. [3]

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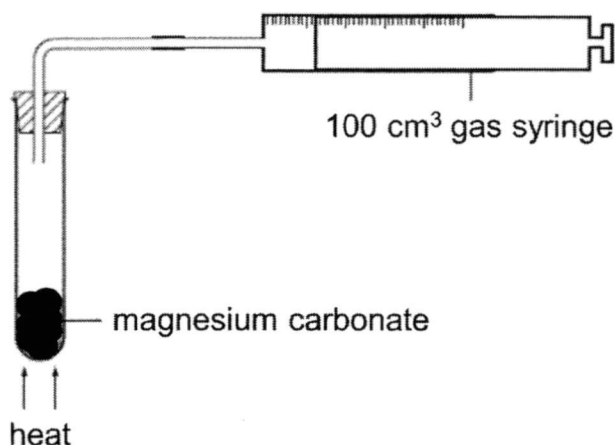
- (b) A surface anti-submarine ship used sonar to detect the presence of an enemy submarine. The sound was emitted from the sonar in the ship, bounced off the surface of the submarine and reached the detector of the surface anti-submarine ship. The time between the emitting of the sound to the detection of the sound is 2.8 s. Assuming the speed of sound is 1800 m/s in water, calculate the distance between the surface anti-submarine ship and the enemy submarine. [2]

distance between anti-submarine ship and submarine =

[Total: 5 marks]

SECTION B (40 marks)Answer Q6 and any **3 other questions** in this section.

- 6 (a) The experiment shows the thermal decomposition of solid powder magnesium carbonate into magnesium oxide and carbon dioxide.



The volume of carbon dioxide gas collected in the 100 cm³ gas syringe over a period of 7 minutes of strong heating was recorded in the table below.

Time / min	0	1	2	3	4	5	6	7
Volume of gas collected / cm ³	0	0	7	15	25	30	32	32

- (i) Explain why there was no gas collected in the first minute of heating. [1]

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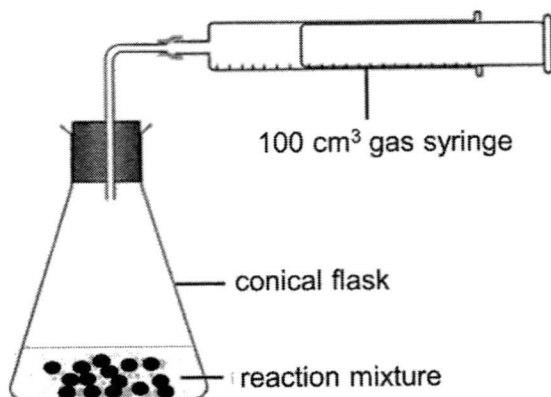
- (ii) Explain why there was no increase in the gas collected after 6 minutes of heating. [1]

.....

- (iii) Describe how you would modify the set-up to verify that the gas produced was indeed carbon dioxide. [2]

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- 6 (b) The experiment shows the reaction of magnesium granules with dilute hydrochloric acid. The reaction mixture contained magnesium granules with excess of dilute hydrochloric acid. After 30 minutes, the volume of hydrogen gas produced was measured by the 100 cm³ gas syringe. There was no more magnesium granules observed in the conical flask.



- (i) A pH meter was used to measure the pH of the mixture at the start and after the reaction has ended. The reading showed the mixture has a pH of 2 at the start and after the reaction has ended. Explain why it was so.

[1]

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- (ii) The experiment was repeated with zinc instead of magnesium. Measures had been taken to ensure it was a fair test. The volume of hydrogen gas collected in the 100 cm³ gas syringe 30 minutes was recorded in the table below. Generally, the more reactive a metal, the faster the reaction with an acid.

Metal used	magnesium	zinc
Volume of gas collected in 30 min / cm ³	60	40

Comment on the reactivity of magnesium as compared to zinc using the data given above. Explain your answer.

[2]

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- 6 (c) Peter read up in the Upper Secondary Chemistry textbook that “the reactivity of the metal affects the rate of thermal decomposition of the metal carbonate that the metal is part of.” He wanted to find out how exactly the reactivity of the metal affects the rate of thermal decomposition of the metal carbonate that the metal is part of.

He repeated the experiment shown in part (a) while replacing magnesium carbonate with zinc carbonate. Measures had been taken to ensure it was a fair test.

The volume of carbon dioxide gas collected in the 100 cm³ gas syringe over a period of 7 minutes of strong heating of zinc carbonate was recorded in the table below.

Time / min	0	1	2	3	4	5	6	7
Volume of gas collected / cm ³	0	0	13	25	32	32	32	32

Using the data given in part (a) and (c) and your answer in part (b), suggest how exactly the reactivity of the metal affects the rate of thermal decomposition of the metal carbonate that the metal is part of.

