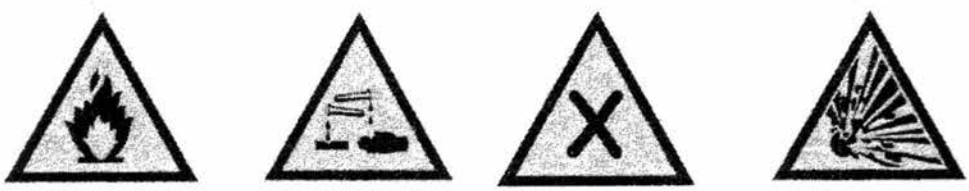
Section A (30 marks)

Answer **all** questions.
Shade your answers in the OTAS provided.

1 Which of the symbols should be printed on a bottle of alcohol?

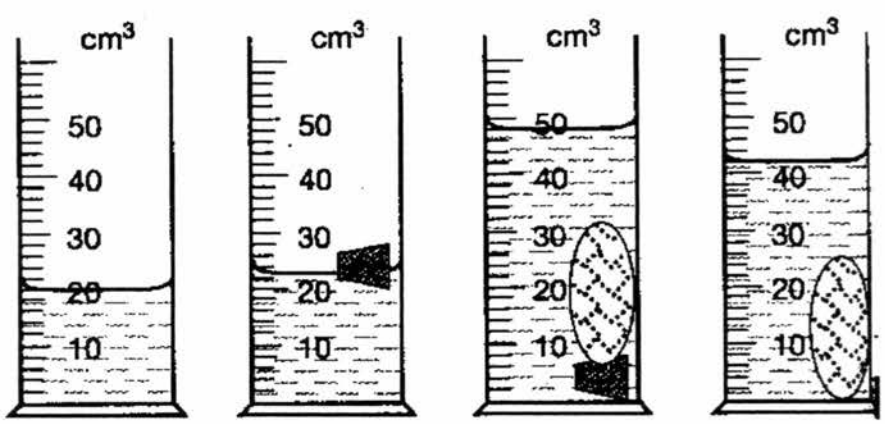


A B C D

2 Which of the following is a property of a luminous flame?

A It is invisible at a distance.
B It does **not** produce soot.
C It is produced when the air-hole is closed.
D It is hotter than the non-luminous flame.

3 Justin wants to find the volume of a cork by using a measuring cylinder. He uses a stone to keep the cork under water. The results of each stage of the experiment are shown below.



What is the volume of the cork?

A 2 cm^3 **B** 6 cm^3 **C** 22 cm^3 **D** 28 cm^3

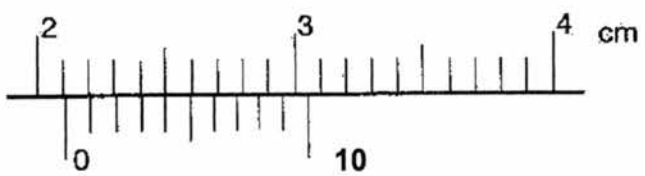
4 Which of the following SI units are correctly matched?

	quantity	SI unit
I	length	metre (m)
II	time	minutes (min)
III	temperature	Kelvin (K)

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

5 Huimin used a pair of vernier calipers to measure the diameter of a test tube. The diagram below shows the enlargement of part of the vernier calipers.

How large is the diameter of the test tube?



A 2.14 cm **B** 2.15 cm **C** 2.45 cm **D** 2.54 cm

6 A student aims to investigate how an egg of the same density will behave in liquids of different densities.

P Q R S

List the **liquids** P to S from the densest to the least dense.

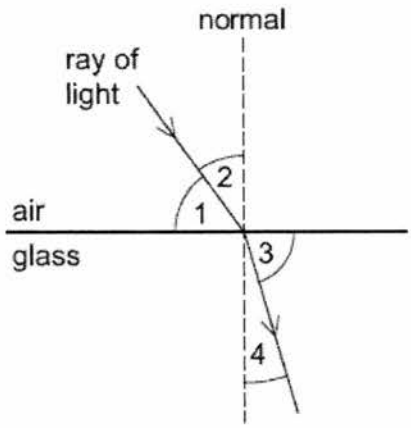
A P, Q, R, S
B S, R, Q, P
C R, Q, P, S
D S, P, Q, R

7 An object is placed 5 m in front of a mirror. A boy sits between the object and the mirror and viewed that the image of the object is 7 m away from him.

What is the distance between the boy and the object?

A 2 m **B** 3 m **C** 4 m **D** 5 m

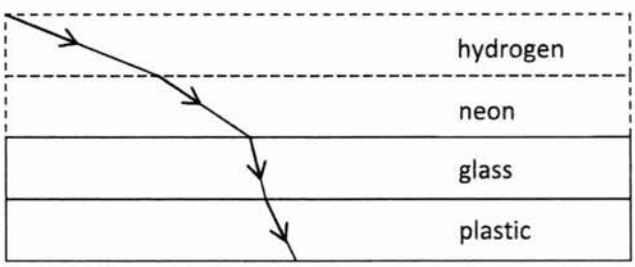
8 The diagram shows a ray of light entering a block of glass.



Which numbered angles are the angles of incidence and of refraction?

	angle of incidence	angle of refraction
A	1	3
B	1	4
C	2	3
D	2	4

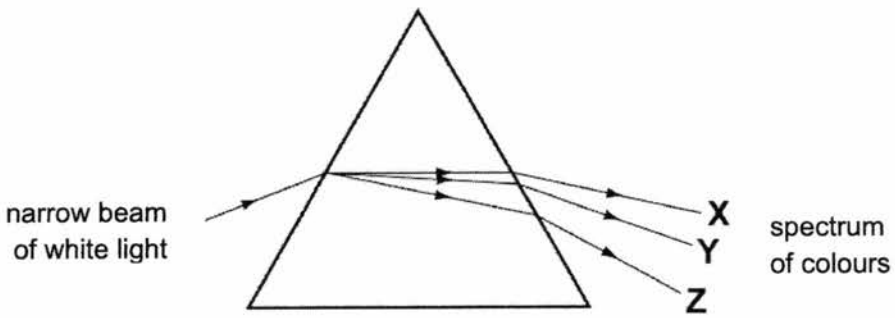
9 The following diagram shows the path of light as it passes through four substances.



Which of the following options ranks the four substances in increasing order of density?

A glass, plastic, neon, hydrogen
B hydrogen, neon, glass, plastic
C hydrogen, neon, plastic, glass
D plastic, glass, neon, hydrogen

10 A student shines a narrow beam of white light into a prism as shown in the diagram. He sees a spectrum of colours emerging from the prism.



Which three colours does he see at X, at Y and at Z?

	X	Y	Z
A	violet	yellow	red
B	red	violet	yellow
C	red	yellow	violet
D	yellow	red	violet

11 Which of the following statements is true?

A A magenta object appears red in blue light.
B A blue object appears blue only in blue light.
C A green object appears yellow in white light.
D A black object appears black in light of any colour.

12 A car is travelling at an average speed of 60 km/h.

Calculate how far it would travel if the motorist starts at 0800 h and ends his journey at 0940 h.

A 84 km **B** 100 km **C** 140 km **D** 600 km

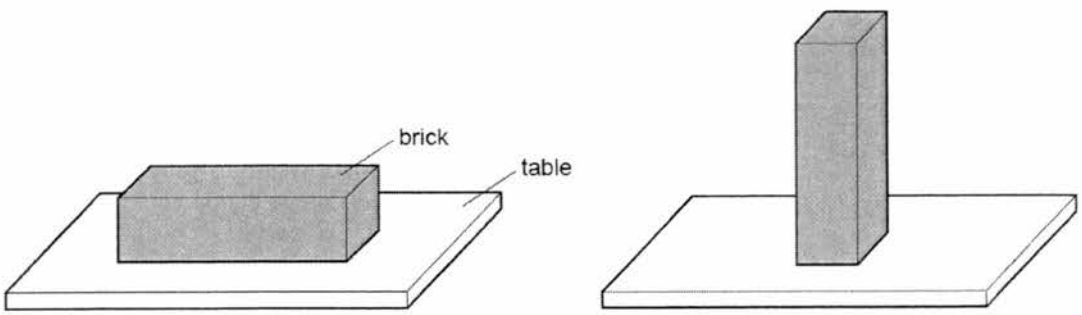
13 Mountain bike tires are specially designed to provide good grip on the ground.
Four methods are suggested below.

- add tread pattern on the tires
- apply lubricating oil on tires
- increase the width of tires
- use a smooth material to make tires

How many method(s) will effectively improve the grip of mountain bike tires?

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

14 A brick with flat rectangular sides rests on a table. The brick is then turned so that it rests on the table on its smallest surface.



Which row correctly shows how the force and pressure exerted by the brick on the table changed?

	force	pressure
A	increased	increased
B	increased	unchanged
C	unchanged	increased
D	unchanged	unchanged

15 Which are the correct units for friction, weight and pressure?

	friction	weight	pressure
A	N	N	Pa
B	kg	kg	Pa
C	kg	g	kg/m^2
D	N	N	kg/m^2

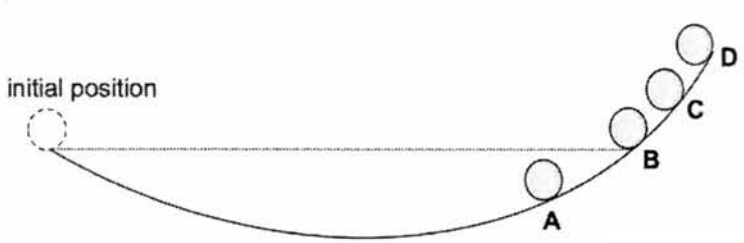
16 A boy holds a 40-newton dumbbell at arm's length for 10 seconds. His arm is 1.5 metres above the ground.

What is the work done by the force of the boy on the 40-newton dumbbell when he is holding it?

A 0 J **B** 40 J **C** 60 J **D** 400 J

17 A ball rolls down a ramp as shown below.

Assuming there is no friction, what is the highest possible position the ball can reach?



