NEW TOWN SECONDARY SCHOOL
Final Examination
Secondary 2 Express

NAME

CLASS

INDEX NUMBER

Lower Secondary Science

7 Oct 2021
0800-1000
2 hours

READ THESE INSTRUCTIONS FIRST
Write your name, register number and class in the spaces provided above.
Write in dark blue or black pen.
DO NOT use staples, highlighters, glue or correction fluid/tape.

Section A – Multiple Choice Questions (30 marks)
There are **thirty** multiple choice questions in this paper.
Answer **all** the questions.
For each question, there are four possible correct answers, **A**, **B**, **C** and **D**.
Choose the one you consider correct and record your answer in the table provided on page 12.

Section B – Structured Questions (70 marks)
Answer **all** questions in the spaces provided.
The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 100.

The use of an approved scientific calculator is expected, where appropriate.
A copy of the Periodic Table is provided on page 30.

For Examiner's Use	
Section A	
Section B	
Total	

This document consists of 30 printed pages.

Setters: Mr Liau Chee Mun, Ms Wee Shu Ying and Mr Prathap

Section A [30 marks]

Each question consists of four possible answers. Choose the best answer for each question and write your answer in the table on page 12.

1 Which statement about an atom is correct?

A The mass of an atom is almost entirely due to its nucleus.

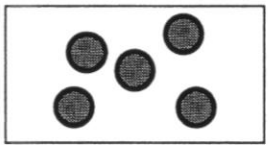
B The nucleus and the electrons repel each other.

C The protons and neutrons have opposite charges.

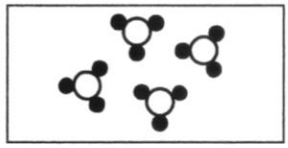
D The shell nearest to the nucleus always contains the most number of electrons.

2 Which diagrams shows a compound only?

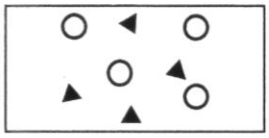
A



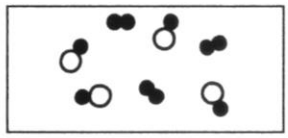
B



C



D



3 Which substance contains the least number of elements?

A SiO_2

B KOH

C $KMnO_4$

D $NaSO_4$

4 Which statement is true of a chemical reaction?

A Atoms are created during a chemical reaction.

B Atoms are destroyed during a chemical reaction.

C Atoms in the reactants rearrange to form the products.

D The number atoms found the reactants is different from the number of atoms found in the products.

5 Which changes describe interaction of matter with light?

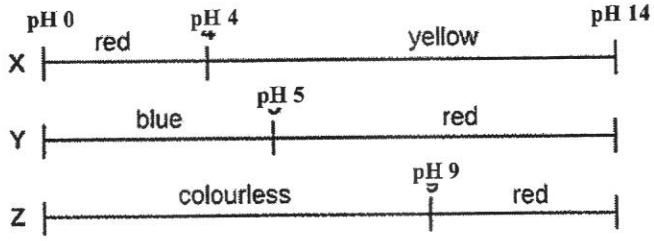
1. combustion
2. respiration
3. photosynthesis
4. developing of x-ray films

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

6 What is **not** an example of a harmful effect of chemical changes?

A burning of fossil fuels leading to air pollution
B decomposition of dead organisms
C formation of acid rain
D rusting of iron bridges

7 The information below gives the colour change of three indicators **X**, **Y** and **Z**.



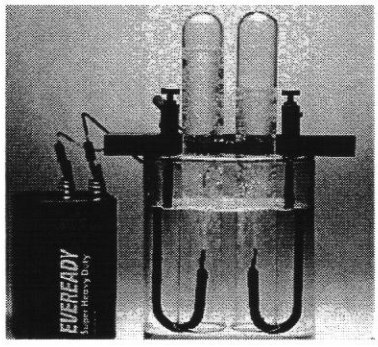
What are the colours of these three indicators when they are added separately to pure water?

	X	Y	Z
A	red	blue	colourless
B	red	red	red
C	yellow	blue	red
D	yellow	red	colourless

8 Antacid tablets are usually used to neutralise the acid in gastric juice in our stomach if we have gastric pain. Which substance is most likely to be found in antacid tablets?

A hydrochloric acid
B magnesium hydroxide
C nitric acid
D sodium chloride

9 The diagram below shows an experimental set-up that is used to break down water into hydrogen and oxygen gas.



Which of the following correctly describes this reaction?

A acid-carbonate reaction
B acid-metal reaction
C electrolysis
D electroplating

10 A string extended 4 mm for every 0.5 N pulling on it.
How much would the string extend with a mass of 300 g hanging on it?

A 4 mm **B** 8 mm **C** 12 mm **D** 24 mm

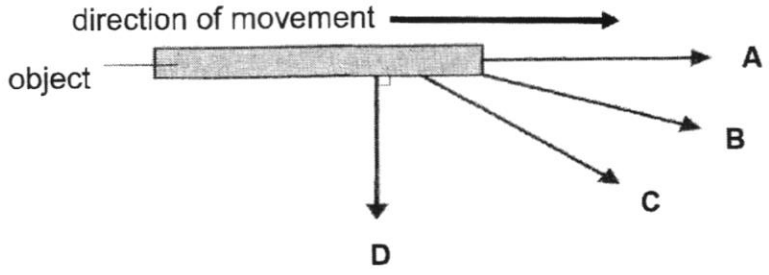
11 Which of the following enables us to open a bottle screw cap with our hands?

A electrostatic force
B magnetic effect of a force
C pressure
D turning effect of a force

12 The weight of a spacecraft on Earth is 1250 N and on Mercury it is 475 N.
The gravitational field strength on Earth is 10 N/ kg.
What is the gravitational field strength on Mercury?

A 0.26 N/ kg **B** 0.38 N/ kg **C** 2.63 N/ kg **D** 3.80 N/ kg

13 The diagram below shows the direction of movement and the direction of force applied on an object. The direction of the object movement is horizontal.
Which position of the force applied would result in no work done on the object in the horizontal direction?



14 The sum of the gravitational potential energy and kinetic energy of an object falling freely under gravity is called its mechanical energy.

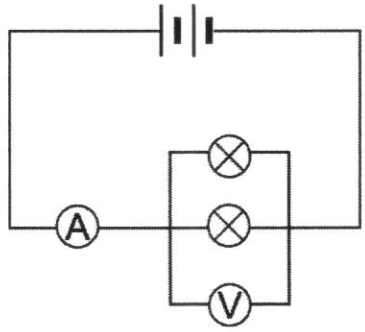
Assuming that air resistance is negligible, which of the following best represents the changes in the different energies when the object is falling freely under gravity?

	gravitational potential energy	kinetic energy	mechanical energy
A	decreases	increases	decreases
B	decreases	increases	remains the same
C	increases	decreases	increases
D	increases	decreases	remains the same

15 Which of the following correctly classifies the sources of energy as renewable and non-renewable?

	renewable	non-renewable
A	coal	wind energy
B	hydroelectric energy	wind energy
C	natural gas	coal
D	wind energy	natural gas

16 In the circuit below, both bulbs are identical.



Which of the following statements below is **incorrect**?

