GAN ENG SENG SCHOOL
End-of-Year Examination 2016

CANDIDATE NAME			
CLASS		**INDEX NUMBER**	

SCIENCE
Paper 1 Multiple Choice

12 October 2016
Papers 1 and 2: 2 hours

Sec 1 Express

Additional Materials: OTAS

Calculators are allowed in the examination

READ THESE INSTRUCTIONS FIRST

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

There are **thirty** questions in this paper. Answer **all** questions. For each question there are four possible answers **A, B, C,** and **D.**
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OTAS.

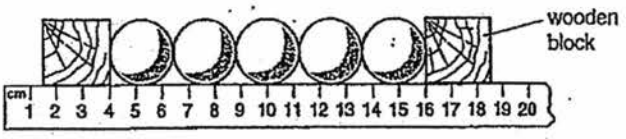
Read the instructions on the OTAS very carefully.

Answers to Paper 1 and 2 must be handed in separately.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
You are advised to spend no more than **36 minutes** on **Paper 1.**
You may proceed to answer Paper 2 as soon as you have completed Paper 1.
Any rough working should be done in this booklet.
A copy of the periodic table is found on page 12.

Total Marks
30

This paper consists of **12** pages including the cover page.

1 Some balls are measured as shown in the diagram of a ruler below.



What is the radius of each ball?

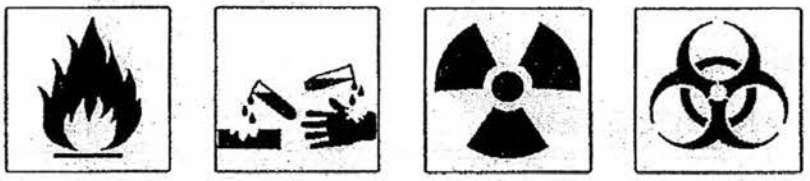
A 1.2 cm

B 1.6 cm

C 2.4 cm

D 3.2 cm

2 A bottle of chemical contains micro-organisms that may potentially infect humans with diseases. Which label should be pasted on the bottle?



A B C D

3 As a scientist, which of the following steps should you take when your experimental results do **not** support your hypothesis?

A Change the experimental results so as to explain the original hypothesis.

B Discard the original observations.

C Make another new observation.

D Propose a new hypothesis so as to explain the original observations.

4 The boiling points of some elements are given in the table.

Element	*Boiling point / °C*
Nitrogen	-196
Oxygen	-183
Argon	-186

A mixture of nitrogen, argon and oxygen at -200 °C is allowed to warm up to -180 °C.
Which elements are still in the liquid state at -185 °C ?

A A mixture of nitrogen, oxygen and argon

B A mixture of nitrogen and argon

C A mixture of oxygen and argon

D Oxygen only

5 When can parallax error occur?

I Using an electronic balance to measure the mass of a beaker.
II Reading the volume of a liquid from a measuring cylinder.
III Estimating the area of an irregular shaped figure.
IV Using a metre rule to measure the length of a cloth for making curtains.

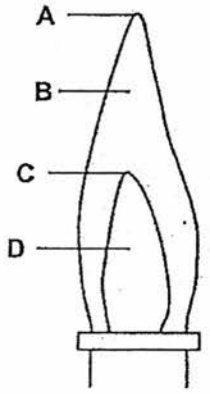
A I and III.

B II and IV.

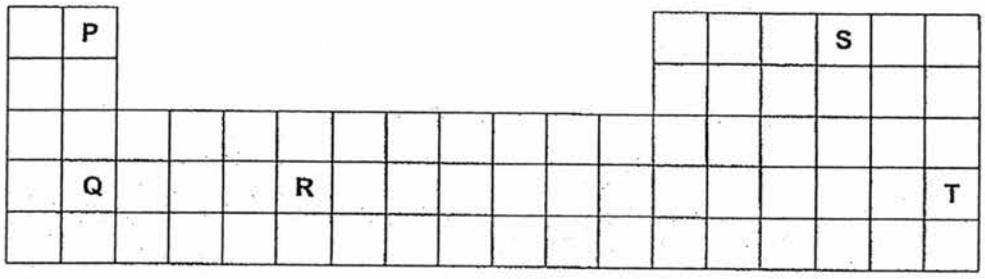
C I, II and IV.

D IV only.

6 Which part of the flame is the hottest when the air-hole of a Bunsen burner is open?



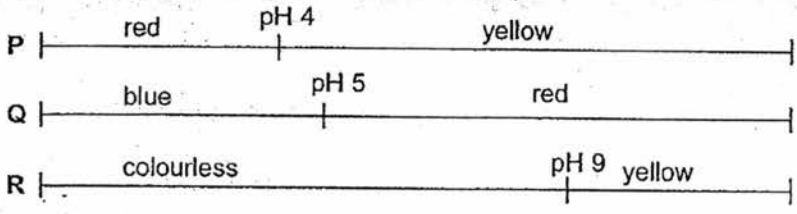
7 The diagram below shows the outline of the Periodic Table.



Which of the following pairs of elements belong in the same group?