[3]

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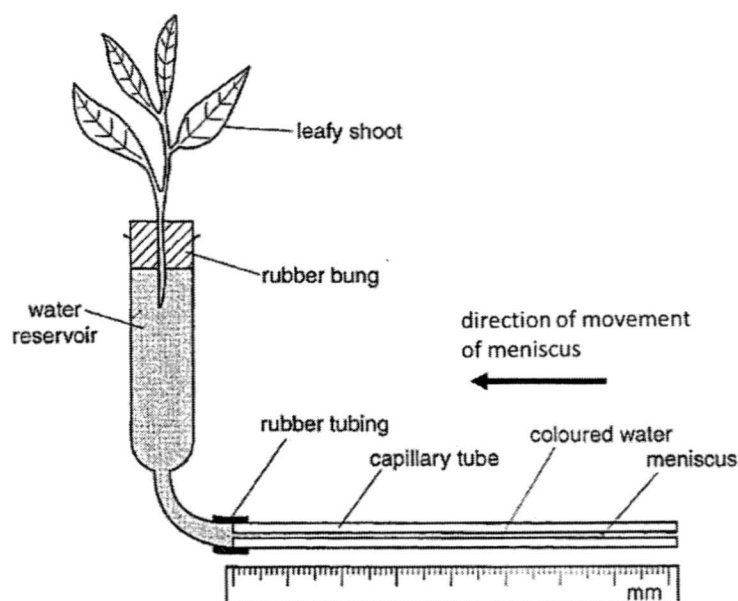
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[10 marks]

- 7 (a) A student used the setup shown in the figure below to investigate water loss in a leafy shoot. As water is lost from the shoot the meniscus of the coloured water in the capillary tube moves to the left.



She measured how far the meniscus moved during ten minutes at each different temperature. The results were shown in the table below.

Temperature / °C	0	10	20	30	40
Movement / mm	3	17	29	38	45

- (i) Explain how the change in temperature affected the distance which the meniscus moved. [2]

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- (ii) Predict and explain how the movement of the meniscus would be different between the two period of 6:00 am to 6:10 am and 12:00 pm to 12:10 pm, assuming the temperature of the surrounding of the setup remains the same. [2]

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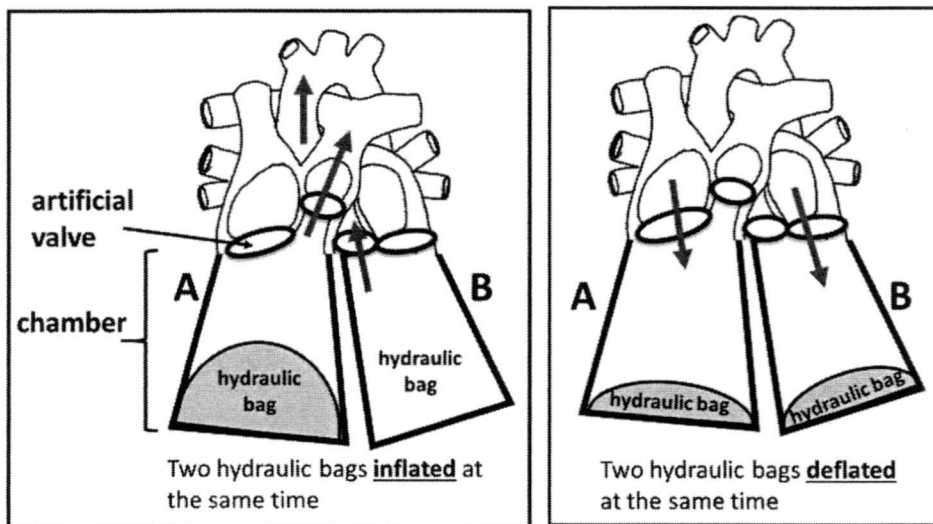
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- 7 (b) A group of scientists invented an artificial heart that was designed for patients who are waiting for heart transplant. Each artificial heart has two chambers and four artificial valves. The artificial heart is powered by pumps that can either inflate or deflate the hydraulic bags in the chambers. Four artificial valves are installed to replace the original valves, which were removed along with the damaged part of the heart.

The figure shows two instances of the operation of the artificial heart. Firstly, the hydraulic bags in both chamber inflated (increase in volume) at the same time. Secondly, the hydraulic bags in both chamber deflated (decrease in volume) at the same time. The arrows indicate the direction of the flow of blood.



- (i) State which chamber (A or B) generates the highest blood pressure. Explain the need for the chamber to generate the highest blood pressure.

[1]

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- (ii) State and explain the difference in blood composition of the blood in chamber A and B.

[2]

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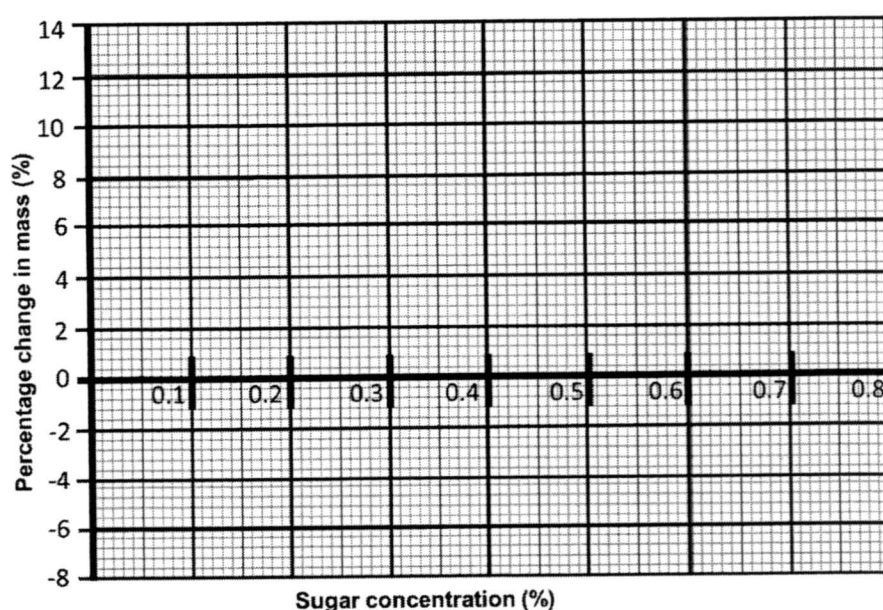
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- 7 (c) A student cut five similar-sized pieces of potato and weighed each one. He placed each piece of potato in a different concentration of sugar solution for 60 minutes. He then re-weighed each piece of potato. His results are shown in the table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

- i) Plot the results on the grid and complete graph.