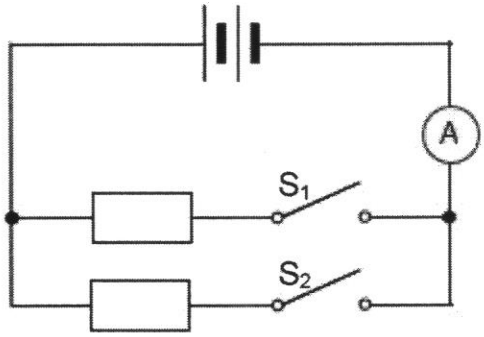
A If one bulb is removed, the ammeter reading will change.

B If one bulb is removed, the other bulb will still light up.

C If one bulb is removed, the voltmeter reading will change.

D If one cell is removed, both bulbs will be dimmer.

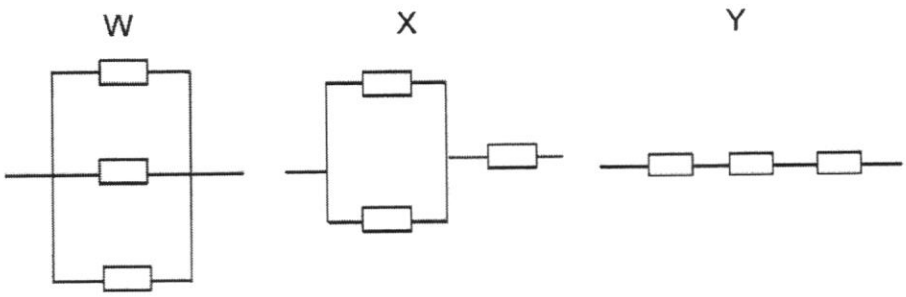
17 In the circuit shown, both resistors are identical.



Which of following will reflect the highest reading on ammeter A?

	S_1	S_2
A	close	close
B	close	open
C	open	close
D	open	open

18 Three identical resistors are connected in four different arrangements.



Which of the following orders of arrangement shows **increasing** total resistance?

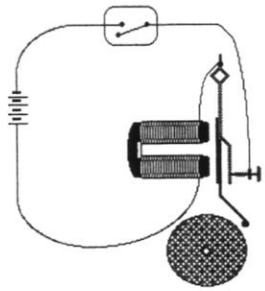
A W, X, Y

B X, W, Y

C Y, X, W

D Y, W, X

19 The diagram below shows a simplified doorbell that rings when the switch is closed in the circuit. This doorbell works based on one of the effects of an electric current.



Which of the following is the correct representation of this effect?

A chemical effect

B heating effect

C magnetic effect

D sound effect

20 Overloading occurs when many appliances are connected to the same power outlet, resulting in a larger current flowing through the outlet.

Which one of the following explains why a larger current would flow?

A The appliances are connected in parallel, decreasing the total resistance in the circuit.

B The appliances increase the total resistance in the circuit.

C There is a short circuit.

D There is no earth wire connected to the appliances.

21 Which of the following are precautions to prevent electrocution?

I Electrical appliances or gadgets must not be used in wet places.
II Call a certified electrician to repair damaged electrical appliances or cables.
III Do not insert any item, such as a screwdriver, into an electrical socket.

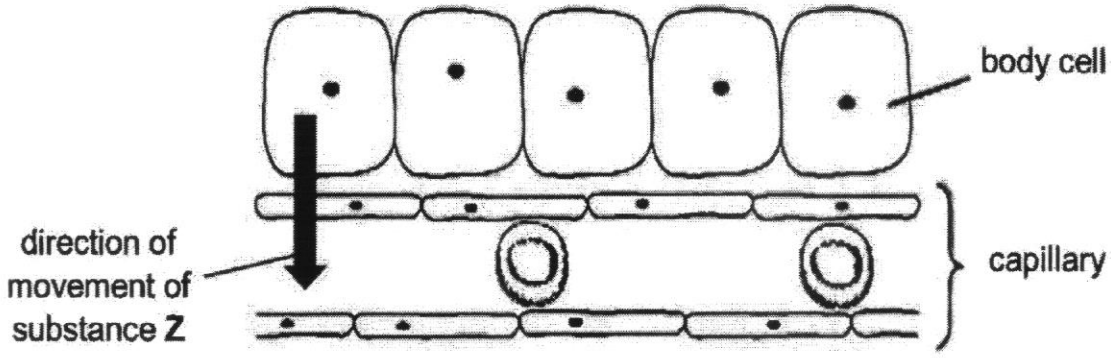
A I and II only

B I and III only

C II and III only

D All of the above

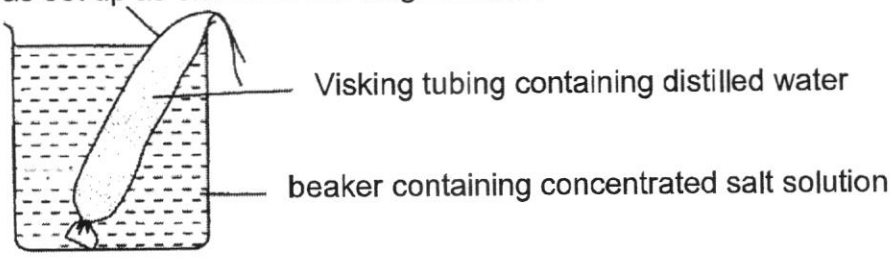
22 The diagram shows some body cells and a nearby blood capillary.
The arrow shows the direction of movement of substance **Z**.



Which row correctly describes the identity and movement of substance **Z** as indicated by the arrow?

	identity of substance **Z**	how substance **Z** moves
A	dissolved minerals	osmosis
B	dissolved waste substances	diffusion
C	dissolved nutrients	diffusion
D	oxygen	osmosis

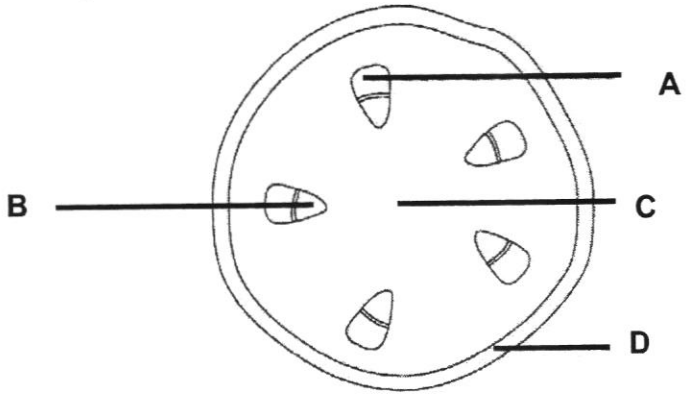
23 An experiment was set up as shown in the diagram and left to stand for one hour.