A P and Q
B Q and R
C R and T
D S and T

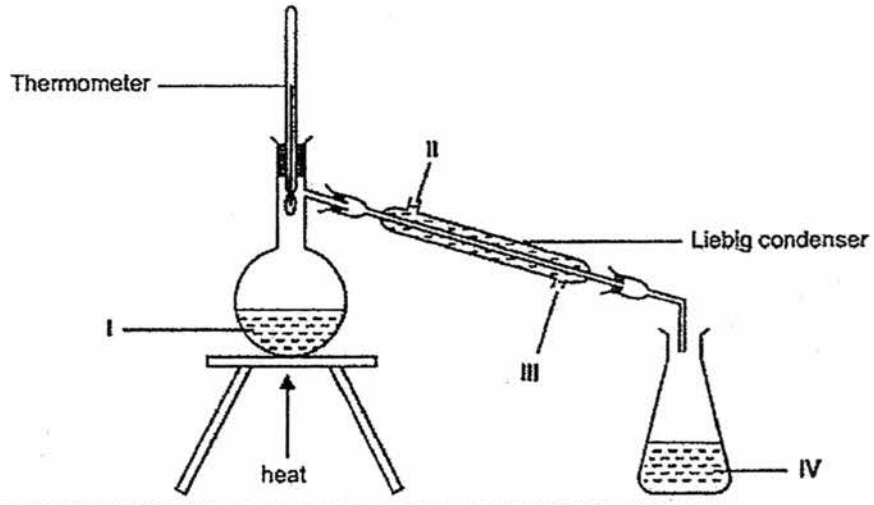
8 The following information gives the colour change of three indicators **P**, **Q** and **R**.



What are the colours of these three indicators when they are added to sugar solution?

	P	Q	R
A	Red	Yellow	Colourless
B	Yellow	Red	Colourless
C	Yellow	Blue	Red
D	Red	Yellow	Red

9 Which of the following option provides the correct labels for **I**, **II**, **III** and **IV** in the diagram?



	I	II	III	IV
A	distillate	water in	water out	solution
B	solution	water in	water out	distillate
C	distillate	water out	water in	solution
D	solution	water out	water in	distillate

10 The table shows some information about the solubilities of three solids.

solid	solubility in water	solubility in ethanol	effect of heating
M	insoluble	soluble	stable
N	insoluble	insoluble	unstable
O	soluble	insoluble	stable

The following operations could be carried out to obtain pure **O** from a mixture of **M**, **N** and **O**. Not all the operations may be carried out.

I add ethanol
II add water
III filter
IV evaporate filtrate to dryness

In what order should the operations be carried out?

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

11 Which of the following are threats to the biodiversity of natural systems?

I Creation of wildlife sanctuaries
II Unregulated fishing
III Introduction of foreign organisms to control local pests.
IV Reforestation

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

12 Which of the following characteristics distinguishes vertebrates from invertebrates?

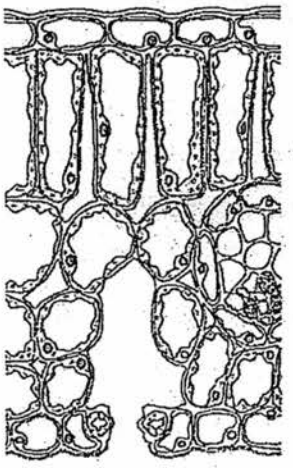
A Lays eggs or give birth to young alive
B Presence or absence of backbone
C Presence or absence of jointed legs
D Warm-blooded or cold-blooded

13 Which of the following statements best describes classification?

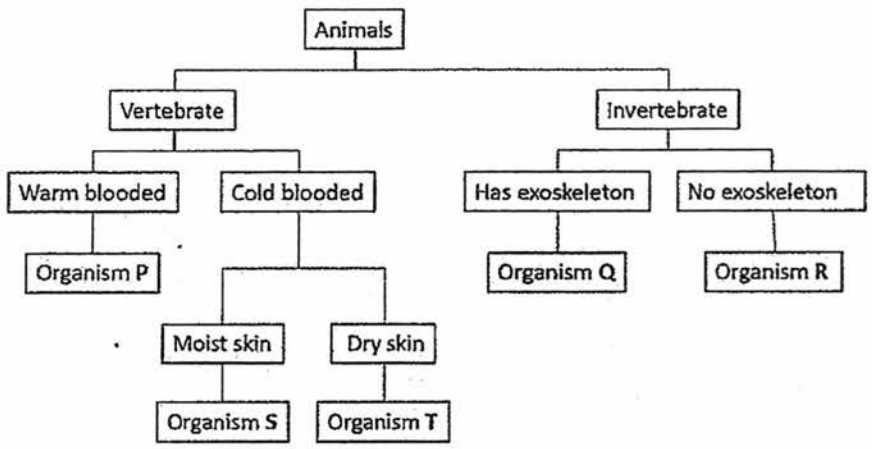
A It is the grouping of objects with the same physical properties.
B It is the grouping of objects with similar characteristics.
C It is the grouping of objects with similar chemical characteristics.
D It is the grouping of objects that is based on at least two same characteristics.

14 The following image shows part of a leaf. Which of the following terms best describes what a leaf functions as?

A cells
B tissue
C organ
D system



15 Study the dichotomous key below.



Which of the following sets correctly show the identity of each organism?

	P	Q	R	S	T
A	Cockroach	Mouse	Frog	Crocodile	Starfish
B	Frog	Crocodile	Cockroach	Starfish	Mouse
C	Mouse	Cockroach	Starfish	Frog	Crocodile
D	Crocodile	Frog	Cockroach	Mouse	Starfish

16 After observing several types of tissue through a microscope, John made several observations, as listed below.

I All tissues are made up of cells.
II Cells within the same tissue cannot be different.
III Organs are made up of the same tissue types.
IV Cells found in a tissue perform a similar function.