[2]



- ii) Using the graph above, state the percentage change to the mass of the potato piece placed in 0.3% sugar solution.

[1]

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[Total: 10 marks]

- 8 (a) Describe the processes in the formation of a zygote (fertilised egg) starting with the production of the sperms and the release of an egg. [4]

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- (b) A pharmaceutical company invented a new cream that contains both spermicide and antibiotics. The company claimed that the cream alone is enough to prevent both pregnancy and the spread of sexually transmitted infections.

Comment on their claim and explain your answer. [3]

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- 8 (c) The figure below shows the calendar of August and September 2017. A married couple used the calendar to track the menstrual cycle of the wife. She had the first day of menstruation on 3rd August (bolded and with *).

August 2017						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3 *	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

September 2017						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

State the range of dates in August and September which the couple should avoid sexual intercourse if they want to avoid pregnancy. Assuming the wife's menstrual cycle followed the standard duration, explain your answer. [3]

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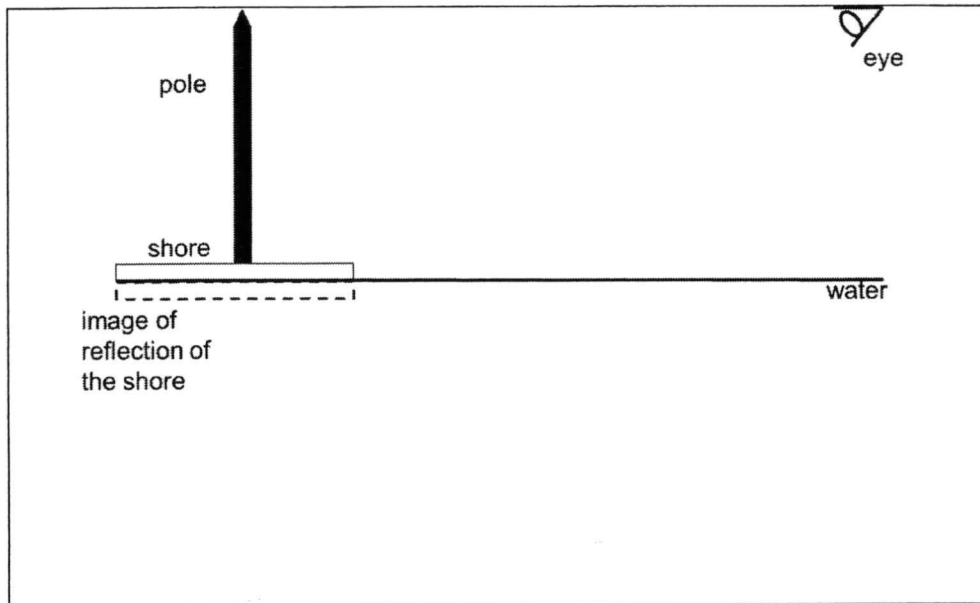
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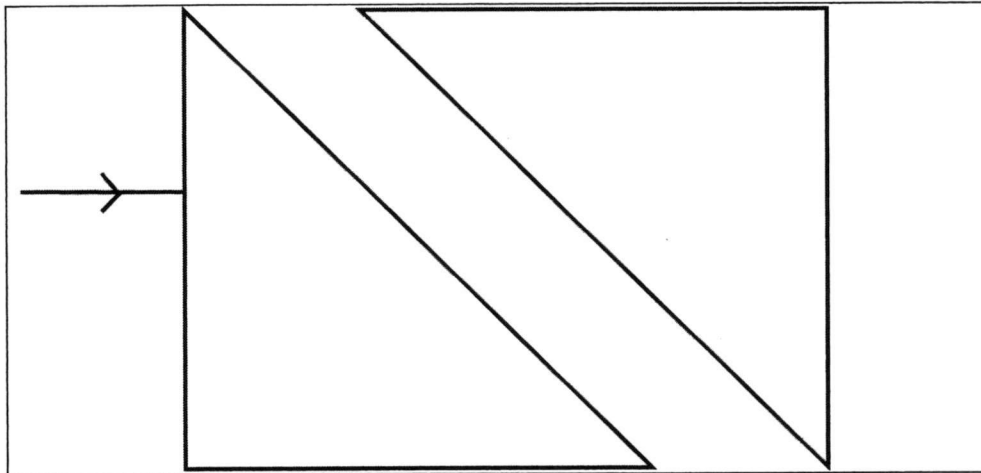
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[Total: 10 marks]

- 9 (a) Complete a double-ray diagram to show what happens during a regular reflection on a water's surface where the eye can see the image of the top of the pole. [3]



- (b) The refractive index of the glass blocks shown below is 1.33. A red light ray is shown to enter one of the blocks. Complete the ray diagram **accurately**. You will have to label and state the value of the angles of incidence (i) and angles of reflection / refraction (r). You will have to show your calculations for angles of reflection / refraction (r) in the space given below. [4]



Calculation:

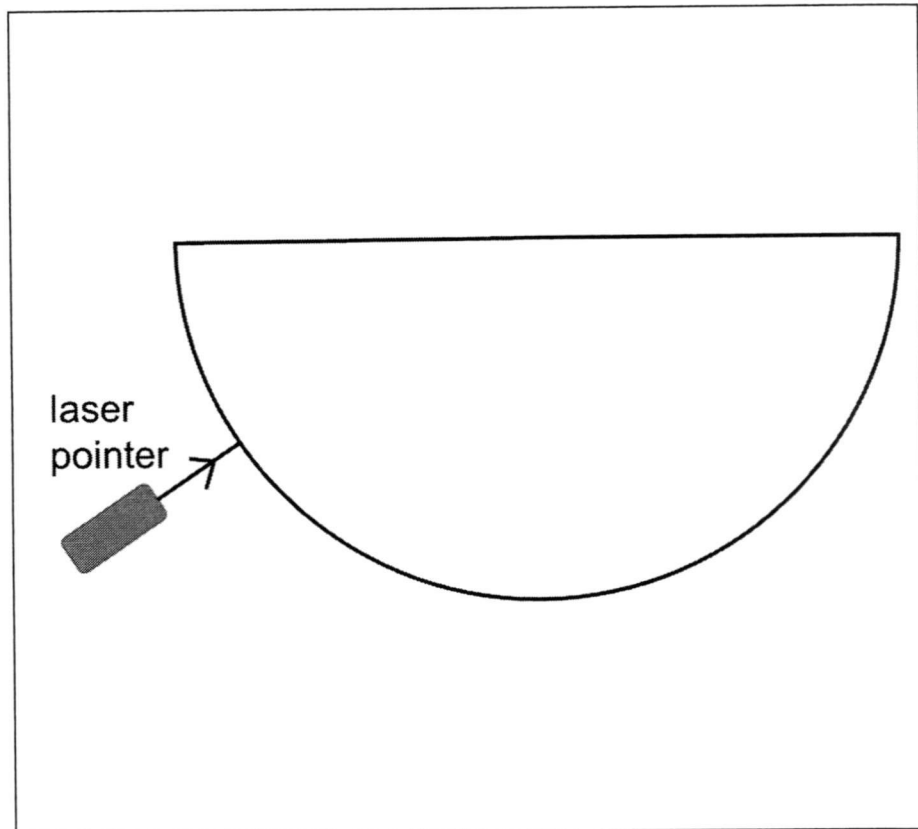
- 9 (c) (i) Calculate the critical angle of glass block with a refractive index of 1.67.

[1]

critical angle of glass block =

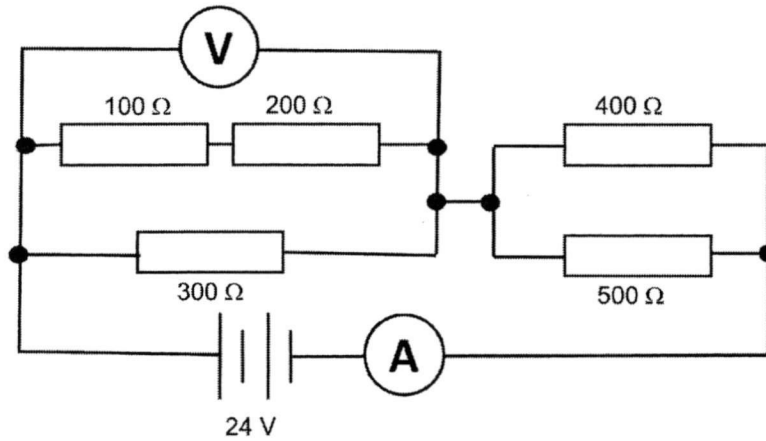
- (ii) A laser pointer shines a light ray into a semi-circular block of glass. Draw a single light ray to represent what happened to the light as it exits the pointer to entering into the glass block and emerges from the glass block. The glass block has a refractive index of 1.67. You will have to label and state the value of the angle of incidence (i) and angle of reflection / refraction (r).

[2]



[Total: 10 marks]

- 10 (a) The figure below shows an electrical circuit.



- (i) Calculate the reading of the ammeter.

[3]

Ammeter reading =

- (ii) Calculate the reading of the voltmeter.

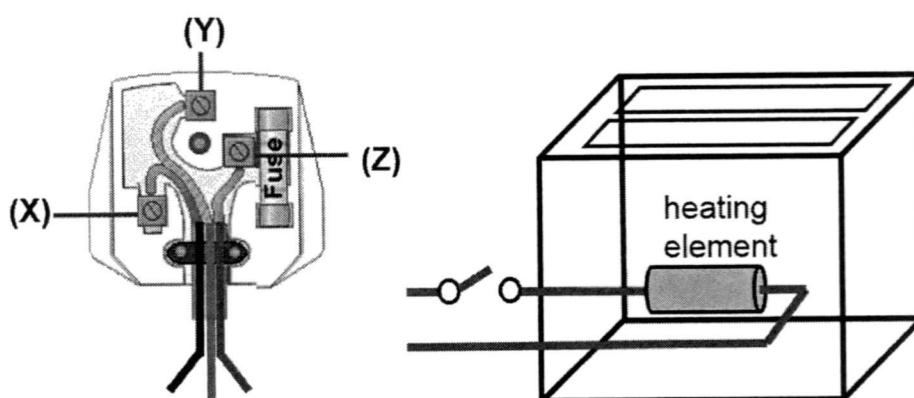
[1]

Voltmeter reading =

- 10 (b) The electric oven has a power rating of 1250 W. Given that the cost of using 1 kWh of electricity is 28 cents, calculate the cost of electricity used by the electric oven when it is used for 2 hours and 30 minutes. [2]

cost of electricity =

- (c) The diagram below shows a three pin plug and a simplified circuit diagram of an electric toaster, which has a metal case.