18 Which of the following is a correct classification of an organelle, a cell, a tissue or an organ?

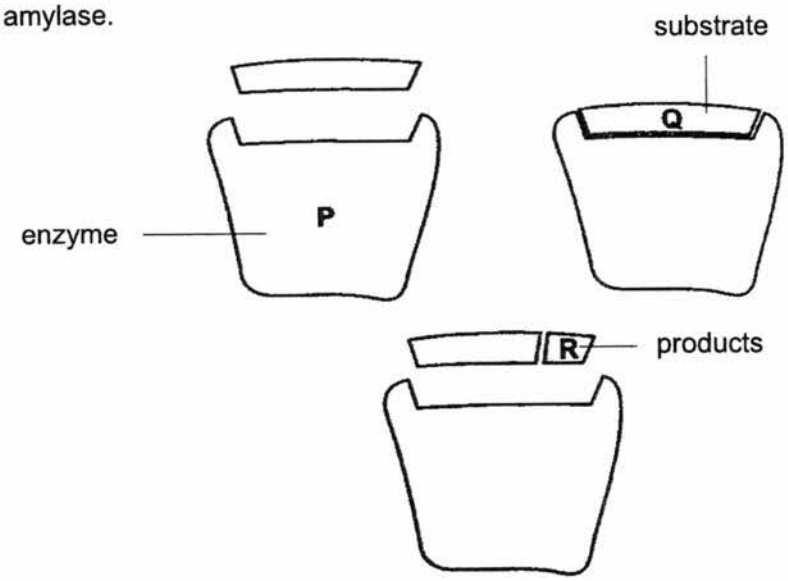
	classification	example
A	cell	chloroplast
B	organ	nucleus
C	organelle	kidney
D	tissue	blood

19 The table below shows the composition of four foods in grams per 100 g portion.

Which food would be most useful for providing an immediate source of energy?

food	carbohydrate /g	fat /g	protein /g
A	69.2	0.0	0.5
B	8.6	49.0	28.1
C	0.0	0.9	18.0
D	4.8	3.8	3.3

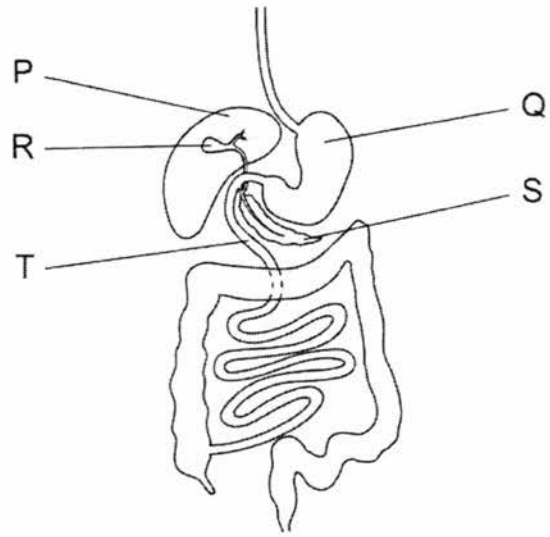
20 The diagram represents stages in the breakdown of starch to maltose by the enzyme amylase.



Which line is correct?

	starch	maltose	amylase
A	P	R	Q
B	Q	R	P
C	Q	P	R
D	R	Q	P

21 The diagram shows the human digestive system.

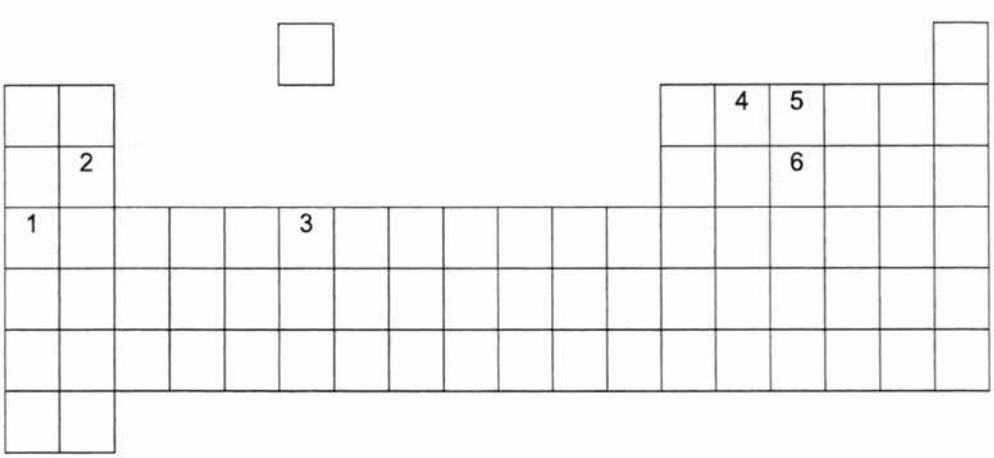


Where is bile made, where is it stored and where does it act?

	where it is made	where it is stored	where it acts
A	P	Q	R
B	P	R	T
C	Q	S	P
D	Q	T	S

22 In the outline of the Periodic Table shown below some elements are represented by numbers.

Which two of these are non-metals in the same Period?



A 1 and 3 **B** 2 and 6 **C** 4 and 5 **D** 5 and 6

23 The table below gives the melting points, densities and electrical conductivities of four elements.

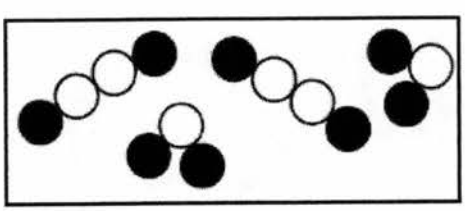
Which element is copper?

	melting point (°C)	density (g/cm^3)	electrical conductivity
A	-38.9	13.6	good
B	-7.2	3.12	poor
C	97.8	0.97	good
D	1083	8.96	good

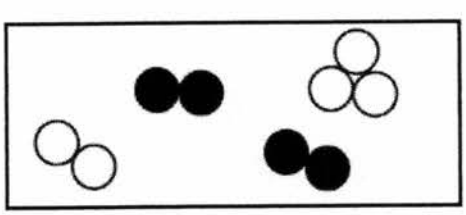
24 The symbols ○ and ● represent particles of different elements.

Which diagram shows a mixture of an element and a compound?

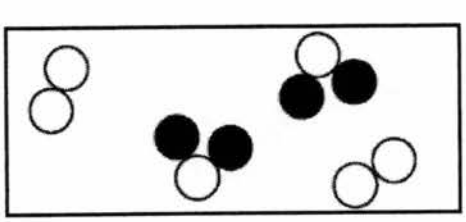
A



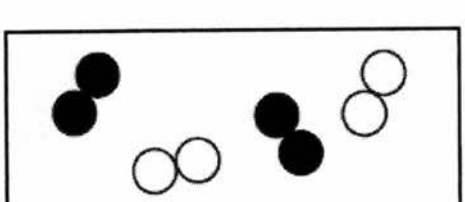
B



C



D



25 Cobalt chloride has a chemical formula of $CoCl_2$.

Four statements are made about cobalt chloride.

1 Cobalt chloride is a mixture of elements.
2 Cobalt chloride can only be broken down by chemical methods.
3 The constituent elements of cobalt chloride are carbon, oxygen and chlorine.
4 There are two chlorine particles in cobalt chloride.

Which of the statements are **correct**?

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

26 A mixture can be classified as a solution or a suspension.

Which of the following methods will **not** allow you to distinguish between a solution and a suspension?

A allow the mixture to stand for a period of time
B shine a beam of light through the mixture
C filter the mixture
D heat the mixture strongly

27 A very old painting has been vandalised with new paint. The solubilities of the old and new paints in different solvents **A**, **B**, **C** and **D** are shown in the table below.

Which solvent could be used to remove the vandalism without damaging the original paint?

solvent	old paint	new paint
A	insoluble	insoluble
B	insoluble	soluble
C	soluble	insoluble
D	soluble	soluble

28 Singapore uses reverse osmosis as one of the separation techniques in the process of producing NEWater.

Which one of the following best describes the process of reverse osmosis?

A A high pressure is used to push a solvent through a partially permeable membrane.
B A low pressure is used to push a solvent through a partially permeable membrane.
C A high pressure is used to force bacteria and viruses through a partially permeable membrane so that they are removed from the solution.
D A low pressure is used to force bacteria and viruses through a partially permeable membrane for removal from the solution.

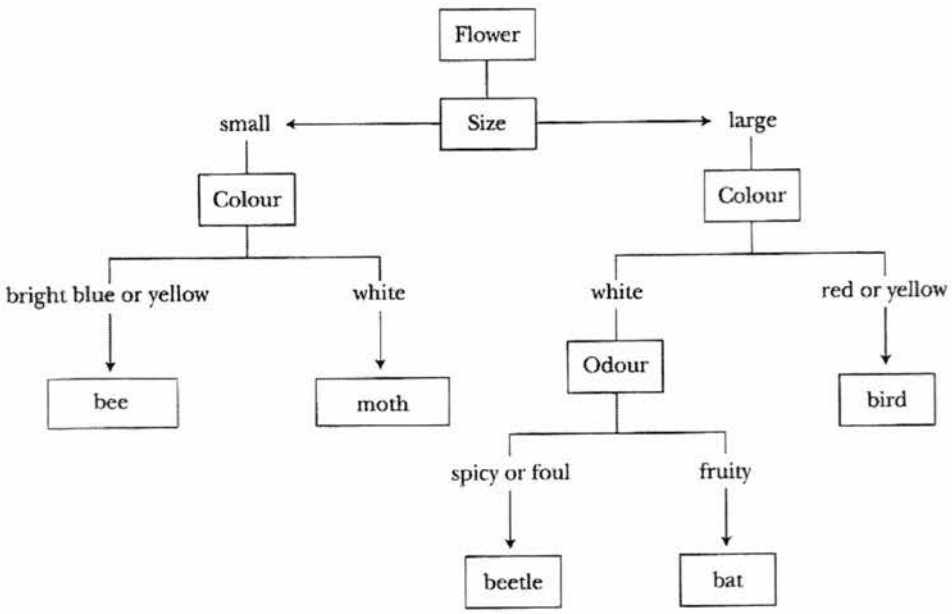
29 The table shows steps that are used to separate a mixture containing iron filings, chalk powder and table salt. The steps are not in correct sequence.

step	description
1	heating to dryness
2	using a bar magnet
3	dissolving in water
4	filtering

Which of the following shows the correct sequence to obtain these substances separately?

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

30 The key shows one way to classify flowers according to the animals that they attract.



Which animal would be attracted by a large, brightly coloured flower?

A bat **B** bee **C** bird **D** moth

Section B (40 marks)

Answer **all** questions in the spaces provided.

B1 Read the following passage below and answer the question that follows.

Marie Curie was the first woman who was awarded a Nobel Prize in Physics for her discovery of radioactivity and in Chemistry for the discovery of two new elements Polonium (named after Marie's native country, Poland) and Radium (meaning "ray").

The discovery of new elements was not easy during the 18th century due to the limitations of technology then, and due to limited research background knowledge on the properties of substances. Marie's and her husband's work was thus met with many set backs and critics. They spent many of their years proving their work was accurate.

After overcoming many trials, Marie finally gained recognition through the Nobel Prize.

State **one** quality that Marie had that led her to success. Support with reason(s) from the passage.

.....

.....

.....[2]

B2 A launderette owner is testing the effectiveness of some solvents **A**, **B** and **C** on two types of stains **X** and **Y**.

type of stain	mass of stain that dissolves in 100 cm^3 of solvent / g					
	solvent **A**		solvent **B**		solvent **C**	
	10 °C	**70 °C**	**10 °C**	**70 °C**	**10 °C**	**70 °C**
X	17.0	20.2	1.2	3.0	5.0	17.6
Y	15.0	29.9	1.3	2.5	19.0	31.2

(a) Identify the control variable in the test.

.....[1]

(b) Which solvent is most effective in removing stains caused by **Y**? ..... [1]

(c) A garment marked 'cold wash only', is stained with **X**.
Which solvent should be used? ..... [1]

(d) How does the temperature affect the effectiveness of the solvents?

.....[1]

B3 Aluminium is a commonly used element. Aluminium can be mixed with other elements to make aeroplanes.

(a) Explain what is meant by an *element*.

.....

.....[1]

(b) Identify the Period and Group of aluminium in the Periodic Table.

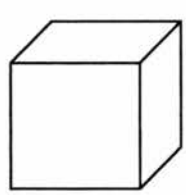
Period : ..... Group : ..... [2]

(c) State **two** physical properties of aluminium that are important in the manufacturing of aeroplanes.

.....

.....[2]

(d) Isaac carried out an experiment to determine the density of an aluminium cube measuring 0.03 m on each side. He measured the mass of the cube in the laboratory and it was 72.9 g.