Which statements are true?

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

17 Division of labour among cells can take place in all of the following except ..... .

A amoeba

B earthworm

C mushroom

D grass

18 Which of the following characteristics would **not** be observed in a sample of regular toothpaste?

I Universal indicator gives a dark violet colour when mixed with it.
II Red litmus paper remains unchanged.
III It produces salt and water when added to a solution of hydrochloric acid.

A I and II

B I and III

C II and III

D I, II and III

19 Which two substances when mixed produces hydrogen gas?

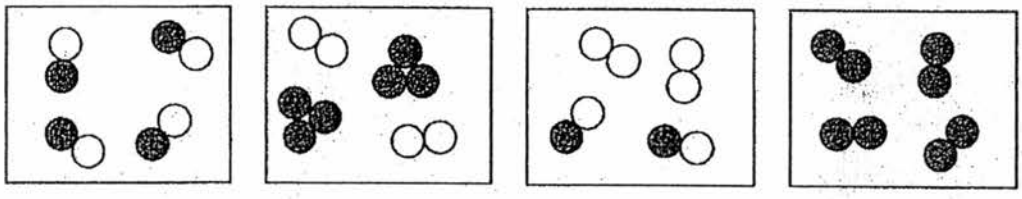
A Sodium hydroxide and nitric acid

B Calcium carbonate and hydrochloric acid

C Potassium chloride and sulfuric acid

D Sulfuric acid and magnesium

20 Which diagram represents a mixture of a different elements?



A B C D

21 A block of iron has a mass of 15 kg on the earth. The gravitational pull on the moon is one-sixth of the gravitational pull on earth. What is the iron block's mass on the moon? (Assume gravitational pull on earth is 10 N/kg)

A 2.5 kg
B 15 kg
C 25 kg
D 150 kg

22 Which of the following statements is **not** true?

A A 20 N iron bar always exerts the same amount of pressure as a 20 N stone when resting on the ground.
B The sharp edge of a knife exerts more pressure than a dull edge of a knife when the same force is applied on them.
C A lady wearing a pair of high heel shoes exerts more pressure on the ground compared to when she is wearing a pair of flat sandals.
D Skis with large surface area enables the skier to glide over soft snow without sinking into it.

23 Which of the following has the same value as 30 Pa?

A 0.003 N/cm^2
B 0.3 N/cm^2
C 3 N/cm^2
D 30 N/cm^2

24 Which of the following people has done the most work?

A A boy weighing 500 N climbing 1 m up a tree.
B A girl lifting a 10 N book up onto a table 1 m high.
C A man releasing a 100 N rock which then falls a distance of 10 m into a pit.
D A weight-lifter holds a 600 N weight in the same position for 1 minute.

25 Which of the following statements is **not** correct about chemical potential energy?

A Chemical potential energy can be changed into electrical energy.

B Animals obtain chemical potential energy directly or indirectly from plants.

C Fossil fuels and biofuels are examples of chemical potential energy.

D Green plants create chemical potential energy from sunlight and store it in the form of starch.

26 A forklift lifts a crate from the floor to a shelf on a rack. If the crate has a mass of 250 kg and the work done is 4000 J on the crate, what is the distance between the floor and the shelf? (Assume that force due to gravity is 10 N/kg)

A 0.625 m

B 1.6 m

C 8 m

D 16 m

27 Which of the following statements is true about friction?

A It only happens when an object moves.

B A stationary object is free from friction.

C It causes energy conversion to heat.

D It always acts in the same direction as the motion of an object.

28 In cold countries, glass windows consist of two pieces of glass separated by a thin layer of air. The layer of air helps to reduce heat loss from the inside of the buildings to the surroundings by .....

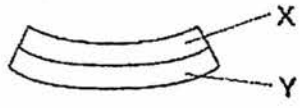
A conduction

B contraction

C convection

D radiation

29 The diagram below shows two different bimetallic strips 1 and 2, made of metals X, Y and Z, being heated to the same temperature.



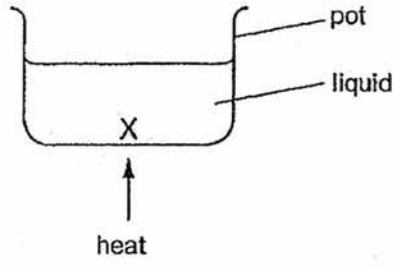
bimetallic 1

bimetallic 2

From the results shown above, arrange the rate of expansion of the three different metals in increasing order.

A Z, X, Y
B Y, Z, X
C X, Z, Y
D X, Y, Z

30 The figure below shows some liquid being heated in a pot.



What happens to the mass, volume and density of the liquid in the region X?

	mass	volume	density
A	decreases	stays the same	increases
B	increases	decreases	stays the same
C	stays the same	decreases	decreases
D	stays the same	increases	decreases

END OF PAPER

The Periodic Table of the Elements

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

*58-71 Lanthanoid series

†90-103 Actinoid series

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

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

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

GAN ENG SENG SCHOOL
End-of-Year Examination 2016

CANDIDATE NAME	
CLASS	**INDEX NUMBER**

SCIENCE
Paper 2

12 October 2016
Papers 1 and 2: 2 hours

Sec 1 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 **10** 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.

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

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 found on page 17.