Which option is **correct** about the Visking tubing after one hour?

	size of Visking tubing after one hour	process that caused this result
A	becomes smaller	diffusion
B	becomes smaller	osmosis
C	becomes larger	diffusion
D	becomes larger	osmosis

24 The diagram shows a section through the stem of a dicotyledonous plant.
Which tissue transports sugars produced in the leaves during photosynthesis?



25 Which of the following is/are carried out by white blood cells?

I clot formation
II phagocytosis
III transport of dissolved substances

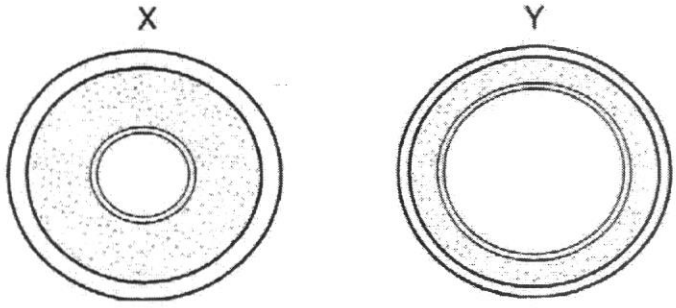
A I only

B II only

C I and II only

D II and III only

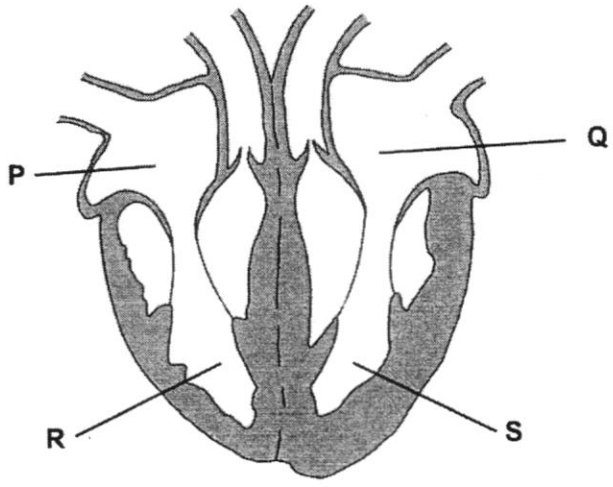
26 The diagram below shows two types of blood vessels.



What are the functions of blood vessels X and Y?

	function of X	function of Y
A	carries blood towards heart	carries blood away from heart
B	carries blood away from heart	carries blood towards heart
C	carries oxygenated blood only	carries deoxygenated blood only
D	carries deoxygenated blood only	carries oxygenated blood only

27 The diagram shows the cross-section of a human heart



Which labelled structures refer to the ventricles?

A P and Q

B P and R

C R and Q

D R and S

28 Where does fertilisation take place in the female reproductive system?

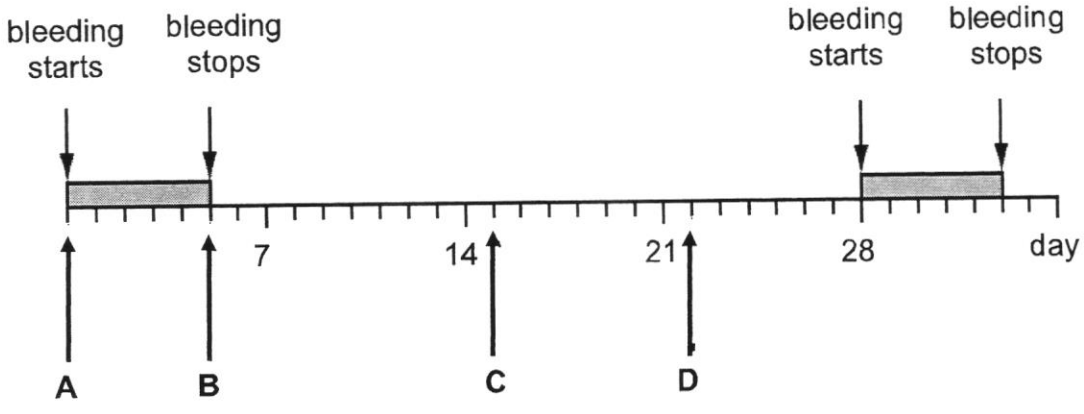
A cervix

B ovary

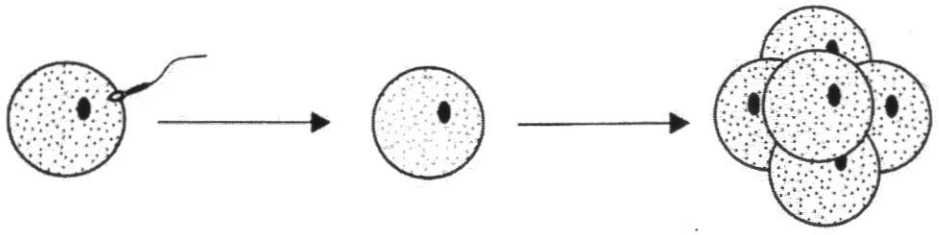
C oviduct

D uterus

29 The diagram shows a woman's menstrual cycle.
On which day is sexual intercourse most likely to result in the woman becoming pregnant?



30 The diagram shows a series of events starting with human sex cells.



X Y Z

Which option correctly describes X, Y and Z?

	X	Y	Z
A	fertilisation	embryo	zygote
B	fertilisation	zygote	embryo
C	zygote	fertilisation	embryo
D	zygote	embryo	fertilisation

Question	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Answer										
Question	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Answer										
Question	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Answer										

Section B Structured Questions [70 marks]

Answer all questions in the spaces provided.

B1 **(a)** Fig. 1.1 shows the structure of a nitrogen atom.

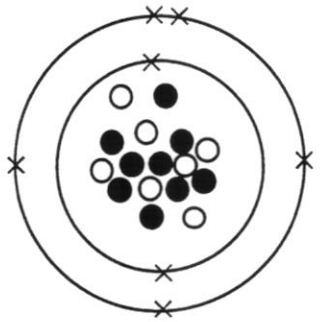


Fig. 1.1

Complete the table below to show the names and relative masses of the sub-atomic particles represented by the symbols in the nitrogen atom.

symbol	name	relative mass	relative charge
●			0
○		1	
×	electron		

[3]

(b) Table 1.1 shows some information about six particles, **A**, **B**, **C**, **D**, **E** and **F**. The letters do not correspond to the symbols of the elements in the Periodic Table.

Table 1.1

particle	proton number	relative atomic mass	number of electrons
A	2	3	2
B	9	19	10
C	19	39	18
D	12	24	12
E	17	35	17
F	10	20	10

From Table 1.1, choose the particle that

(i) is a neutral atom of metal,

..... [1]

(ii) has a positive charge.