0.03 m

(i) Name the instrument that Isaac used to measure the mass of the aluminium cube.

.....[1]

(ii) Calculate the density of the aluminium cube.
Leave your answer in kg/m^3.

(iii) The force of gravity on the Moon is about 1/6 (one sixth) that on Earth.

What is mass of the aluminium cube on the Moon?
Explain your answer.

.....

.....[2]

B4 **(a)** State the energy conversions that take place in a wind-up toy car.

kinetic energy → ..... → ..... + ... [2]
energy energy energy

(b) A car is initially at rest on a level road. The car begins to move and travels a distance of 2 kilometres.

State what has happened to the car's (*increase/decrease/remain unchanged*)

(i) gravitational potential energy .....

(ii) kinetic energy .....[2]

(c) **(i)** Suggest a practical renewable source of energy for Singapore.

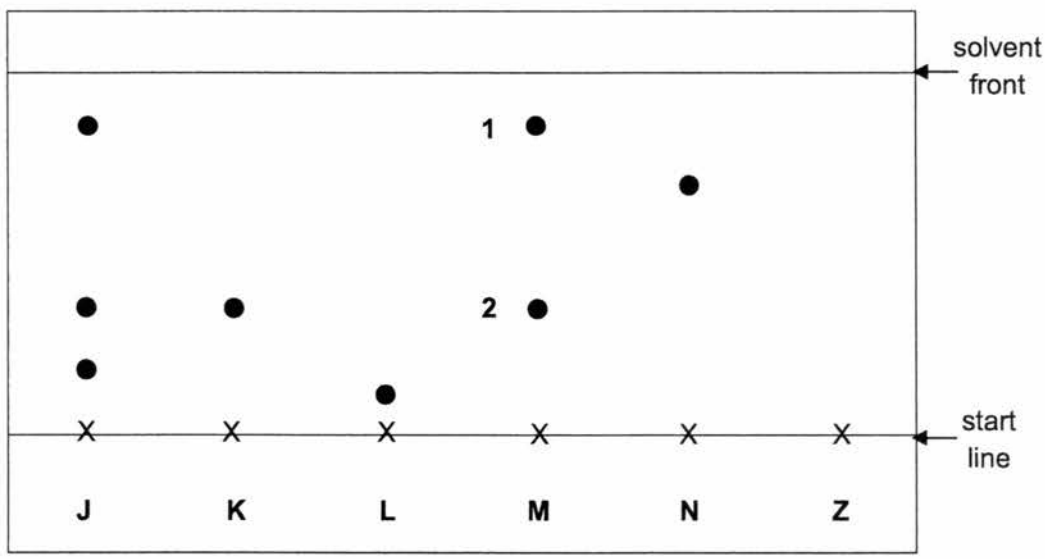
.....[1]

(ii) Give **one** environmental advantage of using the energy source stated in **c(i)** in producing energy.

.....

.....[1]

B5 The figure below shows the chromatogram produced for all the six substances **J**, **K**, **L**, **M**, **N** and **Z** using ethanol as the solvent.



(a) State which substances are made up of pure substances only.

.....[1]

(b) **(i)** **Z** is a mixture containing substances **M** and **N**.
On the figure, draw the result you would expect for substance **Z**. [1]

(ii) Explain the difference in the results for substances **K** and **N**.

.....

.....[2]

(c) Explain why the start line is drawn in pencil and not in ink.

.....

.....[2]

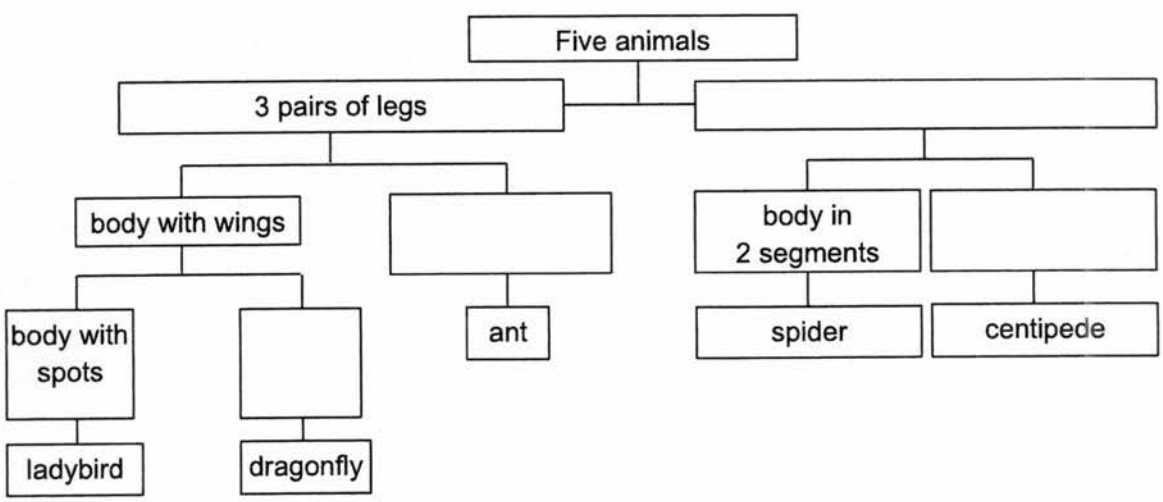
(d) Chromatography is used in the detection of counterfeit drugs.
State **one** advantage of chromatography.

.....[1]

B6 During an ecology field trip, a group of students caught the five animals as shown below.

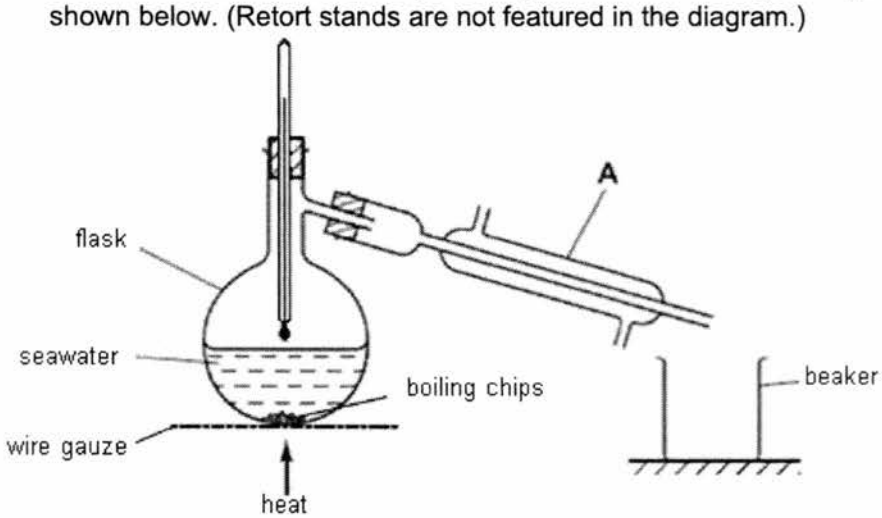
ant	dragonfly	ladybird	spider	centipede
				
3 pairs of legs	3 pairs of legs	3 pairs of legs	4 pairs of legs	more than 4 pairs of legs

Complete the following dichotomous key with the observable characteristics of the animals caught. [4]



B7 **(a)** Draw a neat, **labeled** scientific diagram of the set up used to separate sand from seawater. [2]

(b) Pure water can be obtained by distilling the seawater using the apparatus shown below. (Retort stands are not featured in the diagram.)



(i) State the name of the apparatus labelled **A**.

.....[1]

(ii) Draw **two** arrows to show the direction of water flow to cool the vapour in **A**. Label 'water in' and 'water out'. [1]

(iii) What is the purpose of boiling chips?

.....[1]

(iv) Identify a mistake made in the drawing of the above apparatus and how it should be corrected.

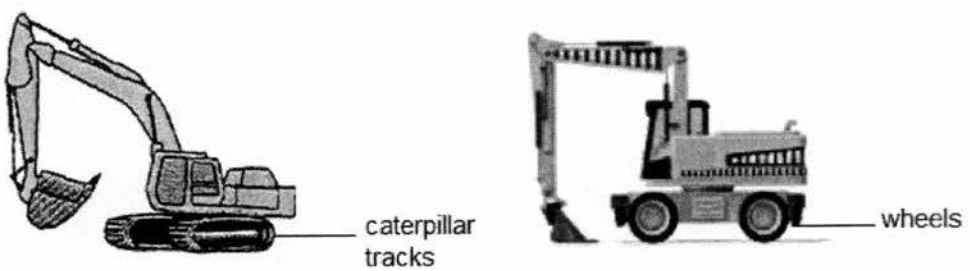
.....[1]

Section C (30 marks)

Answer **all** questions in the spaces provided.

C1 **(a)** The diagram shows two different types of excavators of the same mass.

Excavator A **Excavator B**



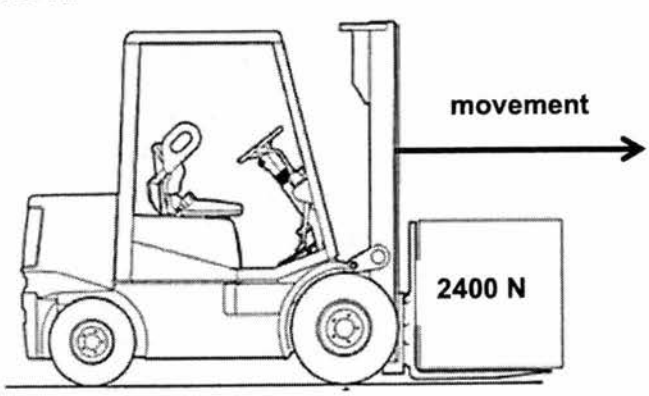
Which excavator is more suitable for operating on soft, muddy ground? Explain your answer using the concept of pressure.

.....

.....

.....[2]

(b) The figure below shows a fork-lift truck with a mass of 3000 kg transporting a load of 2400 N.



(i) Draw **two** labelled arrows to show the forces acting on the fork-lift truck in the figure above. [2]

(ii) Calculate the total weight of the fork-lift and load, given gravitational field strength is 10 N/kg.

(iii) The contact area of a wheel is 0.8 m^2.

Calculate the pressure exerted on the floor by the fork-lift and load if the fork-lift truck has 4 wheels.

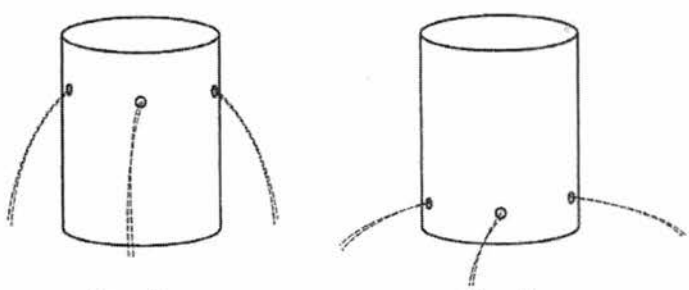
pressure = ...[2]

(iv) Calculate work done if the load is lifted to a height of 2 m and the fork-lift truck has travelled 1.5 m.

Show clearly how you work out the answer.

work done = ...[2]

(c) Two identical soft drink cans were taken and three holes were made on can **A** and **B** at different levels on each of the can.



Can A Can B

Explain why the liquid shoots out further in can **B** compared to can **A**.

.....

.....[1]

C2 Fig. A below shows a diagram of the human alimentary canal.