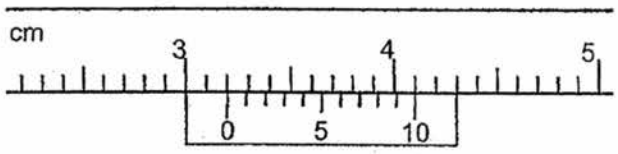
For Examiner's Use	
Section A	/30
Section B	/40
Q10	
Q:	
Q:	
Q:	
Total	/70

SECTION A [30 Marks]

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

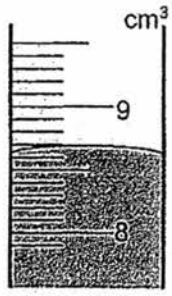
1 Write the readings that can be read from each apparatus below.

(a) Vernier calipers



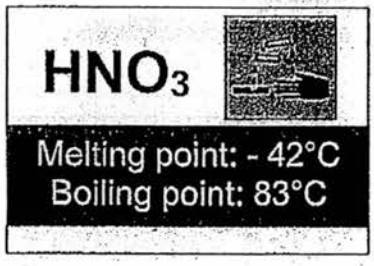
Reading : ..... [1]

(b) Measuring cylinder



Reading : ..... [1]

2 The diagram below shows a label pasted on a bottle. The bottle is kept at room temperature.



(a) State if the bottle contains an element or a compound. Explain your answer. [1]

.....

.....

.....

(b) Eugene accidentally added an unknown substance into the bottle. Describe an experiment that can be carried out to confirm that the bottle is contaminated. [2]

.....

.....

.....

3 The figure below shows Ethan performing an experiment in a science laboratory.

State **two** mistakes he has made and the respective corrections he should do to avoid these mistakes. [2]

.....

.....

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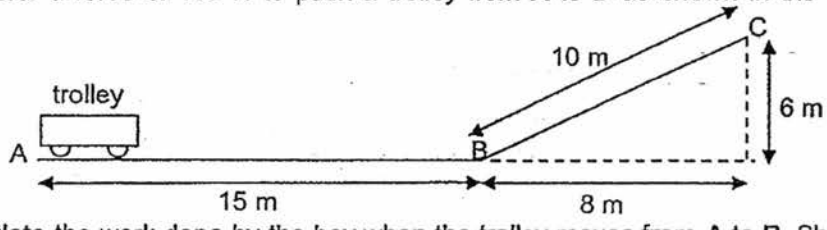
.....

.....

4 A boy exerts a force of 180 N to push a trolley from **A** to **B** as shown in the diagram below.



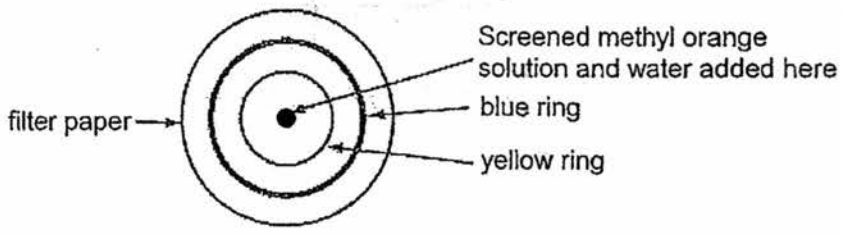
(a) Calculate the work done by the boy when the trolley moves from **A** to **B**. Show your workings clearly.

Work done = ... [1]

(b) If the boy does 3800 J of work pushing the trolley up the slope from **B** to **C**, calculate the force exerted by the boy. Show your workings clearly.

Force exerted = ... [1]

5 (a) A drop of screened methyl orange solution was placed in the centre of a circular piece of filter paper. Some drops of water were added to the centre of the filter paper. Blue and yellow rings were seen to form after some time as shown below.



(i) State the name of this separation technique. [1]

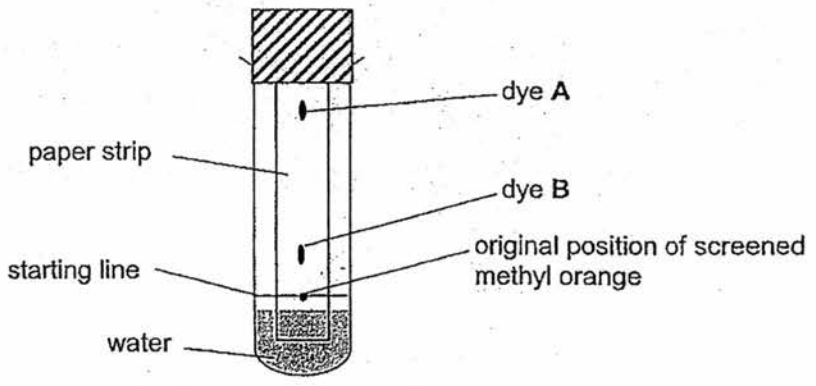
.....

(ii) Explain why the blue dye travelled further than the yellow dye. [1]

.....

.....

(b) The experiment is carried out in another way as shown in the diagram below.



(i) Identify the colours of dyes A and B. [1]

A: ..... B: .....

(ii) Explain why the starting line has to be above the solvent level as shown in the diagram above. [1]

.....

.....

6 For the following applications, state the energy conversions.

(a) A fluorescent lamp that is switched on. [1]

.....