..... [1]

[Total: 5 marks]

B2 Oxygen is found in Group VI of the Periodic Table. It has three known isotopes, oxygen-16, oxygen-17 and oxygen-18. An oxygen atom gains two electrons to form an ion with negative charges.

(a) Complete the following table by stating the number of protons, electrons and neutrons in each of the particles.

particles	number of protons	number of electrons	number of neutrons
oxygen-16 atom	8		
oxygen-17 ion		10	

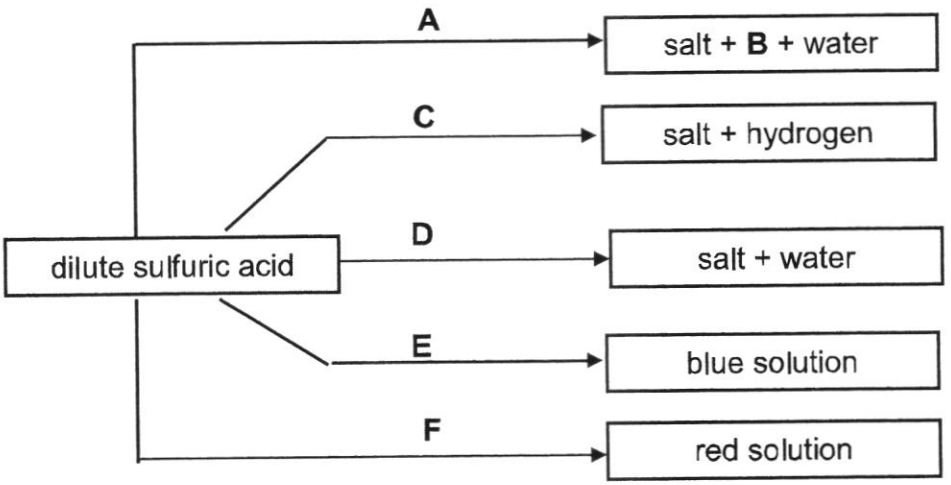
[2]

(b) Write a word equation to represent the combustion of petrol in the car engine.

..... [1]

[Total: 3 marks]

B3 **(a)** The flow chart shows some reactions of dilute sulfuric acid.
Five unknown substances, **A, C, D, E** and **F** as shown in the chart are added to the acid.



Use the substances **A**, **B**, **C**, **D**, **E** and **F** to answer the following questions.

(i) Which substance is the Universal indicator?

..... [1]

(ii) Name the type of reaction if **D** is sodium hydroxide.

..... [1]

(iii) Which substance is a reactive metal?

..... [1]

(b) The label on a bottle of sulfuric acid has fallen off.
Besides Universal Indicator, describe a simple test you could carry out in a Science laboratory to confirm that the bottle contains sulfuric acid.

test: .....

.....

observation: .....

..... [1]

(c) Subtance **C** reacts with sulfuric acid to produce hydrogen gas.
Describe how you would identify the hydrogen gas.

test: .....

.....

observation: .....

..... [1]

[Total: 5 marks]

B4 Below are some word equations.

I glucose + oxygen $\xrightarrow{\text{in living cells}}$ water + **X**

II copper chloride $\xrightarrow{\text{electricity}}$ copper + **Y**

III iron + oxygen $\longrightarrow$ iron oxide

(a) Name the substances **X** and **Y**.

X

.....

Y

..... [2]

(b) Name the type of reaction in **I** and **III**.

I

.....

III

..... [2]

[Total: 4 marks]

B5 Mercury(II) oxide, a red solid, was heated strongly in the experiment shown in Fig. 5.1. Oxygen gas was produced and shiny beads of silvery liquid mercury formed in the boiling tube.

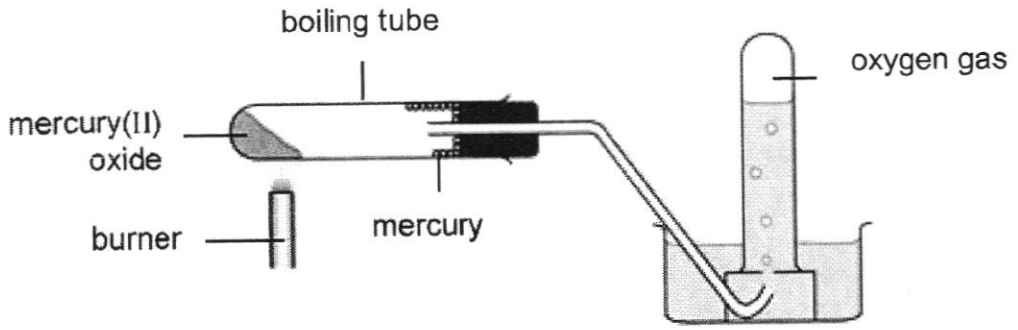


Fig. 5.1

The measurements were recorded in the table below.

mass of boiling tube (g)	50.0
mass of boiling tube and contents before heating (g)	75.0
mass of boiling tube and contents after heating (g)	73.2

(a) Give two pieces of evidence that a chemical change has occurred in the above reaction.

Evidence 1

.....

.....

Evidence 2

.....

..... [2]

(b) Write a word equation for the reaction.

..... [1]

(c) Calculate the mass of oxygen gas produced.

[1]

[Total: 4 marks]

B6 Fig. 6.1 shows a block with surfaces labelled **A**, **B** and **C**.

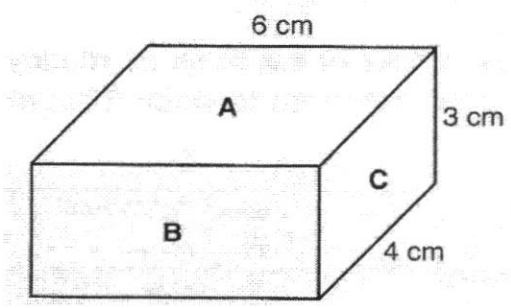


Fig. 6.1

(a) The pressure exerted by the smallest contact area is 0.1 N/cm^2.
Given the gravitational field strength on Earth is 10 N/kg, calculate the mass of the block.

mass = ... kg [2]

(b) Explain why surface **A** exerts the lowest pressure on the ground.

.....

..... [1]

(c) The block is now transported to the moon.
How would the pressure exerted by the block on the ground change?
Explain your answer.

.....

.....

..... [2]

[Total: 5 marks]

B7 Gladius climbs up a slide as shown in Fig. 7.1.