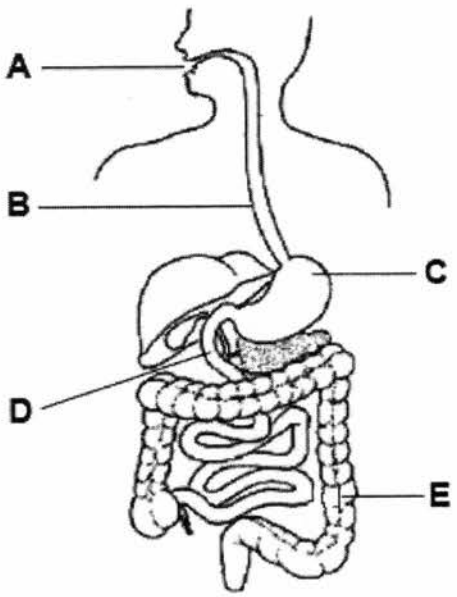


Fig. A

(a) On **Fig. A**, draw a line and **name** the accessory organ that produces digestive enzymes. [1]

(b) Both chemical and physical digestion takes place in the alimentary canal.

Explain why physical digestion is important.

.....

.....[2]

(c) *Food is not digested in part **B**.*

Do you agree with the statement above? Explain your reasoning.

.....

.....[1]

(d) The glands in part **C** produce a digestive juice which contains hydrochloric acid to kill bacteria. Describe one **other** function of the acid in part **C**.

.....[1]

(e) Fig. B shows three different mixtures of starch, protein and fat molecules in different parts of the human alimentary canal.

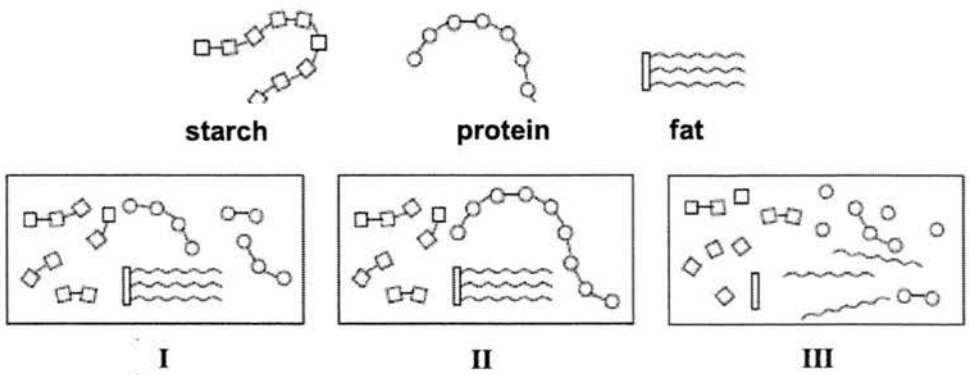
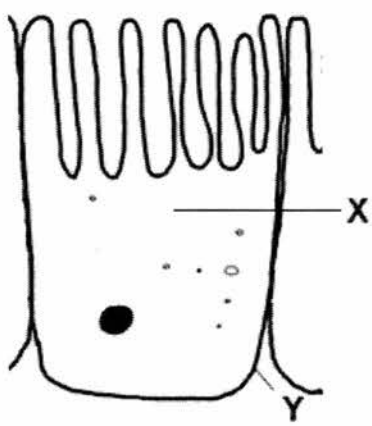


Fig. B

Which of the mixtures (**I**, **II** or **III**) in **Fig. B** would be found at part **A**, **C** and **D**?

A : ..... **C** : ..... **D** : ..... [1]

(f) The diagram below shows a specialised cell found in part **D**. The function of this cell is to absorb nutrients from the digestive tract into the blood stream efficiently.



Identify the labelled cell structures **X** and **Y**, and write down their respective functions. [4]

	cell structure	function
X		
Y		

C3 **(a)** State the Law of Reflection.

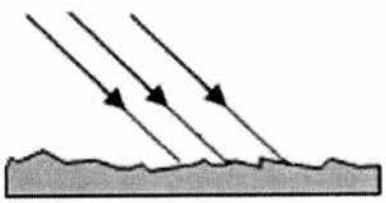
.....[1]

(b) Light falling on a sheet of white paper is reflected but no image is produced.

(i) State the type of reflection that would occur on a sheet of white paper.

.....[1]

(ii) Complete the path to show the reflection of light rays that fall on a sheet of white paper. [1]



(c) A man looks at his reflection in a vertical mirror.
This is shown from the side in Fig.X.

Fig. X

A simplified diagram of the above set up is shown in Fig. Y.

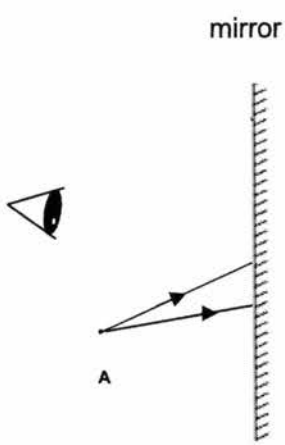


Fig. Y

(i) On Fig. Y, accurately mark with a clear dot labelled **B** where the image of the tip of the man's beard, **A**, will be. [1]

(ii) On Fig. Y, complete the ray diagram to show how the man sees the image of the tip of his beard. [2]

(iii) The man can see the image, but it cannot be formed on a screen.

What is the name given to this type of image?

.....[1]

(d) **(i)** State whether a convex or concave mirror should be used to make cars' side mirrors.

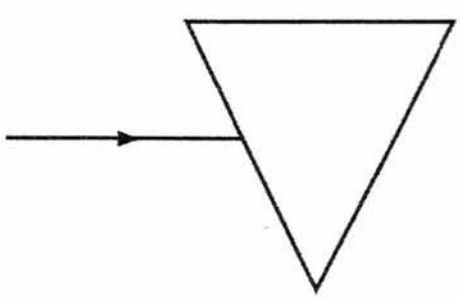
.....[1]

(ii) State **one** advantage of using the mirror suggested in part **(d) (i)** as compared to a plane mirror.

.....[1]

(e) The figure below shows red light from the air entering a glass block.

Complete the figure by drawing the path of light through and out of the glass block. [1]

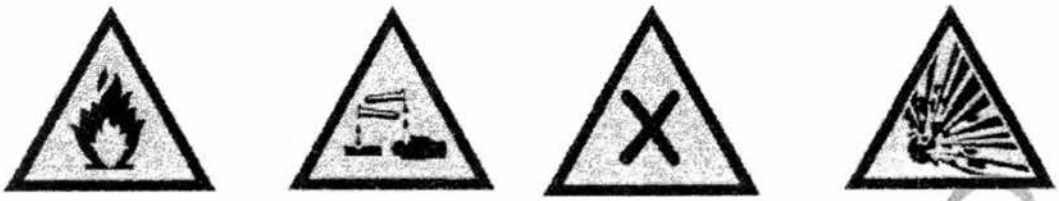


End of Paper

Section A (30 marks)

Answer **all** questions.
Shade your answers in the OTAS provided.

1 Which of the symbols should be printed on a bottle of alcohol?

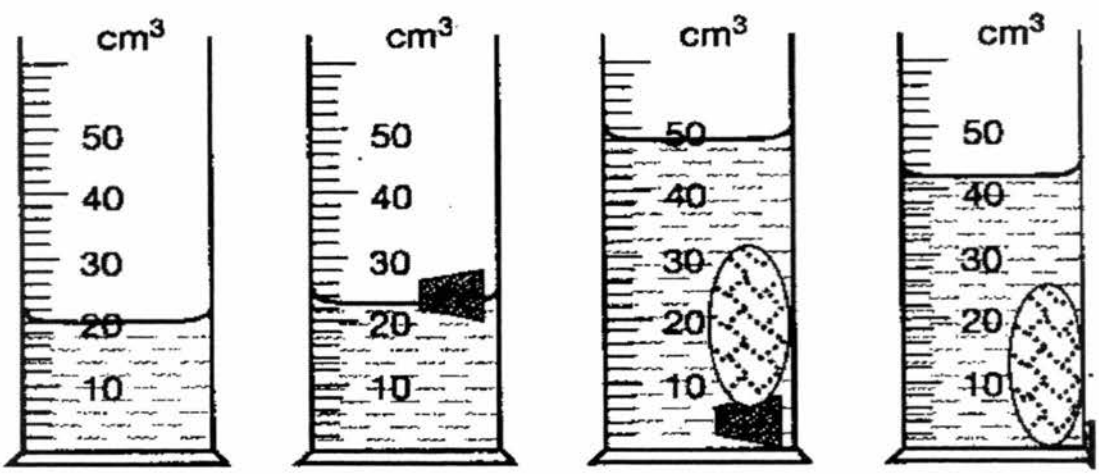


A B C D

2 Which of the following is a property of a luminous flame?

A It is invisible at a distance.
B It does **not** produce soot.
C It is produced when the air-hole is closed.
D It is hotter than the non-luminous flame.

3 Justin wants to find the volume of a cork by using a measuring cylinder. He uses a stone to keep the cork under water. The results of each stage of the experiment are shown below.



What is the volume of the cork?

A 2 cm^3 B 6 cm^3 C 22 cm^3 D 28 cm^3

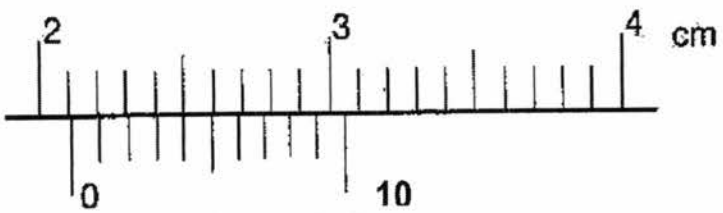
4 Which of the following SI units are correctly matched?

	quantity	SI unit
I	length	metre (m)
II	time	minutes (min)
III	temperature	Kelvin (K)

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

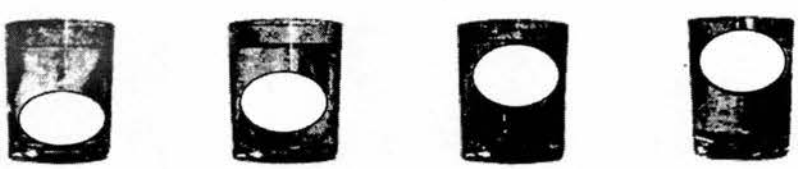
5 Huimin used a pair of vernier calipers to measure the diameter of a test tube. The diagram below shows the enlargement of part of the vernier calipers.

How large is the diameter of the test tube?



A 2.14 cm B 2.15 cm C 2.45 cm D 2.54 cm

6 A student aims to investigate how an egg of the same density will behave in liquids of different densities.



P Q R S

List the liquids P to S from the densest to the least dense.

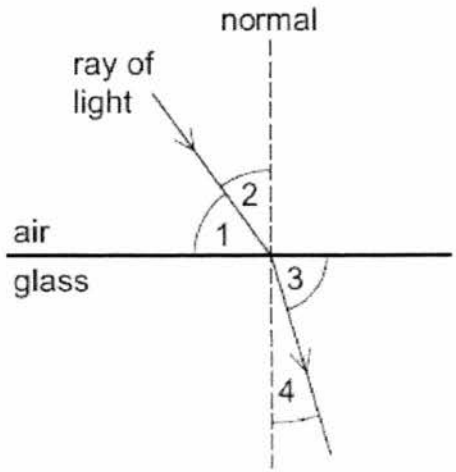
A P, Q, R, S
B S, R, Q, P
C R, Q, P, S
D S, P, Q, R

7 An object is placed 5 m in front of a mirror. A boy sits between the object and the mirror and viewed that the image of the object is 7 m away from him.