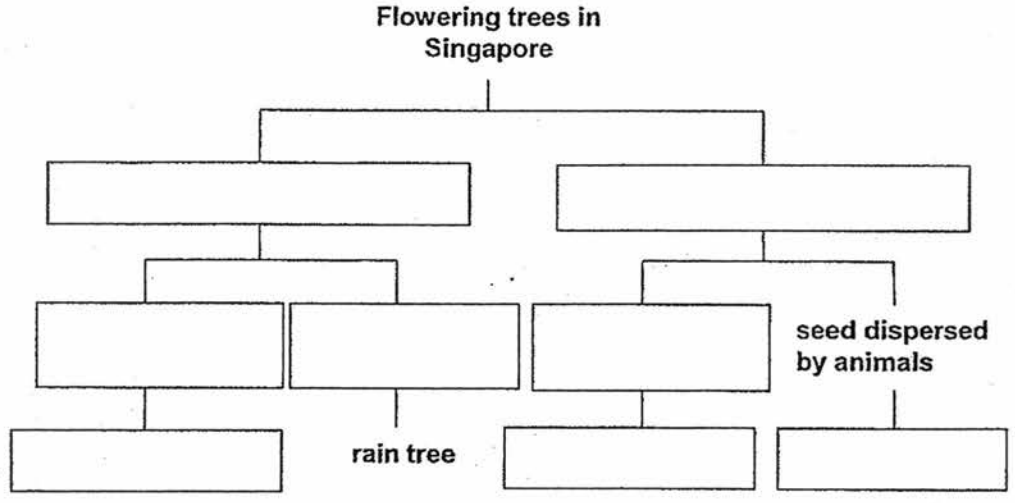
(b) A wound up toy car that is released. [1]

.....

7 Megan was given the following information about four common trees found in Singapore and was asked to organise the plants using a dichotomous key.

The rain tree is a flowering tree with an umbrella-shaped crown and its seeds are dispersed by animals. The trumpet tree is a flowering tree with a conical crown and the seeds are dispersed by splitting. The tembusu tree is a flowering tree with a conical crown and the seeds are dispersed by animals. The saga tree is a flowering tree with an umbrella-shaped crown and its seeds are dispersed by splitting.

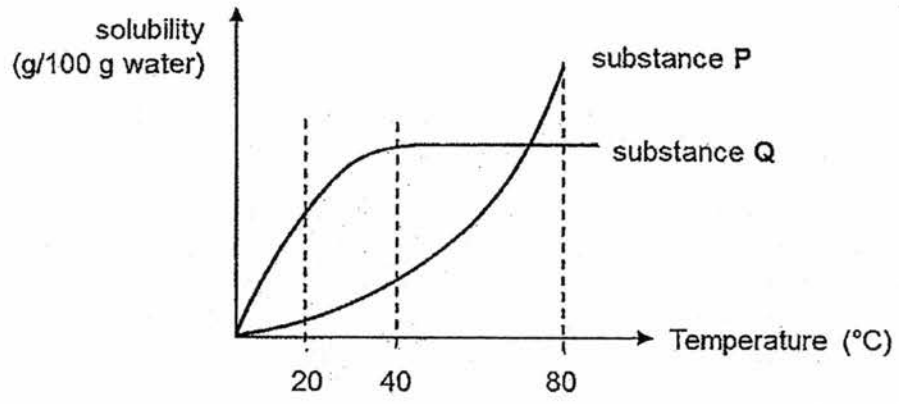
Using the information given, complete the dichotomous key to classify the trees correctly. [4]



8 (a) State one similarity between a solution and a suspension. [1]

.....

(b) An experiment is performed to investigate how temperature affects the solubility of substances **P** and **Q** in 100 g of water. The results are shown in the graph below.



(i) Define solubility. [1]

.....

.....

(ii) State the substance that is more soluble at 40 °C. [1]

.....

(iii) Describe the difference in the effect of temperature on the solubility of both substances **P** and **Q** at temperatures above 40 °C [2]

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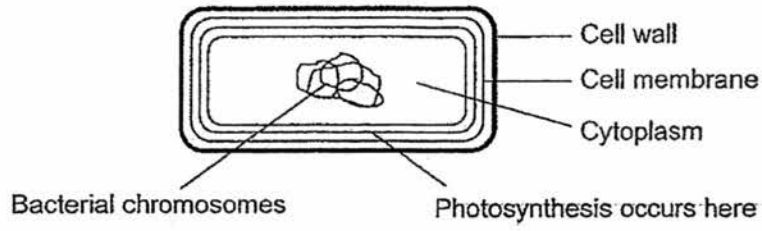
9 **(a)** The diagram below shows a bacterium.



(i) State one way in which it resembles a plant cell. [1]

.....

.....

(ii) State two ways in which it is different from a typical plant cell [2]

.....

.....

.....

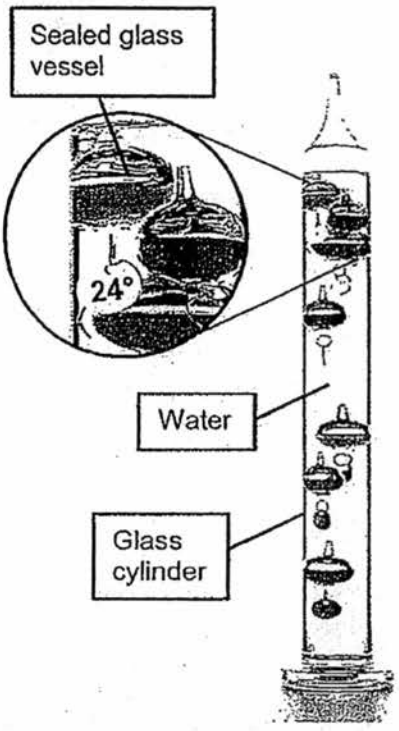
.....