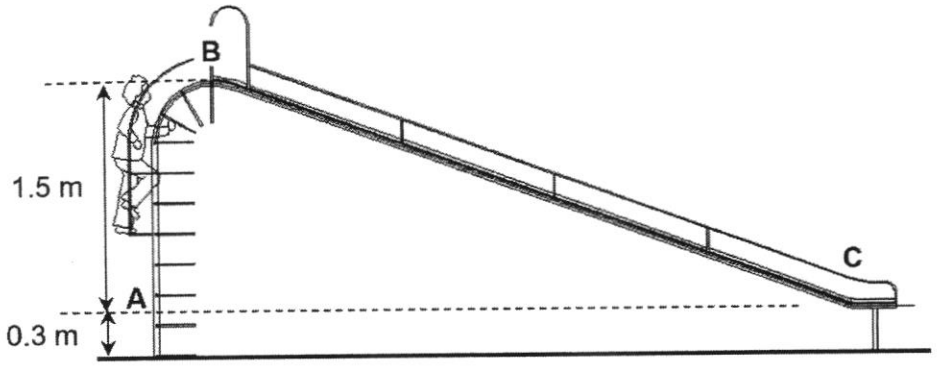


Fig. 7.1

(a) Explain whether there is work done by Gladius when she is climbing from A to B.

.....

.....

..... [2]

(b) State the type of energy gained by Gladius when she climbs from A to B.

..... [1]

(c) List two forces that are acting on Gladius when she slides down from B to C.

1 .....

2 ..... [2]

(d) Suggest a method to increase Gladius's speed at C.

.....

..... [1]

[Total: 6 marks]

B8 Fig. 8.1 shows a pendulum bob, which was fixed at position Y.

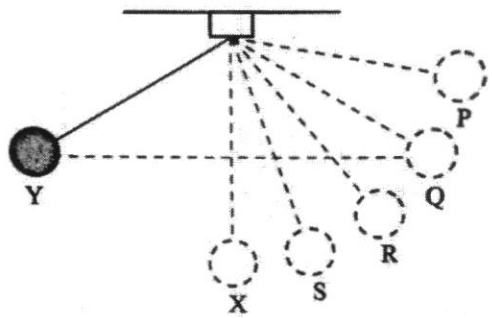


Fig. 8.1

The pendulum bob is gently released from rest at position Y.
Explain why in real life, the bob reaches position R and not position Q or P.

.....

.....

.....

.....

..... [3]

[Total: 3 marks]

B9 A student sets up an electric circuit as shown in Fig. 9.1.

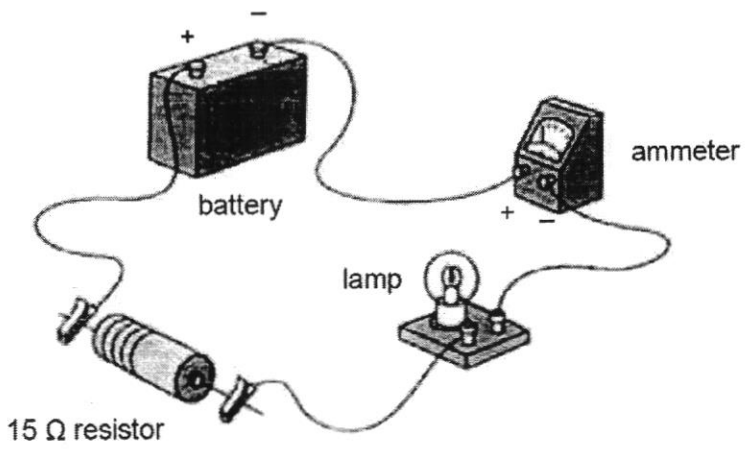


Fig. 9.1

(a) The lamp lights up but the needle of the ammeter moves below the zero mark. Identify the change that should be made so that the ammeter works correctly.

.....

..... [1]

(b) In the box below, draw the correct circuit diagram.

[2]

(c) Using your answer in (b), draw how you would connect a voltmeter to measure the potential difference across the 15 Ω resistor. [1]

(d) **(i)** Another 15 Ω resistor is connected in parallel with the 15 Ω resistor in the circuit. State the effect, if adding the 15 Ω resistor has on the brightness of the lamp.

..... [1]

(ii) Explain your answer in **d(i)**.

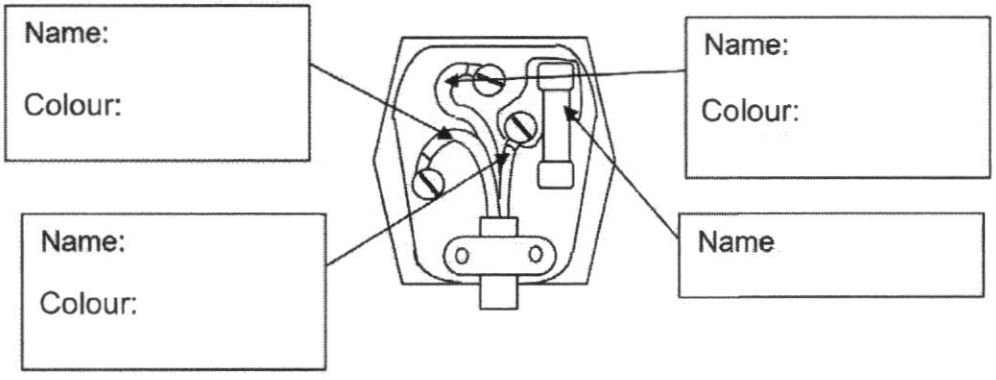
.....

.....

..... [2]

[Total: 7 marks]

B10 Label the name and colour of the wires and the component in the 3-pin plug. [4]



[Total: 4 marks]

B11 Table 11.1 shows the usage of three electrical appliances in a day.

appliance	power rating	duration used
fan	80 W	8 hours
lamp	120 W	4.5 hours
electric kettle	3 kW	15 minutes

Table 11.1

(a) Calculate the total amount of electrical energy used by the three electrical appliances for the duration shown in a day.

total electrical energy = ...kWh [2]

(b) The cost of electricity is 20 cents per kWh. Using your answer in (a), calculate the cost of using all three electrical appliances for a week.

cost = $..... [1]

[Total: 3 marks]

B12 In an experiment, a U-shaped tube was filled with equal volumes of sucrose solutions **P** and **Q**. One sucrose solution had a concentration of 5 g/cm^3 while the other had a concentration of 25 g/cm^3.

Fig 12.1 shows this experimental setup.

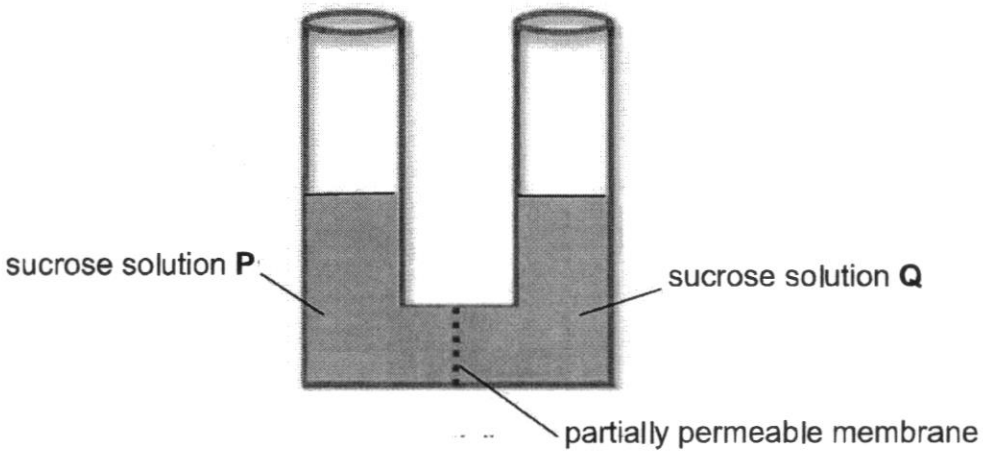


Fig. 12.1

Fig 12.2 shows the heights of solutions **P** and **Q** after one hour.