What is the distance between the boy and the object?

A 2 m B 3 m C

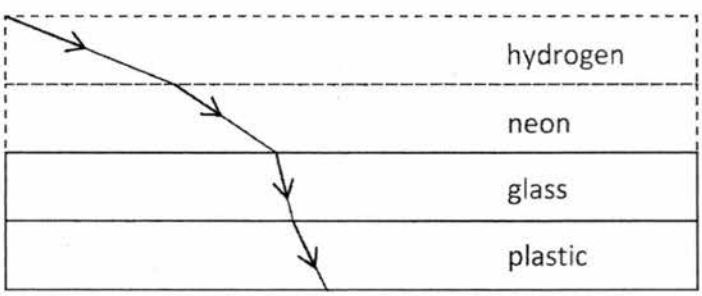
8 The diagram shows a ray of light entering a block of glass.



Which numbered angles are the angles of incidence and of refraction?

	angle of incidence	angle of refraction
A	1	3
B	1	4
C	2	3
D	2	4

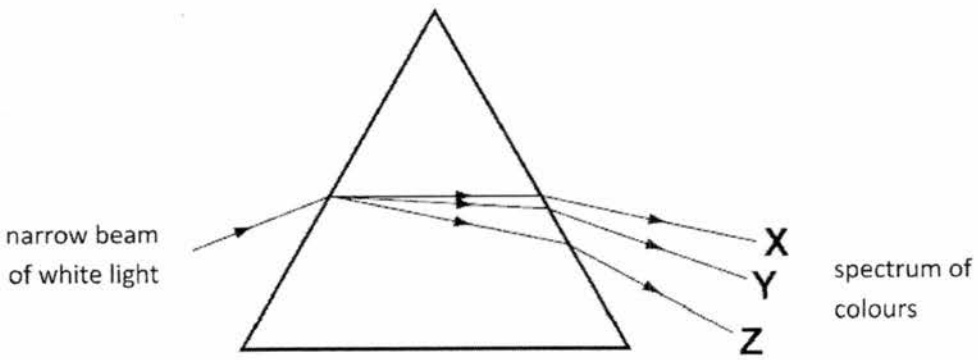
9 The following diagram shows the path of light as it passes through four substances.



Which of the following options ranks the four substances in increasing order of density?

A glass, plastic, neon, hydrogen
B hydrogen, neon, glass, plastic
C hydrogen, neon, plastic, glass
D plastic, glass, neon, hydrogen

10 A student shines a narrow beam of white light into a prism as shown in the diagram. He sees a spectrum of colours emerging from the prism.



Which three colours does he see at X, at Y and at Z?

	X	Y	Z
A	violet	yellow	red
B	red	violet	yellow
C	red	yellow	violet
D	yellow	red	violet

11 Which of the following statements is true?

A A magenta object appears red in blue light.
B A blue object appears blue only in blue light.
C A green object appears yellow in white light.
D A black object appears black in light of any colour.

12 A car is travelling at an average speed of 60 km/h.

Calculate how far it would travel if the motorist starts at 0800 h and ends his journey at 0940 h.

A 84 km **B** 100 km **C** 140 km **D** 600 km

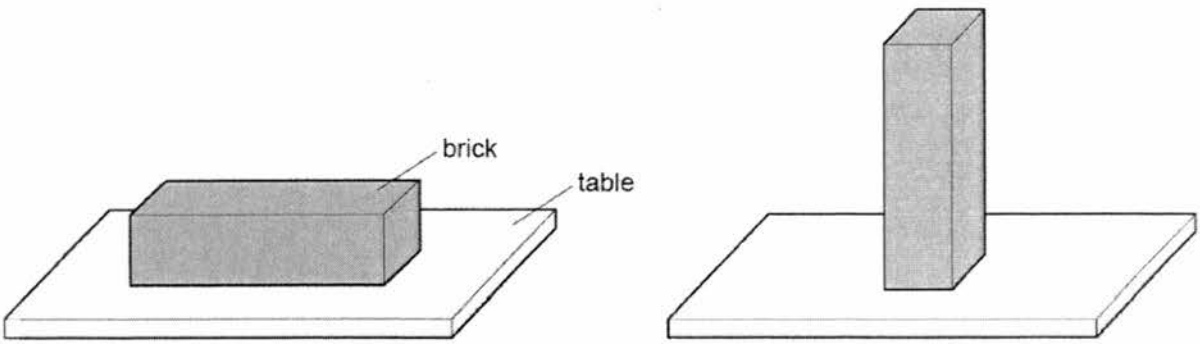
13 Mountain bike tires are specially designed to provide good grip on the ground.
Four methods are suggested below.

- add tread pattern on the tires
- apply lubricating oil on tires
- increase the width of tires
- use a smooth material to make tires

How many method(s) will effectively improve the grip of mountain bike tires?

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

14 A brick with flat rectangular sides rests on a table. The brick is then turned so that it rests on the table on its smallest surface.



Which row correctly shows how the force and pressure exerted by the brick on the table changed?

	force	pressure
A	increased	increased
B	increased	unchanged
C	unchanged	increased
D	unchanged	unchanged

15 Which are the correct units for friction, weight and pressure?

	friction	weight	pressure
A	N	N	Pa
B	kg	kg	Pa
C	kg	g	kg/m^2
D	N	N	kg/m^2

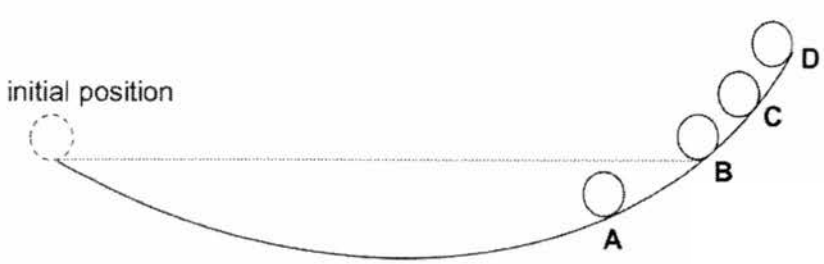
16 A boy holds a 40-newton dumbbell at arm's length for 10 seconds. His arm is 1.5 metres above the ground.

What is the work done by the force of the boy on the 40-newton dumbbell when he is holding it?

A 0 J **B** 40 J **C** 60 J **D** 400 J

17 A ball rolls down a ramp as shown below.

Assuming there is no friction, what is the highest possible position the ball can reach?
B



18 Which of the following is a correct classification of an organelle, a cell, a tissue or an organ?

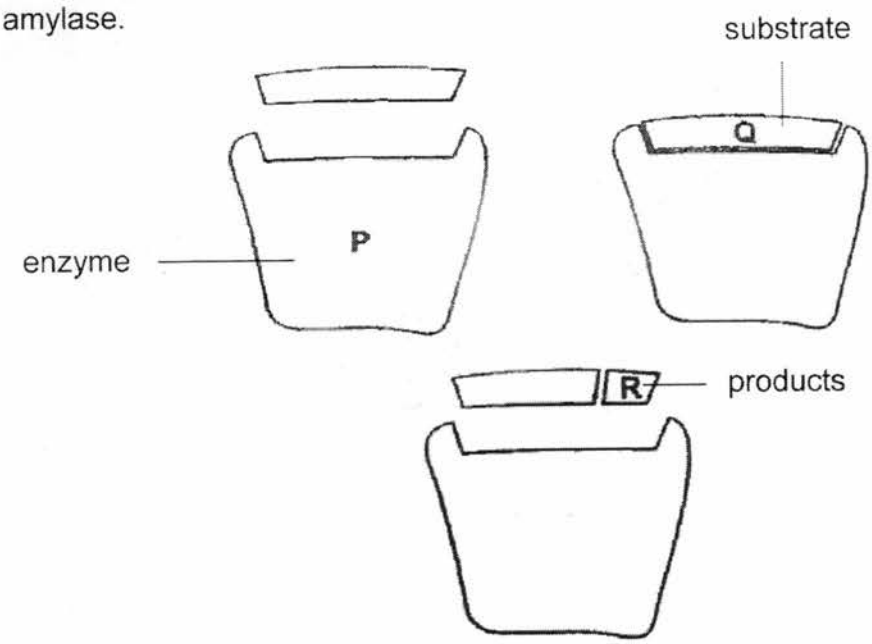
	classification	example
A	cell	chloroplast
B	organ	nucleus
C	organelle	kidney
D	tissue	blood

19 The table below shows the composition of four foods in grams per 100 g portion.

Which food would be most useful for providing an immediate source of energy?

food	carbohydrate /g	fat /g	protein /g
A	69.2	0.0	0.5
B	8.6	49.0	28.1
C	0.0	0.9	18.0
D	4.8	3.8	3.3

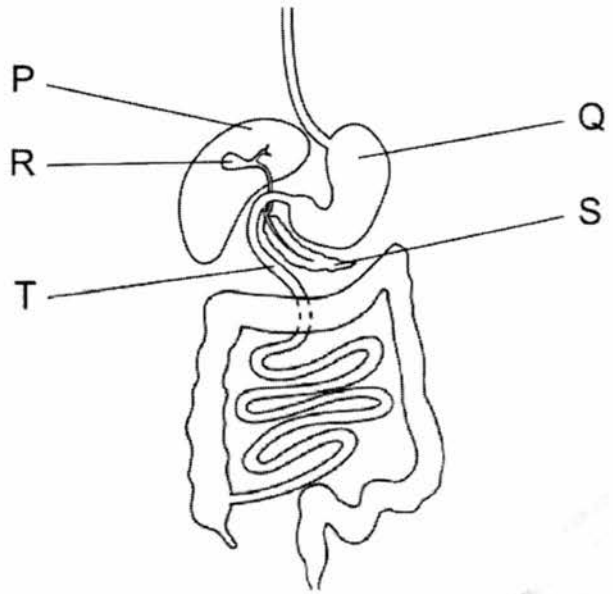
20 The diagram represents stages in the breakdown of starch to maltose by the enzyme amylase.



Which line is correct?

	starch	maltose	amylase
A	P	R	Q
B	Q	R	P
C	Q	P	R
D	R	Q	P

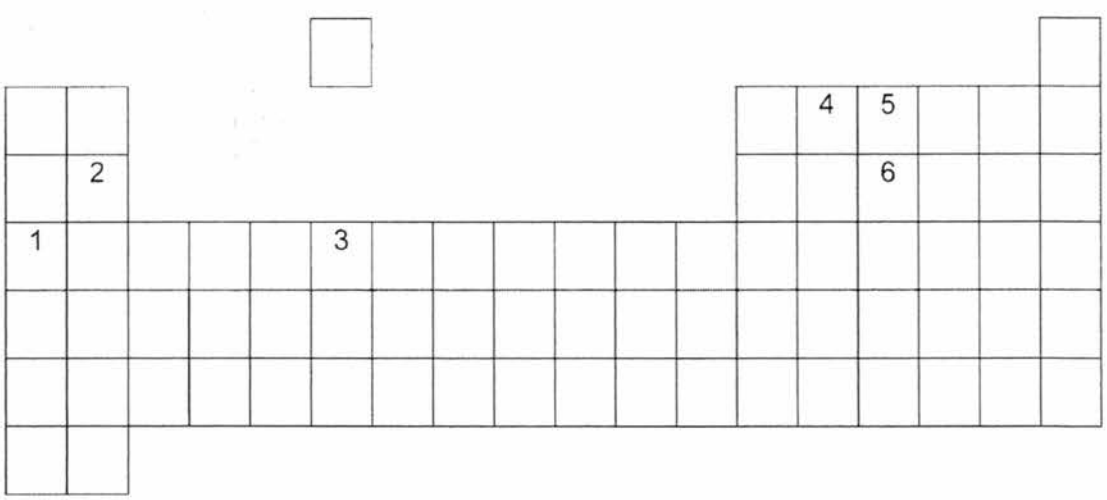
21 The diagram shows the human digestive system.