- (i) State the name and colour of each of the wire in the three pin plug. [2]

Wire	Name	Colour
X		
Y		
Z		

- (ii) In the diagram above, complete the circuit by connecting each of the wire to the electric toaster. [2]

[Total: 10 marks]

END OF PAPER

The Periodic Table of Elements

Group																																																																																																																																		
I	II	Key										III	IV	V	VI	VII	0																																																																																																																	
		proton (atomic) number atomic symbol name relative atomic mass										1 H hydrogen 1																																																																																																																						
3 Li lithium 7	4 Be beryllium 9																		5 B boron 11							6 C carbon 12							7 N nitrogen 14							8 O oxygen 16							9 F fluorine 19							10 Ne neon 20																																																																												
11 Na sodium 23	12 Mg magnesium 24																		13 Al aluminium 27							14 Si silicon 28							15 P phosphorus 31							16 S sulfur 32							17 Cl chlorine 35.5							18 Ar argon 40																																																																												
19 K potassium 39	20 Ca calcium 40																		21 Sc scandium 45							22 Ti titanium 48							23 V vanadium 51							24 Cr chromium 52							25 Mn manganese 55							26 Fe iron 56							27 Co cobalt 59							28 Ni nickel 59							29 Cu copper 64							30 Zn zinc 65							31 Ga gallium 70							32 Ge germanium 73							33 As arsenic 75							34 Se selenium 79							35 Br bromine 80							36 Kr krypton 84						
37 Rb rubidium 85	38 Sr strontium 88																		39 Y yttrium 89							40 Zr zirconium 91							41 Nb niobium 93							42 Mo molybdenum 96							43 Tc technetium -							44 Ru ruthenium 101							45 Rh rhodium 103							46 Pd palladium 106							47 Ag silver 108							48 Cd cadmium 112							49 In indium 115							50 Sn tin 119							51 Sb antimony 122							52 Te tellurium 128							53 I iodine 127							54 Xe xenon 131						
55 Cs caesium 133	56 Ba barium 137																		57 – 71 lanthanoids							72 Hf hafnium 178							73 Ta tantalum 181							74 W tungsten 184							75 Re rhenium 186							76 Os osmium 190							77 Ir iridium 192							78 Pt platinum 195							79 Au gold 197							80 Hg mercury 201							81 Tl thallium 204							82 Pb lead 207							83 Bi bismuth 209							84 Po polonium -							85 At astatine -							86 Rn radon -						
87 Fr francium -	88 Ra radium -																		89 – 103 actinoids							104 Rf rutherfordium -							105 Db dubnium -							106 Sg seaborgium -							107 Bh bohrium -							108 Hs hassium -							109 Mt meitnerium -							110 Ds darmstadtium -							111 Rg roentgenium -							112 Cn copernicium -							114 F/ flerovium -							116 Lv livermorium -							-																											

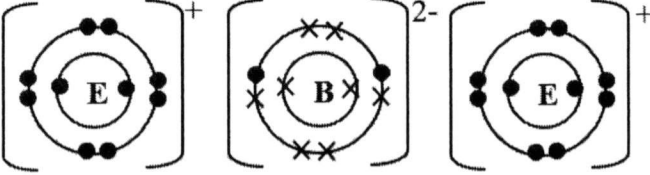
Key
proton (atomic) number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium	90 Th thorium 232	91 Pa protactinium	92 U uranium 238	93 Np neptunium	94 Pu plutonium	95 Am americium	96 Cm curium	97 Bk berkelium	98 Cf californium	99 Es einsteinium	100 Fm fermium	101 Md mendelevium	102 No nobelium	103 Lr lawrencium

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

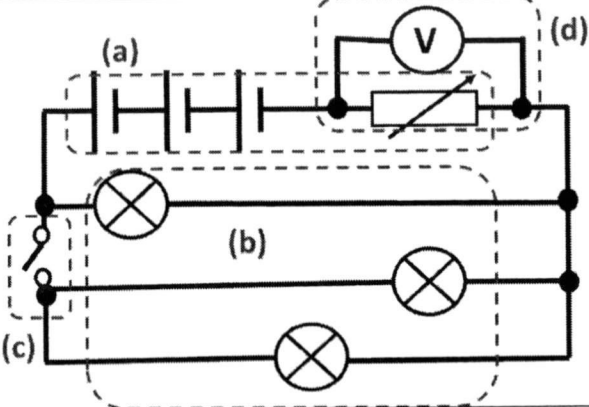
2017 2 EXP EOY – Mark Scheme& Remarks

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

Paper 2									
Q	Answers						m	Remarks & Comments	
1	ai	Particle	Atomic number	Nucleon number	No. of protons	No. of electrons	No. of neutrons	2	Many get either 0 or 1 mark due to incorrect no. of electrons or neutrons.
		A	7	14	7	7	7		
		B	8	16	8	10	8		
		C	9	19	9	9	10		
		D	10	20	10	10	10		
		E	11	23	11	10	12		
		F	12	24	12	12	12		
		no. of protons & no. of electrons correct [1]							
		no. of neutrons correct [1]							
	aii	 B^{2-} ion drawn correctly and with correct charge [1] E^{+} ion drawn correctly and with correct charge [1] (If student use Na and O, -1 mark max)						2	"Poorly answered. Incorrect responses are 1. Draw only one E ion 2. Mix up B with E 3. The ions from E are next to each other in B and not spaced out in opposite sides"
1	b	$3H_2SO_4 + Fe_2(CO_3)_3 \rightarrow Fe_2(SO_4)_3 + 3H_2O + 3CO_2$ - Correct formulae for all substances [1] - Balanced equation [1] (only award 2nd mark if 1st mark is given)						2	Poorly answered. Some think that SO ₄ is sulfuric acid. Many can't balance the equation.