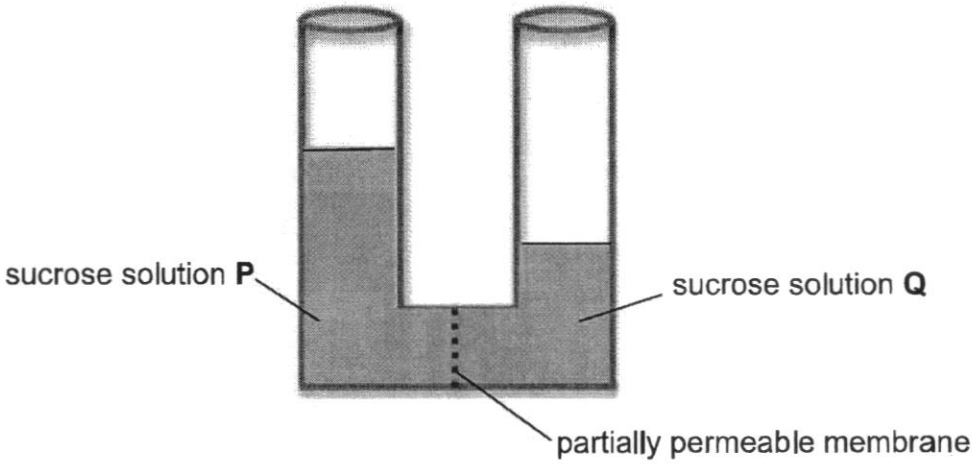


Fig. 12.2

(a) State the concentrations of sucrose solutions **P** and **Q**.

concentration of sucrose solution **P** = ... g/cm^3

concentration of sucrose solution **Q** = ... g/cm^3 [1]

(b) Describe and explain the results of this experiment.

.....

.....

.....

..... [3]

[Total: 4 marks]

B13 Describe how water travels from the soil to the xylem in the roots.

.....

.....

..... [2]

[Total: 2 marks]

B14 Fig 14.1 shows a representation of the human circulatory system.
The arrows show the direction of flow of blood.

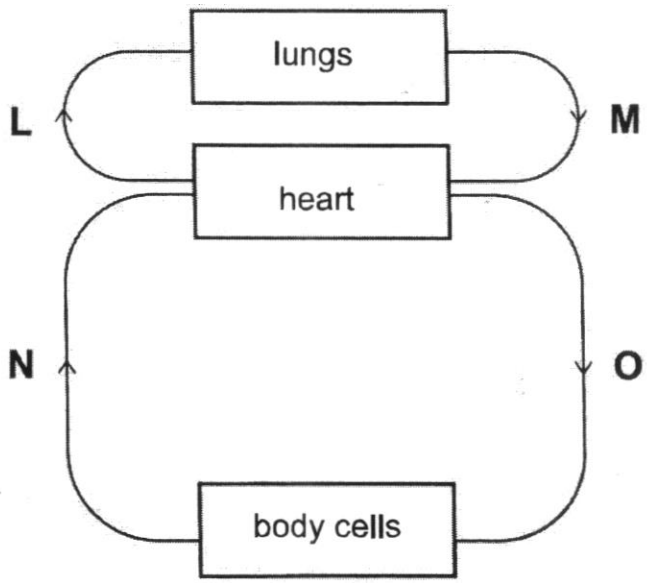


Fig. 14.1

(a) Identify blood vessels **L – O**.

L: ..... **M**: .....

N: ..... **O**: ..... [2]

(b) Which blood vessel has the lowest blood pressure? Explain your answer.

.....

.....

..... [2]

[Total: 4 marks]

B15 Fig 15.1 shows the circulatory systems in fish and humans.

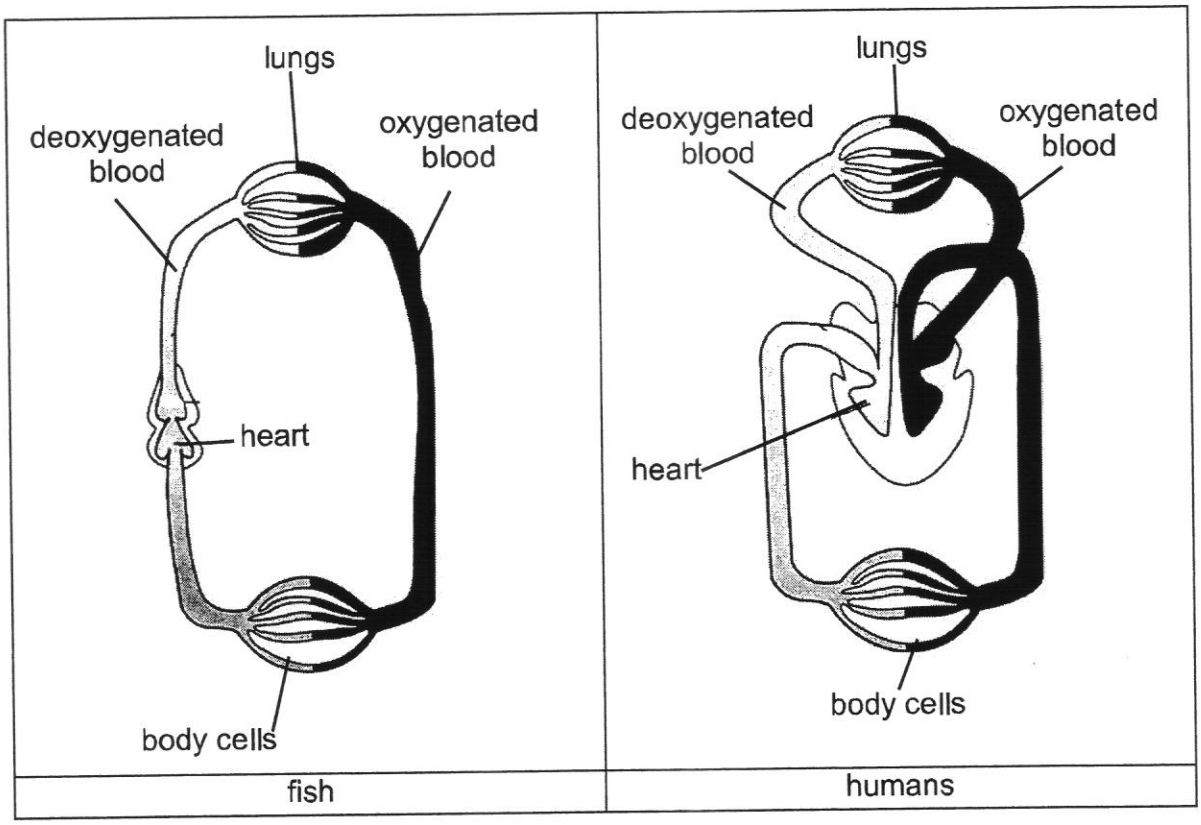


Fig. 15.1

Humans have a bigger heart than fish.
Describe **two** other differences in the circulatory systems in fish and humans.