Where is bile made, where is it stored and where does it act?

	where it is made	where it is stored	where it acts
A	P	Q	R
B	P	R	T
C	Q	S	P
D	Q	T	S

22 In the outline of the Periodic Table shown below some elements are represented by numbers.



A 1 and 3 **B** 2 and 6 **C** 4 and 5 **D** 5 and 6

23 The table below gives the melting points, densities and electrical conductivities of four elements.

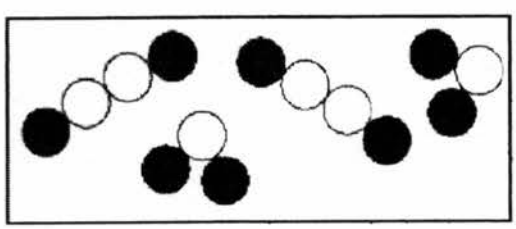
Which element is copper?

	melting point (°C)	density (g/cm^3)	electrical conductivity
A	-38.9	13.6	good
B	-7.2	3.12	poor
C	97.8	0.97	good
D	1083	8.96	good

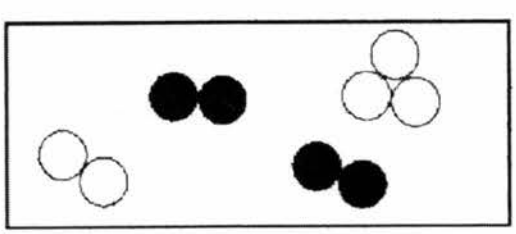
24 The symbols ○ and ● represent particles of different elements.

Which diagram shows a mixture of an element and a compound?

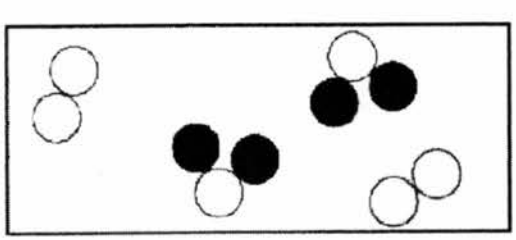
A



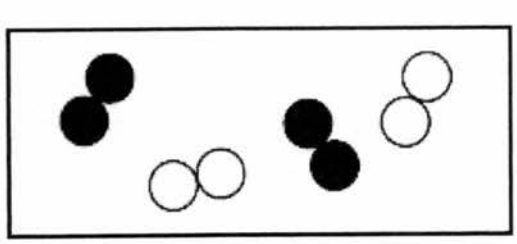
B



C



D



25 Cobalt chloride has a chemical formula of $CoCl_2$.

Four statements are made about cobalt chloride.

1 Cobalt chloride is a mixture of elements.
2 Cobalt chloride can only be broken down by chemical methods.
3 The constituent elements of cobalt chloride are carbon, oxygen and chlorine.
4 There are two chlorine particles in cobalt chloride.

Which of the statements are **correct**?

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

26 A mixture can be classified as a solution or a suspension.

Which of the following methods will **not** allow you to distinguish between a solution and a suspension?

A allow the mixture to stand for a period of time
B shine a beam of light through the mixture
C filter the mixture
D heat the mixture strongly

27 A very old painting has been vandalised with new paint. The solubilities of the old and new paints in different solvents **A**, **B**, **C** and **D** are shown in the table below.

Which solvent could be used to remove the vandalism without damaging the original paint?

solvent	old paint	new paint
A	insoluble	insoluble
B	insoluble	soluble
C	soluble	insoluble
D	soluble	soluble

28 Singapore uses reverse osmosis as one of the separation techniques in the process of producing NEWater.

Which one of the following best describes the process of reverse osmosis?

A A high pressure is used to push a solvent through a partially permeable membrane.
B A low pressure is used to push a solvent through a partially permeable membrane.
C A high pressure is used to force bacteria and viruses through a partially permeable membrane so that they are removed from the solution.
D A low pressure is used to force bacteria and viruses through a partially permeable membrane for removal from the solution.

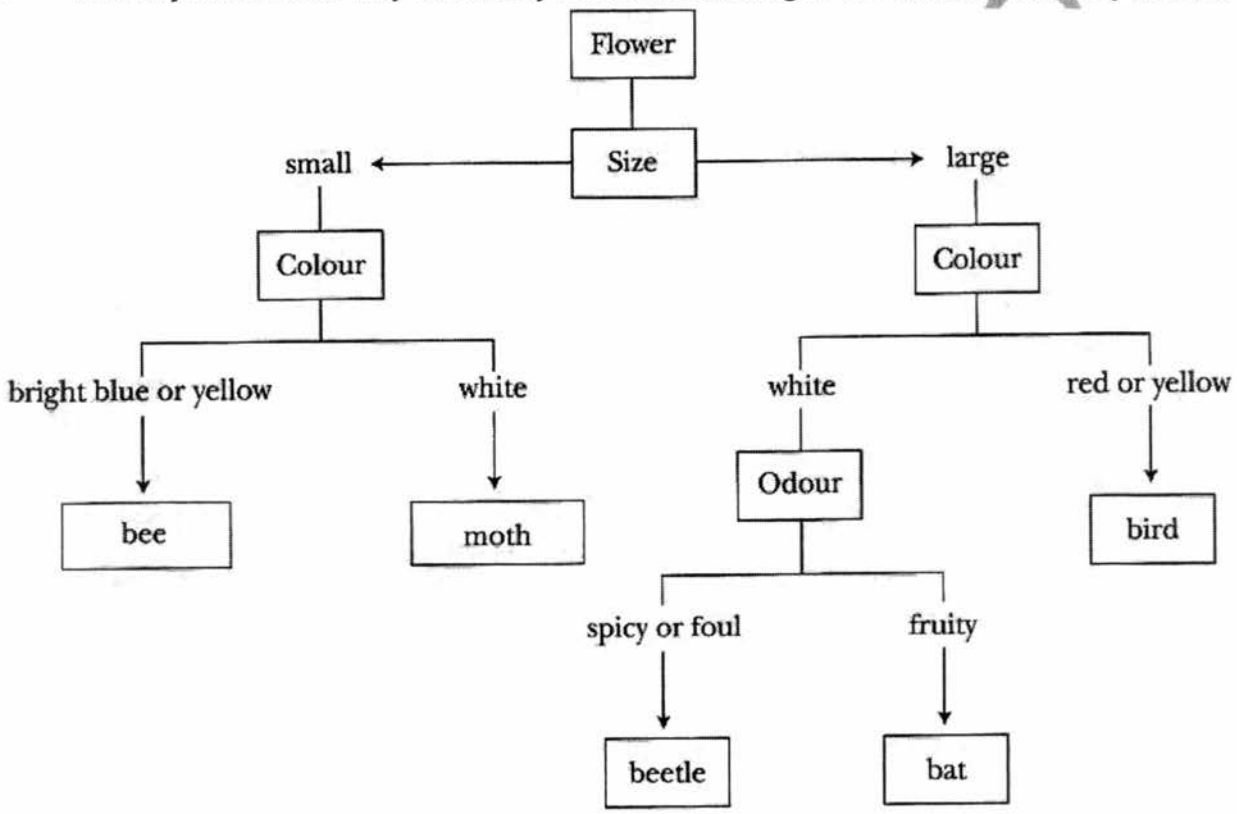
29 The table shows steps that are used to separate a mixture containing iron filings, chalk powder and table salt. The steps are not in correct sequence.

step	description
1	heating to dryness
2	using a bar magnet
3	dissolving in water
4	filtering

Which of the following shows the correct sequence to obtain these substances separately?

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

30 The key shows one way to classify flowers according to the animals that they attract.



A bat B bee C bird D moth

Section B (40 marks)

Answer **all** questions in the spaces provided.

B1 Read the following passage below and answer the question that follows.

> *Marie Curie was the first woman who was awarded a Nobel Prize in Physic for her discovery of radioactivity and in Chemistry for the discovery of two new elements Polonium (named after Marie's native country, Poland) and Radium (meaning "ray").*
>
> *The discovery of new elements was not easy during the 18th century due to the limitations of technology then, and due to limited research background knowledge on the properties of substances. Marie's and her husband's work was thus met with many set backs and critics. They spent many of their years proving their work was accurate.*
>
> *After overcoming many trials, Marie finally gained recognition through the Nobel Prize.*

State **one** quality that Marie has that lead her to success. Support with reason(s) from the passage.

perserverance [1] spent many years proving their work despite set backs and critics[1]

.....[2]

B2 A launderette owner is testing the effectiveness of some solvents **A**, **B** and **C** on two types of stains **X** and **Y**.

type of stain	mass of stain that dissolves in 100 cm^3 of solvent / g					
	solvent **A**		solvent **B**		solvent **C**	
	10 °C	**70 °C**	**10 °C**	**70 °C**	**10 °C**	**70 °C**
X	17.0	20.2	1.2	3.0	5.0	17.6
Y	15.0	29.9	1.3	2.5	19.0	31.2

(a) Identify the control variable in the test.

Volume of solvent

.....[1]

(b) Which solvent is most effective in removing stains caused by **Y**? **C** ..... [1]

(c) A garment marked 'cold wash only', is stained with **X**. Which solvent should be used? **A** ..... [1]

(d) How does the temperature affect the effectiveness of the solvents?

The higher the temperature, the more effective the solvent in dissolving the stain.

.....[1]

B3 Aluminium is a commonly used element. Aluminium can be mixed with other elements to make aeroplanes.

(a) Explain what is meant by an *element*.

Substance that cannot be broken down into simpler substances by

.....

chemical or physical methods

.....[1]

(b) Identify the Period and Group of aluminium in the Periodic Table.

Period : **3**..... Group : **III**..... [2]

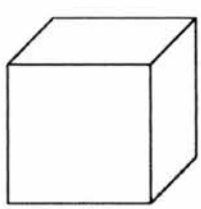
(c) State **two** physical properties of aluminium that are important in the manufacturing of aeroplanes.

Low density/ corrosion resistant/ durable/ strong

.....

.....[2]

(d) Isaac carried out an experiment to determine the density of an aluminium cube measuring 0.03 m on each side. He measured the mass of the cube in the laboratory and it was 72.9 g.



0.03 m

(i) Name the instrument that Isaac used to measure the mass of the aluminium cube.

Electronic balance/beam balance

.....[1]

(ii) Calculate the density of the aluminium cube.
Leave your answer in kg/m^3.

D = 0.0729 kg ÷ (0.03 x 0.03 x 0.03) m^3 = 2700 kg/ m^3
Correct unit conversion [1]
Correct method [1]
Correct answer [1]

(iii) The force of gravity on the Moon is about 1/6 (one sixth) that on Earth.

What is mass of the aluminium cube on the Moon?
Explain your answer.
Same/unchanged [1]

.....
Mass is constant anywhere/ not affected by gravitational field strength.[1]
..... [2]

B4 (a) State the energy conversions that take place in a wind-up toy car.

kinetic energy → **Elastic potential E** → **Kinetic E** + **Heat/sound E**
.. .. [2]

(b) A car is initially at rest on a level road. The car begins to move and travels a distance of 2 kilometres.