(b) Draw and label a typical animal cell observed under high magnification using a light microscope. [3]

SECTION B [30 Marks]

Answer **question 10** and any **three other questions** in this section.

10 A Galileo thermometer (figure on right) is a thermometer made of a glass cylinder containing water and several sealed glass vessels of **varying densities**. Liquids (e.g. water) expand much more than solids (e.g. glass, metal) when heated. It can be assumed that the volume of the glass vessels and contents do not change with temperature. Each glass vessel is labelled with a temperature value. As the temperature changes, each glass vessel would rise or fall depending on its relative density to water. Only approximate temperature ranges can be measured. The table below shows how the density of water varies with temperature.



Temperature (°C)	Density of water (g/cm^3)
20.0	0.99820
22.5	0.99766
25.0	0.99704
27.5	0.99637
30.0	0.99565
32.5	0.99487
35.0	0.99403

Jack wants to make his own Galileo thermometer to measure the temperature of his room, which has a temperature range of **24 °C to 32 °C**. He has some water-proof vessels, each with a fixed volume of **12 cm^3**, and a mass of **2 g** when empty. Fine sand can be added to change the mass of the vessels before sealing them.

Jack decides to use 5 of the vessels, labelled **A** to **E**, to measure his room temperature. He calculates the mass of sand for filling each vessel as shown in the table below.

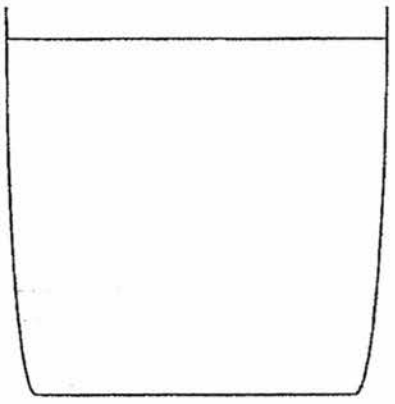
Vessel	Temperature (°C)	Density of water (g/cm^3)	Mass of sand (g)
A	22.5	0.99766	9.972
B	25.0	0.99704	9.964
C	27.5	0.99637	9.956
D	30.0	0.99565	
E	32.5	0.99487	9.938

(a) Calculate the mass of sand needed for container **D** correct to 3 decimal places, showing your working clearly.

mass of sand needed = ... g [2]

10 **(b)** Draw in the figure on the right how the vessels **A** to **E** would be distributed in a container of water at 30 °C. You can indicate the position of each container by drawing a circle around its corresponding letter.

Eg. Vessel **A** would look like this (A) [2]



(c) Explain why the vessels are distributed as shown in your answer to part **(b)**. [3]

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(d) While preparing his vessels, he forgot to label vessels **A** and **B**. Unfortunately his digital weighing scale was not working. However, he has a working mercury thermometer which indicates a current room temperature of 28 °C. Explain how he could differentiate between the 2 vessels. [2]

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(e) State the minimum number of vessels that he would need if he wanted to make a Galileo thermometer for his room with a degree of accuracy of 5 °C instead. [1]

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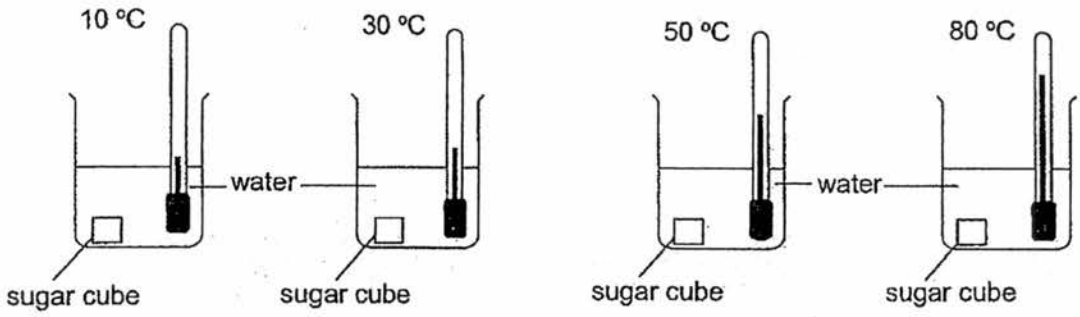
11 (a) Janice reads that most substances dissolve more easily in hot water than cold water. She decides to carry out an experiment to investigate whether it is true. She puts a sugar cube in each of the four beakers of water at various temperatures and measures the time that each sugar cube takes to dissolve completely in the water.



(i) Identify two variables that are kept **constant** during the experiment. [2]

.....

.....