2017 2 EXP EOY – Mark Scheme& Remarks

	c	1. Electrolysis of water is a chemical change but lighting up of a light bulb is a physical change . [1] 2. During electrolysis, new products were formed (water breaks down into hydrogen and oxygen). During lighting up a light bulb, the tungsten in the bulb remained as tungsten . [1]	2	Some think that type or changes is energy conversion.
	d	1. At -182 °C , the particles gained enough energy to overcome the forces of attraction . [1, describe] 2. The particles break free from vibrating at fixed positions and can slide over each other in random arrangement / a not orderly arranged manner. [1, explain]	2	Many think that it is kinetic energy (should be potential energy) needed to overcome forces of attraction.
2	a	1. Starch chemical digestion starts in the mouth but protein chemical digestion starts in the stomach . [1] 2. Both involve enzymes . / Both involves the breaking down of large molecules into simpler molecules . [1]	2	Many mention that both are digested in small intestines. Not acceptable answer.
	b	1. Structure X (capillaries) enable the diffusion of simple sugars and amino acids [1, describe]; 2. by continuous transport of simple sugars and amino acids to maintain a steep concentration gradient . [1, explain] (allow any phrasing to the same effect)	2	"Poorly answered. Incorrect responses are 1. active transport 2. large surface area to volume ratio"
	c	1. Milk protein in dish A has been broken down but not in dishes B and C . [1] 2. Dish A contains hydrochloric acid which activates the pepsin (in sec 2 notes) / provides the optimum pH for pepsin (allow sec 3 knowledge) . Dish B lacks hydrochloric acid and dish C lacks pepsin . [1]	2	Many get 1 mark as they don't write about dish B and C.

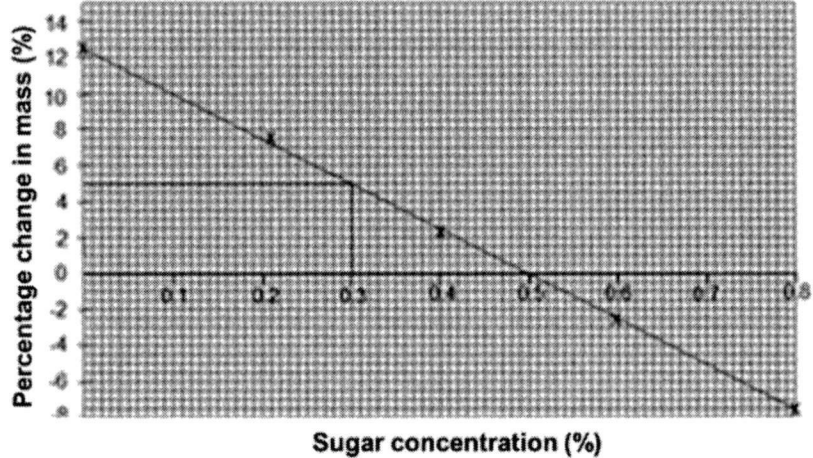
3	 a) 3 dry cells connected in series with a variable resistor [1] b) 3 light bulbs connected in parallel to the 3 dry cells [1] c) an open switch to switch off 2 light bulbs [1] d) a voltmeter to measure the potential difference across the variable resistor [1]	4	"Only a few get all 4 marks. Incorrect responses 1. can't draw the correct symbol of variable resistor 2. draw two light bulbs in series 3. don't show wires are joined"
4	a - Only some / 10% of the energy is being transferred from grass to rabbit and from rabbit to fox. [1] Energy is lost via respiration and undigested parts. [1] b Rabbit and fox: prey-predator relationship Rabbit and flea: parasitic relationship c Population of rabbit increased and provided more food for the fox, thus the fox population increased. [1] - There were more foxes / predators that feed on rabbits, thus the population of rabbit decreased. [1]	2	Poorly answered. Few write 10 %. All never explain why energy is lost. 1 Many write the relationship for rabbit and flea incorrectly, e.g. commensalism. 2 Many get only 1 mark. Many explain after T which is not required in the question.