State what has happened to the car's

(i) gravitational potential energy **No change** .....

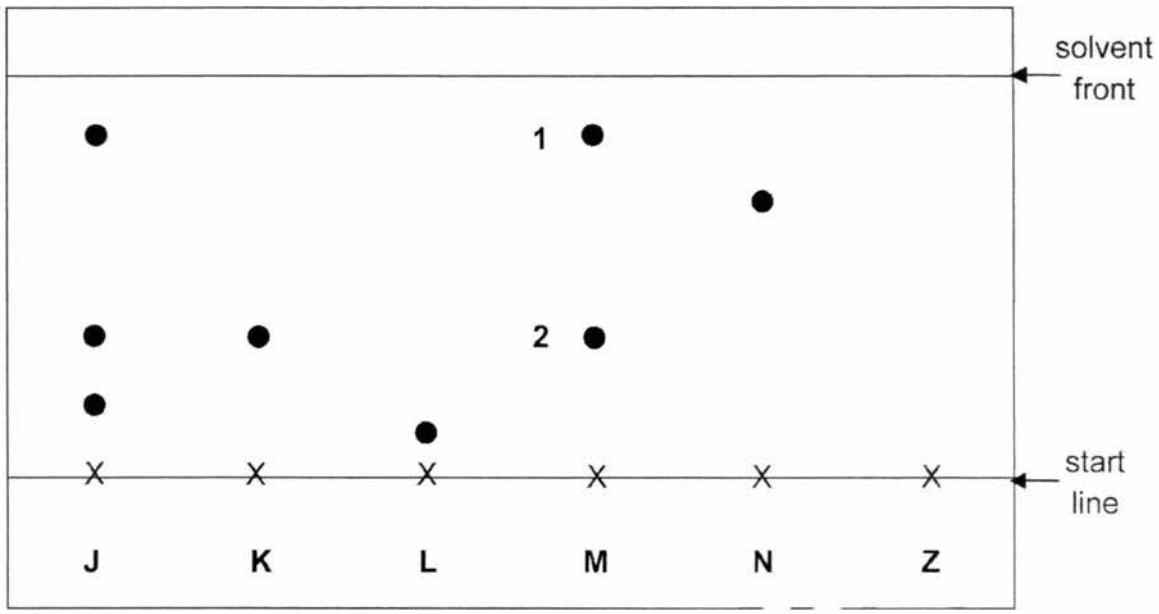
(ii) kinetic energy **increases** ..... [2]

(c) (i) Suggest a practical renewable source of energy for Singapore.
Solar
.....[1]

(ii) Give **one** environmental advantage of using the energy source stated in **c(i)** in producing energy.
Does not produce pollutants
.....

.....[1]

B5 The figure below shows the chromatogram produced for all the six substances **J**, **K**, **L**, **M**, **N** and **Z** using ethanol as the solvent.



(a) State which substances are made up of pure substances only.

K, L N

.....[1]

(b) **(i)** **Z** is a mixture containing substances **M** and **N**.
On Fig. 3.1, draw the result you would expect for substance **Z**. [1]

(ii) Explain the difference in the results for substances **K** and **N**.

N is more soluble than K in the solvent[1],

.....

so travels faster and further up the paper [1]

.....[2]

(c) Explain why the start line is drawn in pencil and not in ink.

Pencil is insoluble in the solvent, pen is soluble. [1]

.....

Pencil will not interfere with the results [1]

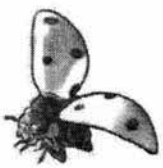
.....[2]

(d) Chromatography is used in the detection of counterfeit drugs.
State **one** advantage of chromatography.

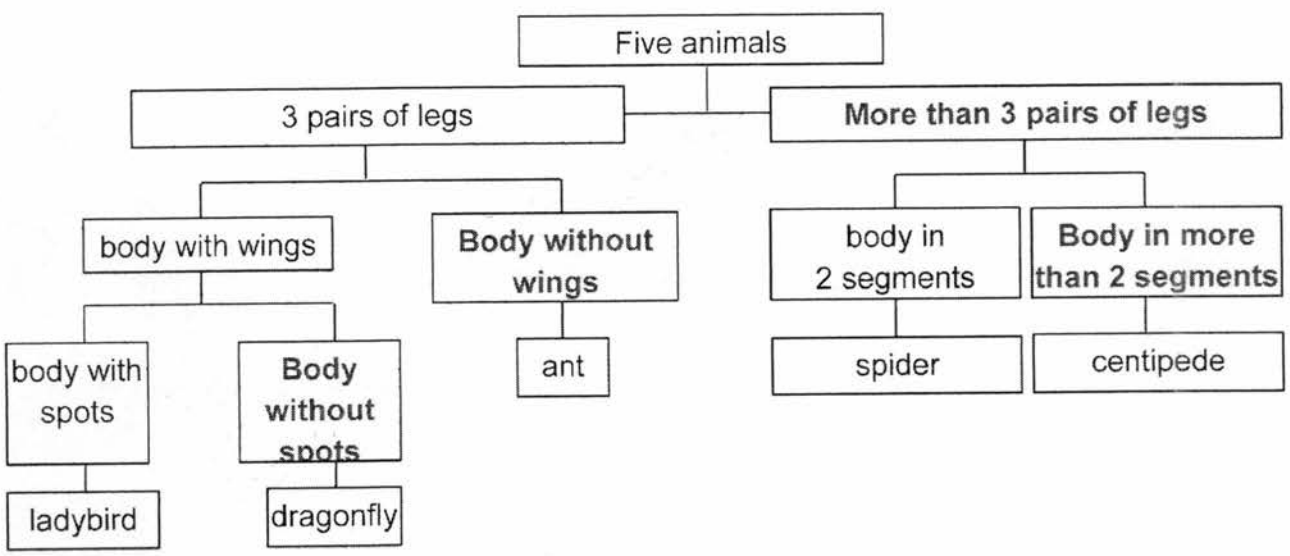
Sensitive/only require a small sample/quick test

.....[1]

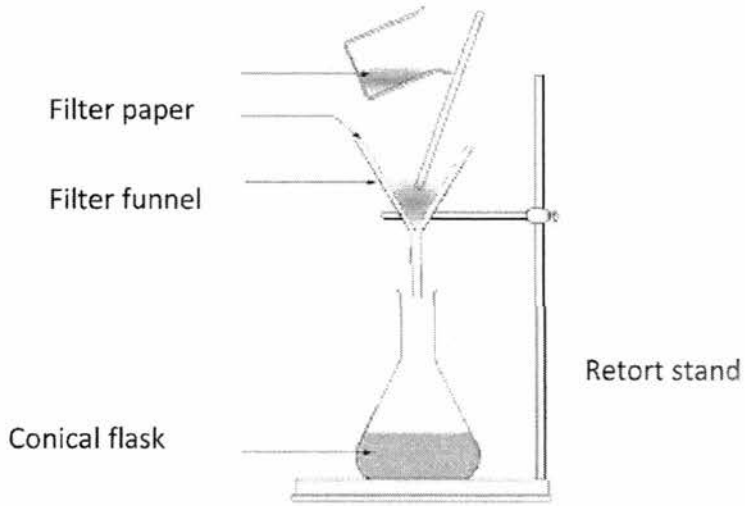
B6 During an ecology field trip, a group of students caught the five animals as shown below.

ant	dragonfly	ladybird	spider	centipede
				
3 pairs of legs	3 pairs of legs	3 pairs of legs	4 pairs of legs	more than 4 pairs of legs

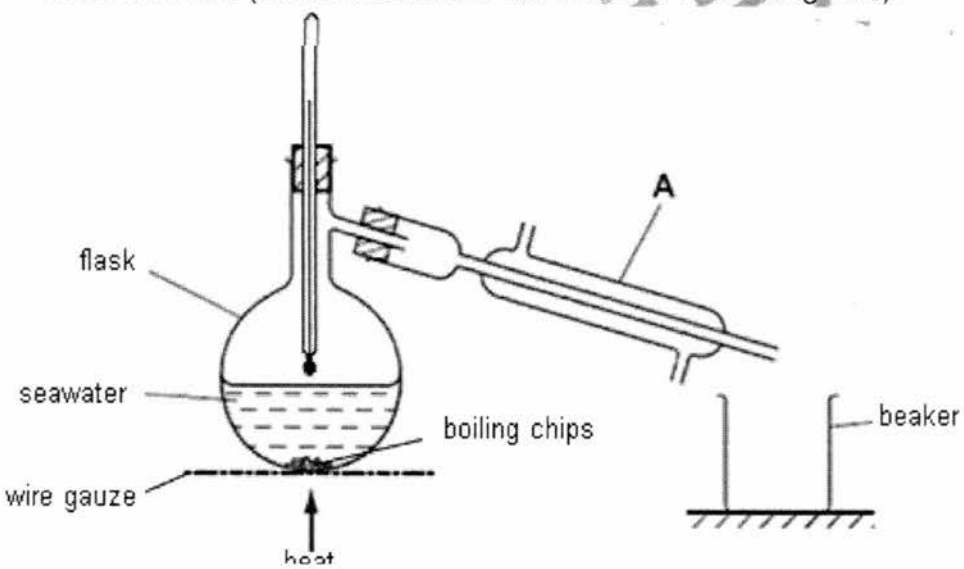
Complete the following dichotomous key with the observable characteristics of the animals caught. [4]



B7 **(a)** With the help of suitable apparatus below, draw a neat, labeled scientific diagram of the set up used to separate sand from seawater. [2]



(b) Pure water can be obtained by distilling the seawater using the apparatus shown below. (Retort stands are not featured in the diagram.)



(i) State the name of the piece of apparatus labelled **A**.
condenser
.....[1]

(ii) Using arrows, show the direction of water flow to cool the vapour in **A**. [1]

(iii) What is the purpose of boiling chips?
To ensure smooth boiling
.....[1]

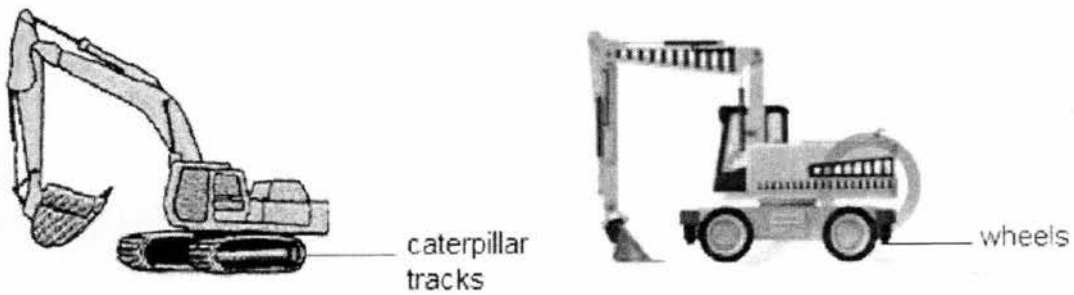
(iv) Identify a mistake made in the drawing of the above apparatus and how it should be corrected.
The thermometer bulb should be placed next to opening to condenser
.....[1]

Section C (30 marks)

Answer **all** questions in the spaces provided.

C1 **(a)** The diagram shows two different types of excavators of the same mass.