.....

.....

.....

..... [2]

[Total: 2 marks]

B16 Hormones **X** and **Y** control the thickness of the uterine lining in a female.

Fig 16.1 shows how the varying concentrations of hormones **X** and **Y** cause changes in thickness of the uterine lining in a female during one menstrual cycle.

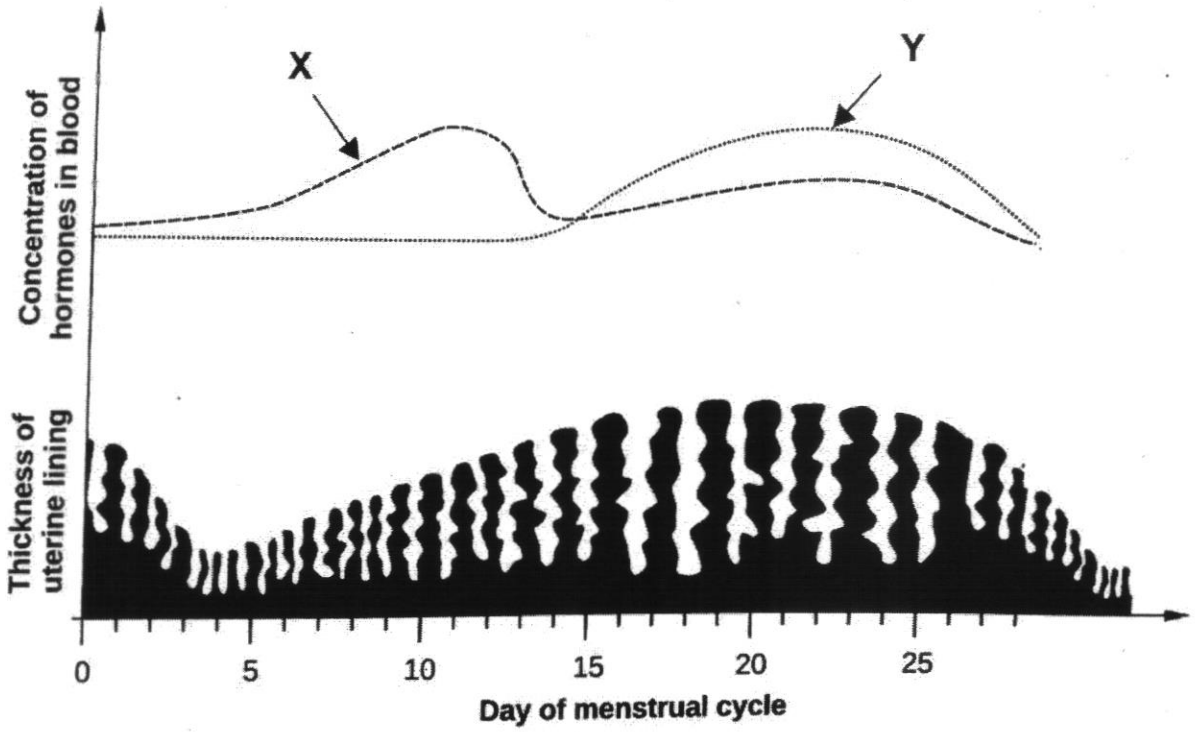


Fig. 16.1

(a) Use Fig 16.1 to describe how hormones **X** and **Y** affect the thickness of the uterine lining from days 5 - 22.

.....

.....

..... [2]

(b) A female takes birth control pills that prevent the production of hormone **Y**. Using information in Fig 16.1, explain how this prevents pregnancy.

.....

.....

..... [2]

[Total: 4 marks]

B17 Fig 17.1 shows the male reproductive system.

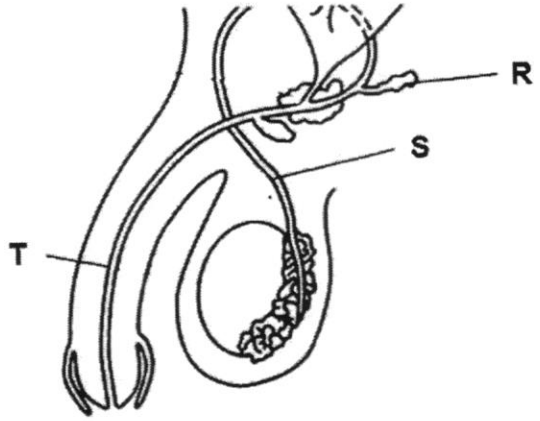


Fig. 17.1

State the functions of structures **R**, **S** and **T**.

R: .....

S: .....

T: ..... [3]

[Total: 3 marks]

B18 Table 18.1 below shows the number of people who had HIV in a particular country from the years 2014 to 2018.

Table 18.1

year	number of people who had HIV
2014	407
2015	390
2016	365
2017	340
2018	250

Describe and explain the change in the number of people who had HIV in the country from the years 2014 – 2018.

.....

..... [2]

[Total: 2 marks]

End of paper

2E SA2 2021 Answers

Section A [30 marks]

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

Section B Structured Questions [70 marks]

Write your answers in the spaces provided.

B1 **(a)**

symbol	name	relative mass	relative charge
●	**neutron**	**1**	0
○	**proton**	1	**+1**
×	electron	**1/1840**	**-1**

1 m for every 3 correct answers — 3

(b) **(i)** D — 1

(ii) C — 1

Total: 5 marks

B2 **(a)**

particles	number of protons	number of electrons	number of neutrons
oxygen-16 atom	8	8	8
oxygen-17 ion	8	10	9

[1] [1]

(b) petrol + oxygen →carbon dioxide + water — [1]

Total: 3 marks

B3 **(a)** **(i)** **F** — 1

(ii) Neutralisation/ acid-base reaction — 1

(iii) **C** — 1

(b) test: place a blue litmus paper into the solution

observation: blue limus turns red — 1

(c) test: place a lighted splint at the mouth of test tube where hydrogen gas evolved