(ii) Identify the variable that is **changed** during the experiment. [1]

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(iii) Identify the variable that is **measured** during the experiment. [1]

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(iv) Identify one change she can make in order to carry out the experiment in a shorter time. [1]

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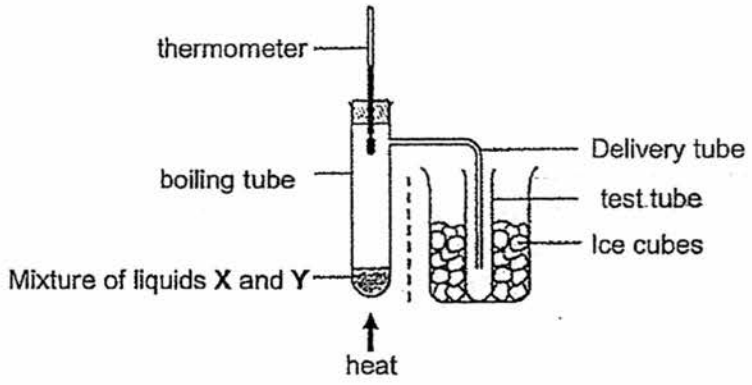
11 (b) The diagram below shows the apparatus used to separate a mixture of liquids **X** and **Y**.



The boiling points of **X** and **Y** are **359 °C** and **68 °C** respectively.

(i) State the name of this separation technique. [1]

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(ii) Describe the purpose of the ice cubes shown in the diagram. [1]

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(iii) Describe in detail how to obtain pure **X** and pure **Y** separately using this method. [3]

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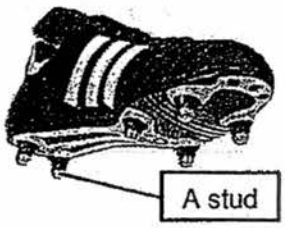
12 (a) Jeffrey received a pair of soccer boots for his birthday. He noted that there were some protrusions (studs) on the soles of his boots as shown in the diagram on the right. With the studs attached, **only** the studs are in contact with the ground when Jeffery wears the boots.



(i) Jeffrey has a mass of 48 kg. On a pair of boots, the total surface area of the studs in contact with the field is ground is 30 cm^2. Calculate the pressure (in terms of Pa) exerted by Jeffery on the soccer field when he wears the soccer boots. (Assume gravitational pull to be 10 N/kg).

Pressure = ... Pa [2]

(ii) Feeling uncomfortable in his new boots, Jeffrey manually unscrewed the studs from his boots. Assuming the studs occupied 10% of the soles' total surface area, calculate the new pressure exerted by Jeffery on the ground with his unstudded boots. (assume the entire sole is in contact with the ground)

Pressure = ... Pa [2]

(iii) Without the studs, Jeffery found himself constantly slipping and falling while participating in soccer matches. With reference to the calculated results in parts **(a)** and **(b)**, explain why it would be better to wear the soccer boots with the studs while on the soccer field which has a soft surface. [2]

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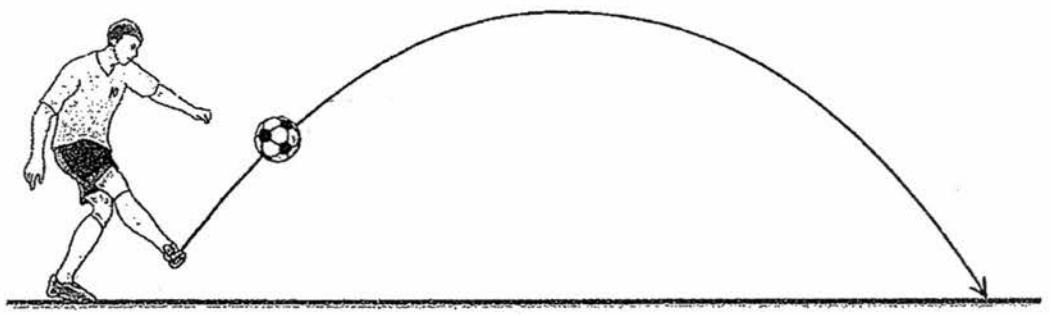
12 (b) During a soccer match, Jeffery kicks the soccer ball into the air. The path of the soccer ball's flight from the time the ball leaves his boot to the time just before it hits the ground is shown below.



(i) Mark with a cross 'X' in the diagram above and label it **'A'** to indicate where the kinetic energy of the ball is highest. [1]

(ii) Mark with a cross 'X' in the diagram above and label it **'B'** to indicate where the potential energy of the ball is highest. [1]

(iii) The total horizontal distance travelled by the ball is 40 m, in a time of 1.34 s. Calculate the horizontal average speed of the ball in km/h correct to 3 significant figures.

Speed = ... km/h [2]

13 (a) Joshua was given a bottle of hydrochloric acid and a bottle of unknown colourless solution, liquid **Y**. He used red and blue litmus papers to test for liquid **Y**. The results are as follows:

	Colour of red litmus	**Colour of blue litmus**
Liquid Y	Turns blue	Remains blue

(i) State what liquid **Y** is most likely to be. [1]

.....

(ii) State two other physical properties of liquid **Y**. [2]

.....

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(iii) Name the products formed when liquid **Y** is mixed well with the hydrochloric acid. [1]

.....

iv) Name the process which describes the reaction which took place in **a(iii)**. [1]

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(b) Joshua added some calcium carbonate into a test tube containing hydrochloric acid.

(i) Name the gas that was given off. [1]

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(ii) One of the products formed as a result of the reaction in **(b)** is calcium chloride. Write a word equation for the reaction described in **(b)**. [2]

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(iii) If Joshua added a few drops of universal indicator into the test-tube before the start of the experiment, describe and explain how the universal indicator would change colour from the start to the end of the reaction. You may assume there is no more hydrochloric acid and calcium carbonate left after the reaction. [2]

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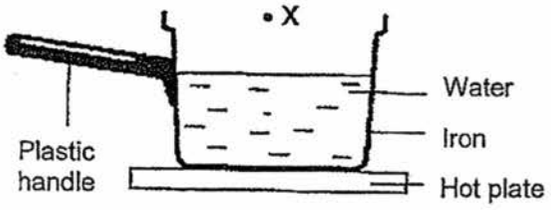
14 (a) The diagram below shows a saucepan containing water placed on a hot plate. After some time the air at point **X** also becomes hot.