Excavator A **Excavator B**

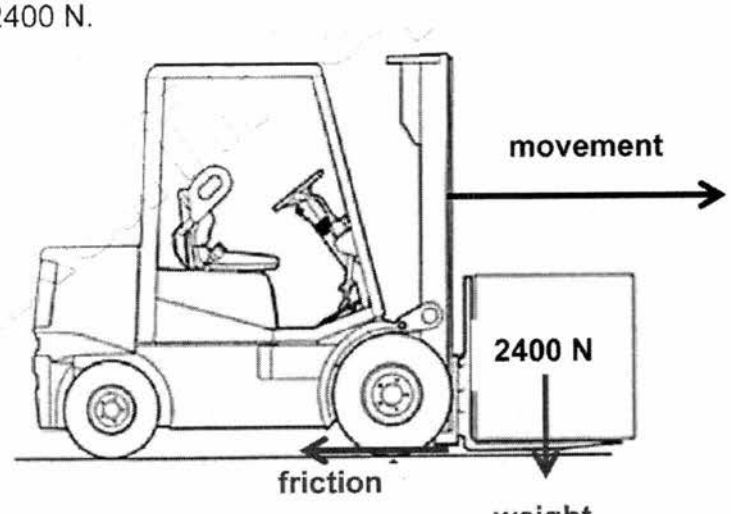


Which excavator is more suitable for operating on soft muddy ground? Explain your answer using the concept of pressure.

A. [1] Caterpillar tracks provide larger surface area in contact with ground,
.....
So decreasing pressure , excavator won't sink into ground so easily. [1]
.....

.....[2]

(b) The figure below shows a fork-lift truck with a mass of 3000 kg transporting a load of 2400 N.



(i) Draw **two** labelled arrows to show the forces acting on the fork-lift truck in the figure above. [2]

(ii) Calculate the total weight of the fork-lift and load, given gravitational field strength is 10 N/kg.

W = (3000 x 10) + 2400 = 32400 N

(iii) The contact area of a wheel is 0.8 m^2.

Calculate the pressure exerted on the floor by the fork-lift and load if the fork-lift truck has 4 wheels.

P = 32400 N ÷ (4 x 0.8) m^2 [1] = 103680 N/m^2 [1]

pressure = ...[2]

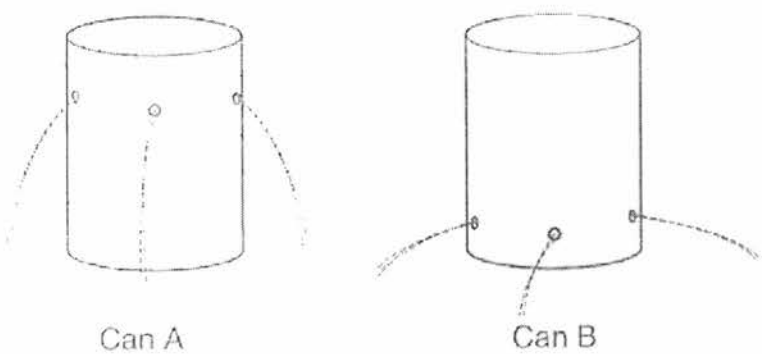
(iv) Calculate work done if the load is lifted to a height of 2 m and the fork-lift truck has travelled 1.5 m.

Show clearly how you work out the answer.

Work done = 2400 x 2 [1] = 4800 Nm or J [1]

work done = ...[2]

(c) Two identical soft drink cans were taken and three holes were made on can **A** and **B** at different levels on each of the can.



Can A Can B

Explain why the liquid shoots out further in can **B** compared to can **A**.
Higher water pressure at greater depths

.....

.....[1]

C2 Fig. A below shows a diagram of the human alimentary canal.

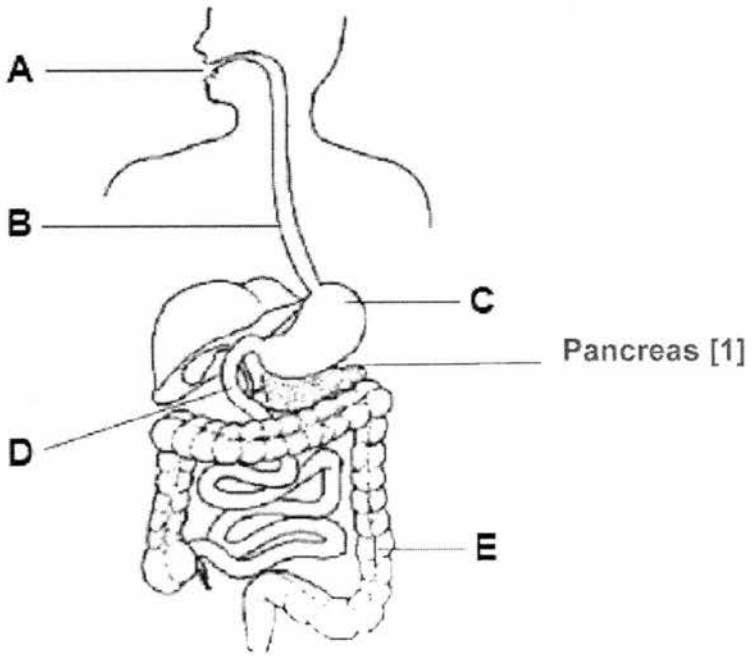


Fig. A

(a) On **Fig. A**, draw a line and name the accessory organ that produces digestive enzymes. [1]

(b) Both chemical and physical digestion takes place in the alimentary canal.

Explain why physical digestion is important.
To break down food into smaller pieces to increase surface area [1]
.....
So that rate of digestion by enzymes is faster [1]
.....[2]

(c) *Food is not digested in part **B**.*

Do you agree with the statement above? Explain your reasoning.
Agree, no enzymes produced by oesophagus OR
.....
Disagree, enzymes from saliva can continue digestion in oesophagus
.....[1]

(d) The glands in part **C** produce a digestive juice which contains hydrochloric acid to kill bacteria. Describe one **other** function of the acid in part **C**.
Activate protease/ provide suitable condition for protease to work
.....[1]

(e) Fig. B shows three different mixtures of starch, protein and fat molecules in different parts of the human alimentary canal.

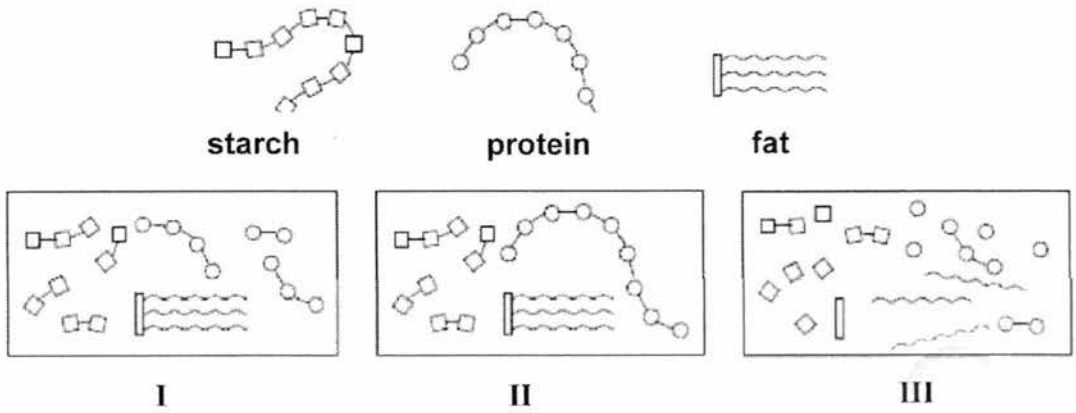
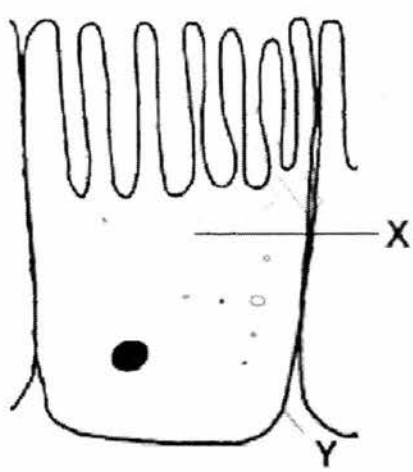


Fig. B

Which of the mixtures (**I**, **II** or **III**) in **Fig. B** would be found at part **A**, **C** and **D**?

A : II ..... **C** : I ..... **D** : III ..... [1]

(f) The diagram below shows a specialised cell found in part **D**. The function of this cell is to absorb nutrients from the digestive tract into the blood stream efficiently.



Identify the labelled cell structures **X** and **Y**, and write down their respective functions. [4]

	cell structure	function
X	Cytoplasm	Site of chemical reactions
Y	Cell membrane	Allow some but not all substances to move in and out of the cell

C3 **(a)** State the Law of Reflection.

Angle of incidence is equal to angle of reflection

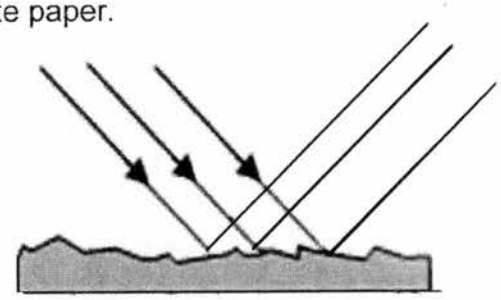
.....[1]

(b) Light falling on a sheet of white paper is reflected but no image is produced.

(i) State the type of reflection that would occur on a sheet of white paper.
Irregular/diffused

.....[1]

(ii) Complete the path to show the reflection of light rays that fall on a sheet of white paper. [1]



(c) A man looks at his reflection in a vertical mirror.
This is shown from the side in Fig.A.

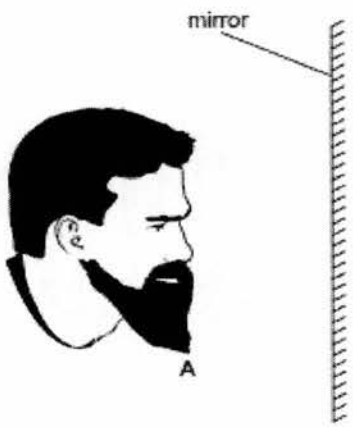


Fig. A

A simplified diagram of the above set up is shown in Fig. B.

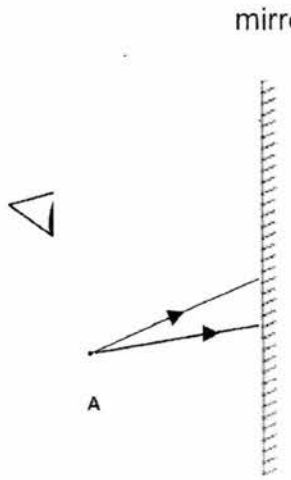


Fig. B

(i) On Fig. B, accurately mark with a clear dot labelled **B** where the image of the tip of the man's beard, **A**, will be. [1]

(ii) On Fig. B, complete the ray diagram to show how the man sees the image of the tip of his beard. [2]

(iii) The man can see the image, but it cannot be formed on a screen.

What is the name given to this type of image?
virtual
.....[1]

(d) **(i)** State whether a convex or concave mirror should be used to make cars' side mirrors.

Convex
.....[1]

(ii) State **one** advantage of using the mirror suggested in part **(d) (i)** as compared to a plane mirror.
Larger range of view
.....[1]

(e) The figure below shows red light from the air entering a glass block.

Complete the figure by drawing the path of light through and out of the glass block. [1]