2017 2 EXP EOY – Mark Scheme& Remarks

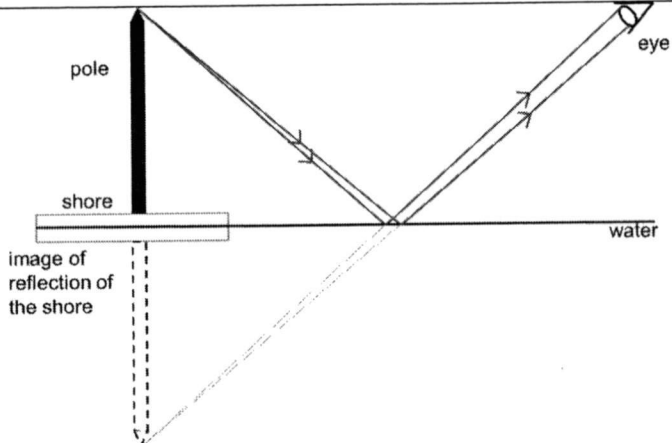
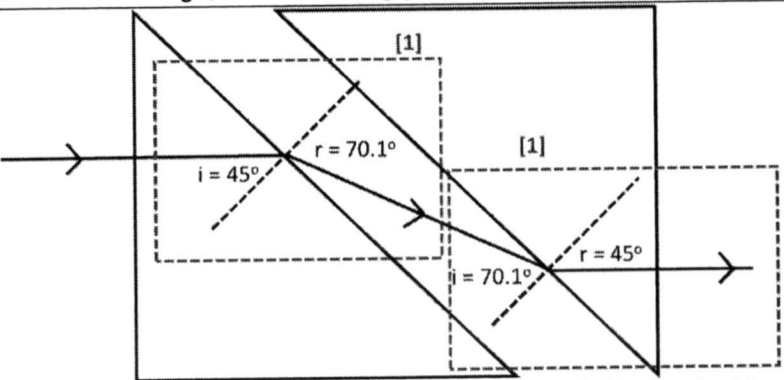
5	a	1. Sound travel faster through solid than through a gas . [1] 2. Solid particles are very closely packed and pass the energy to the next particle rapidly . [1] 3. Gas / Air particles are far apart from each other and pass the energy to the next particle slowly . [1]	3	Many get at most 2 marks as they don't describe why sound travels slower in air.
	b	2 d = speed of sound x time d = $\frac{1}{2}$ (1800 m/s x 2.8 s) [1] = 2520 m [1]	2	Many don't realise it is echo and forget to divide by 2. Incorrect response is 5040 m.
6	ai	The temperature of magnesium carbonate was not high enough for thermal decomposition to take place.	1	Many get it correct.
	aii	All magnesium carbonate has been thermally decomposed . / The thermal decomposition was completed .	1	Some think that only carbon dioxide gas can extinguish lighted splinter.
	aiii	1. Bubble / pass the gas produced into a test tube of limewater . [1] 2. White precipitate should form in the limewater. [1] (reject: limewater turns chalky / milky.)	2	Some think that only carbon dioxide gas can extinguish lighted splinter.
	bi	There was excess hydrochloric acid . / Not all hydrochloric acid has been used up. / Some of the hydrochloric acid has not been used in the reaction.	1	Many get it correct.
	bii	1. Magnesium is more reactive than zinc . [1] 2. More hydrogen gas, 60 cm³ , was produced in 30 min when magnesium was used while only 40 cm³ of hydrogen gas was produced when zinc was used. [1]	2	Many get only 1 mark as they never use data to explain their answer.

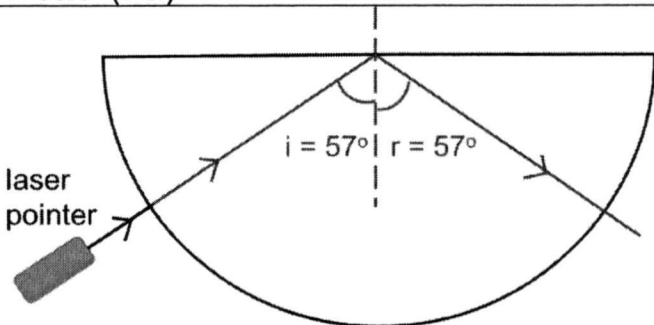
2017 2 EXP EOY – Mark Scheme& Remarks

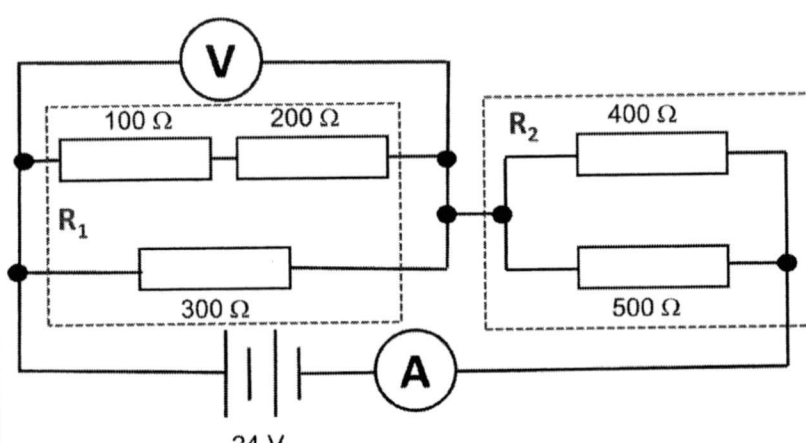
6	c	1. The more reactive / higher reactivity the metal, the lower the rate of thermal decomposition of the metal carbonate that the metal is part of. [1] 2. Magnesium carbonate thermally decomposed slower than zinc carbonate, thus magnesium carbonate has lower rate of thermal decomposition. [1] 3. Thermal decomposition of magnesium carbonate produced 32 cm³ of carbon dioxide in 6 minutes but thermal decomposition of zinc carbonate produced 32 cm³ of carbon dioxide in 4 minutes. [1]	3	Poorly answered. Never use data to explain their answer.
7	ai	1. As temperature increased, the rate of evaporation of water from the leaves increased, thus the rate of transpiration increases. [1] 2. The volume of water absorbed by the shoot increases and the distance which the meniscus moved increases. [1]	2	Accept: As temperature increased, the distance which the meniscus moved increases. [1] Some miss out transpiration.
	aii	1. The distance which the meniscus moved will be greater in 12:00pm to 12:10 pm than in 6:00 am to 6:10 am. [1] 2. The light intensity is greater in 12:00 pm to 12:10 pm than in 6:00 am to 6:10 am, caused stomata to open and the rate of transpiration increases. [1]	2	Some miss out opening of stomata.
	bi	B . It needs to pump blood over a long distance to rest of the body . [1]	1	Many get it correct.
	bii	1. Blood in chamber B will be oxygenated (higher in oxygen content) and blood in chamber A will be deoxygenated (lower in oxygen content). [1] 2. Blood returns from rest of body, where oxygen is used, and flow into right atrium and into chamber A while blood returns from lungs, where oxygen enters the red blood cells and flow into left atrium and into chamber B. [1]	2	Mention of "right / left atrium" is not an essential marking point. Some miss out the movement of blood flow.