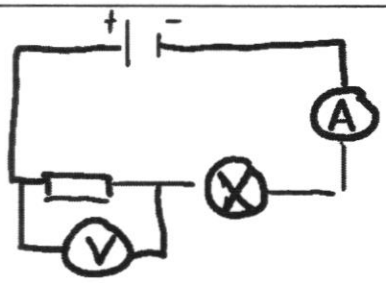
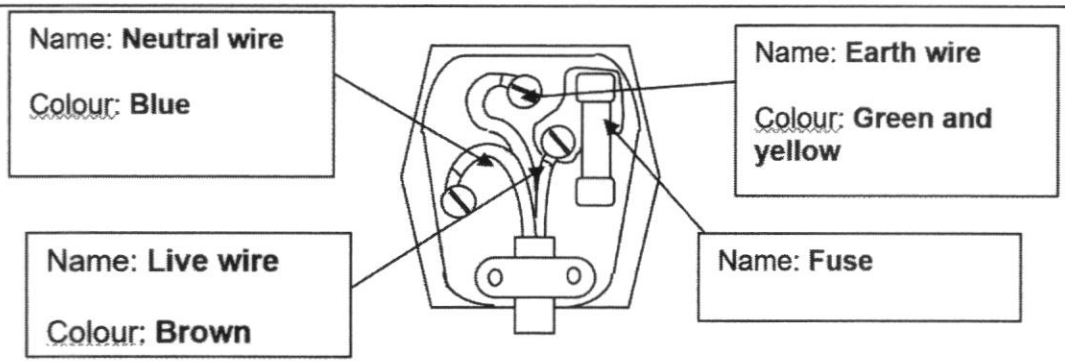
observation: the lighted splint extinguished with a 'pop' sound — 1

Total: 5 marks

B4	**(a)**	**X**	carbon dioxide	1
		Y	chlorine	1
	(b)	I	respiration	1
		III	oxidation Reject: combustion; Accept: combination	1
			Total: 4 marks	

B5	**(a)**	• New products, oxygen and mercury are formed when mercury(II) oxide is heated. • The new products have different properties as the reactant, mercury(II) oxide. • Thermal energy is absorbed in the reaction to break down the reactant, mercury(II) oxide/ heat is involved in the chemical reaction. • The reaction is irreversible as the reactants cannot be easily obtained when the products are formed / products cannot change back to reactants. Any 2 (1 mark each)	[2]
	(b)	heat mercury(II) oxide ⟶ mercury + oxygen ignore condition is missing	[1]
	(c)	Mass of oxygen produced = 75.0 g – 73.2 g = 1.8 g Correct answer and unit Penalised for no unit given	[1]
		Total: 4 marks	

B6a	Pressure = weight / area 0.1 N/cm^2 = Weight / 12 cm^2 Weight = 0.1 N/cm^2 x 12 cm^2 = 1.2 N	1
	W= mg m = W/g = 1.2/ 10 = 0.12 kg	1
13b	**C:** surface A has the biggest contact area with the ground. **R:** Since pressure is the force acting per unit area, for the same force, A exerts the smallest pressure on the ground.	1
13c	The pressure will be smaller. As moon's gravitational field strength is smaller than earth hence weight of the block will be smaller.	1 1
B7a	Yes, there is work done. There is a force applied by the girl and the she moves in the direction of the force. OR There is work done against gravity as she climbs.	1 1
b	Gravitational potential energy	1
c	Weight Friction Accept the following : For weight – 'gravity', 'gravitational force' For friction – 'frictional force'	1 1
d	She can wet the slide / lubricant the slide/ any reasonable answer that reduces friction on the slide. (do not accept ' reduce friction')	1 1
B8	In real life, some energy lost to overcome air resistance/friction during the oscillation. [1] hence it will not reach Q (the same height as Y) Gravitational Potential Energy (GPE) at P will be greater than GPE at Y. [1] Since energy cannot be created [1], it is impossible for the bob to reach P.	3
B9a	Reverse the polarity of the ammeter connected. Accept: swap the wires of the battery.	1

b	 1m – any 2 correct symbols and correct arrangement	
c	See 16b diagram	1
di	Brightness will increase	1
dii	Adding another 15Ω resistor in parallel will decrease the total resistance of circuit Current in circuit will increase hence increasing the brightness	1 1
B10	 1 m for each correct box	4
B11 **a** **b**	E = Pt = 0.08x8 + 0.12x4.5 + 3x0.25 = 1.93 kWh Cost/ day = 20c x 1.93 = 38.6 cents (accept 39 – nearest cent) Cost /week = 38.6 x 7 = 270.2 c = $2. 70 (allow ECF)	 1 1 1

B12a (1m for both correct)

- P = 25 g/cm^3
- Q = 5 g/cm^3

b (any one of the following)

- The level on the left side of the tube/tube containing solution **P** increased in height **(1m)**

- Solution **Q** had a higher water potential than solution **P. (1m)**

- Water molecules moved by osmosis from right side of the tube/solution **Q** into left side of the tube/ solution **P. (1m)**

B13

- Water from the soil enters the root hair cells by osmosis. **(1m)**

- Water travels by osmosis within the root cells until it eventually enters the xylem. **(1m)**

B14a (1m for two correct)

- L = pulmonary artery
- M = pulmonary vein
- N = vena cava
- O = aorta

b

- blood vessel N / vena cava **(1m)**
- blood in N / vena cava: **(1m for any one of the following)**
  - has circulated around the body and has the least (kinetic) energy
    or
  - has circulated around the body and flows the slowest

B15 (1m for any two correct comparisons)

Fish	Humans
(Describing single circulation): Blood flow: body cells → heart → lungs → body cells or Blood enters the heart only once during each cycle/circulation	(Describing double circulation): Blood flow: body cells → heart → **lungs heart** → body cells or Blood enters the heart **twice** during each cycle/circulation
Heart is made up of 2 chambers	Heart is made up of 4 chambers
only deoxygenated blood flows through the heart	both deoxygenated and oxygenated blood flows through the heart

B16a (1m for each)

- Hormone X causes the thickening of the uterine lining from days 5 – 11
- Hormone Y causes the (further) thickening of uterine lining from days 14/15 – 22

b

- The thickness of the uterine lining cannot be maintained from days 14 – 22. **(1m)**
  (or, the thickness of the uterine lining cannot be maintained from day 14.)
  (or, the uterine lining will become thin from day 14.)

- Thus, the foetus cannot attach itself to the uterus and grow. **(1m)**

B17

- R: produces fluids for the sperm to swim in (reject: produces semen) **(1m)**
    - (or, produces nutrients for the sperm)
- S: transports sperm towards the urethra/penis **(1m)**
- T: carries semen / urine out of the male body/penis **(1m)**

B18

There was a decrease in the number of people who had HIV **(1m)** because:
(description of data not needed)

(1m each for any one of the following)

- more men used condom during sexual intercourse
- people avoided having casual sex
- fewer people shared needles / instruments that break the skin
- fewer men shared needles during abuse of drugs
    - or, lesser people abused drugs, causing the incidence of sharing of needles to decrease
- ensuring that tattooing equipment were sterilised before use

(also accept fewer *number of people infected with HIV sought medical help)*

End of paper