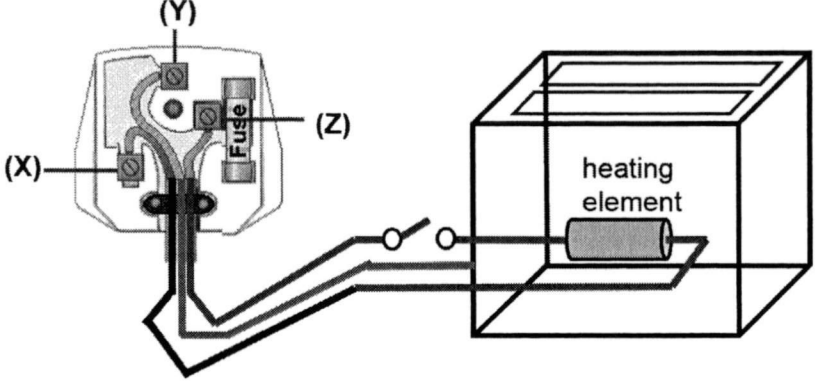
	ci	 Percentage change in mass (%) Sugar concentration (%) All points correct – 1m clean straight line – 1m (allow ECF if points are plotted wrong but has line of best fit)	2	Some don't draw a single (best-fit) straight line graph; some leave it blank.
	cii	5 ± 0.2 (accept answer according to student's graph)	1	Some leave it blank.
	8	(a) 1. Testis produces / Testes produce sperms and sperms will be stored temporarily in the coiled tubes (epididymis). [1] 2. Ovary releases an egg into the oviduct. [1] 3. During sexual intercourse, the sperms travel from the coiled tube to the sperm duct and through the urethra of the penis and deposited into the vagina. The sperms travel through the cervix, into the uterus and into the oviduct. [1] 4. One sperm fused with the egg to form a zygote. [1] (b) 1. The cream alone is enough to prevent pregnancy but not the spread of sexually transmitted infections. [1] 2. Spermicide can kill the sperms and prevent fertilisation. [1] 3. The antibiotics can only kill bacteria but not viruses. Thus Human Immunodeficiency Virus can still be passed / transmitted. [1]	4	
			3	Accept: Human Immunodeficiency Virus can still transmitted by sharing of needles / contact with blood / unchecked blood transfusion. [1]

2017 2 EXP EOY – Mark Scheme& Remarks

	(c)	1. 13th to 18th Aug&10th Sep to 15th Sep [1] 2. Ovulation on 16th Aug and 13th Sep [1] 3. Sperm can survive up to 3 days while egg can survive up to 2 days. [1]	3	
9	(a)	 1. Correct incident rays with correct arrows indicated& dotted lines. [1] 2. Correct reflected rays with correct arrows indicated& dotted. [1] 3. Correct image, in dotted line. [1]	3	
	(b)	 check: all 4 angles & emergent ray to be parallel to the incident ray no arrows drawn (-1m)	4	

	$1.33 = \sin r / \sin i$ $r = \sin^{-1} (1.33 \times \sin 45^\circ)$ $= 70.1^\circ$ (3.s.f) [1] $1.33 = \sin i / \sin r$ $r = \sin^{-1} (\sin 70.1^\circ / 1.33)$ $= 45.0^\circ$ (3.s.f) [1]		
(ci)	$n = 1 / \sin c$ $c = \sin^{-1} (1/n)$ $= \sin^{-1} (1/1.67)$ $= 36.78^\circ$ $= 36.8^\circ$ (3 sf)	1	
(cii)	 1. Correct incident rays with correct arrows indicated and correctly measured and indicated r value of 57°. [1] 2. Correct reflected rays with correct arrows indicated and correctly indicated r value of 57°. [1]	2	

10	ai	 $R_1 = 1/[1/300 + 1/(100 + 200)] = 150 \, \Omega$ [1] $R_{\text{eff}} = R_1 + R_2 = 150 + 1/(1/400 + 1/500) = 372 \, \Omega$ [1] $I = V/ R_{\text{eff}} = 24 \, \text{V} / 372 \, \Omega = 0.064516 \, \text{A} = \mathbf{0.0645 \, \text{A (3sf)}}$ [1]	3													
	a ii	$V_1 = I_1 \times R_1 = 0.064516 \, \text{A} \times 150 \, \Omega = 9.6774 \, \text{V} = \mathbf{9.68 \, \text{V (3sf)}}$	1													
	b	$E = Pt = \mathbf{1250 \, \text{W} \times 2.5 \, \text{h} / 1000 = 3.125 \, \text{kWh}}$ [1] cost = 3.125 kWh x \$0.28/kWh = \$0.875 = \$0.88 / 88 cents [1] (reject 3sf as money cannot be counted in 0.5 cents)	2													
	ci	<table><tr><th>Wire</th><th>Name</th><th>Colour</th></tr><tr><td>X</td><td>neutral wire</td><td>blue</td></tr><tr><td>Y</td><td>earth wire</td><td>green and yellow</td></tr><tr><td>Z</td><td>live wire</td><td>brown</td></tr></table> • All names correct [1] • All colours correct [1]	Wire	Name	Colour	X	neutral wire	blue	Y	earth wire	green and yellow	Z	live wire	brown	2	
Wire	Name	Colour														
X	neutral wire	blue														
Y	earth wire	green and yellow														
Z	live wire	brown														

cii	 Z connected to switch and X connected correctly [1] Y connected to the exterior metal case of the toaster. [1]	2	
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