(i) Name and explain the processes by which heat is transferred from the hot plate to point **X.** [3]

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(ii) The sides of the saucepan are often polished. Explain how this reduces heat loss. [1]

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(iii) Explain why plastic is used for the handle and iron is used for the saucepan.[1]

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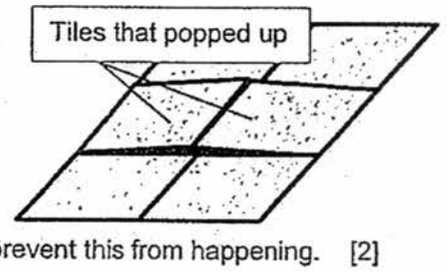
(b) HDB occasionally receives complaints about floor tiles that pop up due to poor workmanship on the part of the contractor. The diagram on the right shows some floor tiles that have popped up during one month of exceptionally hot weather. Explain what could be the cause of this phenomenon and what could have been done to prevent this from happening. [2]



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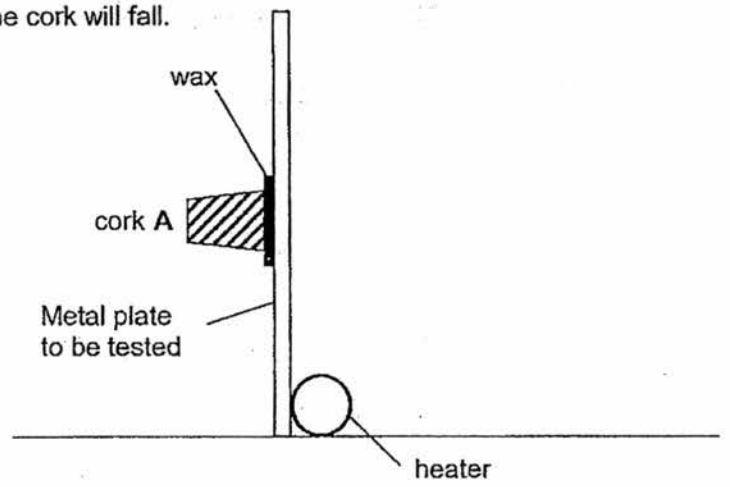
14 (c) Thermal conductivity is a measure of the ability of a substance to conduct heat. In an experiment, as setup below, a student wants to investigate the relationship between the thermal conductivity of several metallic plates with the duration at which the cork will fall.



The table below shows the metal plates used in the experiment and their respective thermal conductivities:

Materials	Copper	Stainless Steel	Iron	Silver	Brass
Thermal Conductivity, W/(m.K)	400	16	80	429	109

(i) Given that the time taken for the cork to fall off when copper and iron plates are used is 20 s and 53 s respectively. Describe what you can infer about the relationship between the thermal conductivity of metallic plates with the duration taken for the cork to fall. Explain your answer. [2]

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(ii) Based on your answer in **c(i)**, rank the metals according to its ability to keep the cork on the plate from the longest duration to the shortest duration. [1]

.....

END OF PAPER

The Periodic Table of the Elements

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

*58-71 Lanthanoid series

†90-103 Actinoid series

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

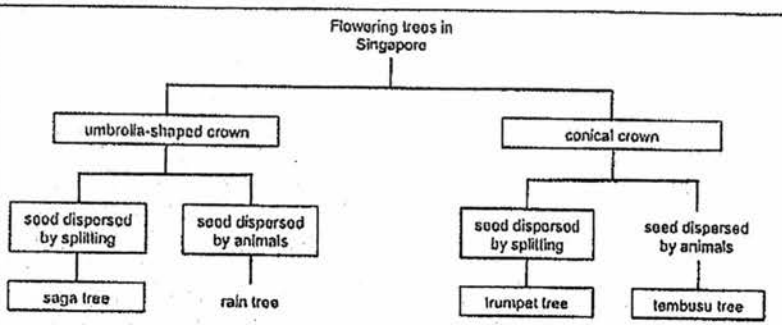
Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

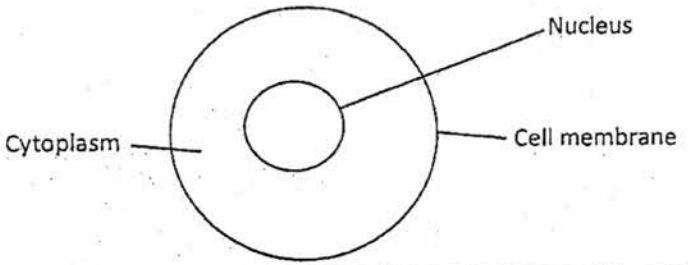
The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

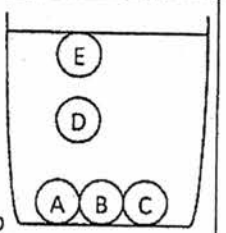
2016 End of Year Exam: Sec 1 Express Science Mark Scheme (Paper 1)					
1	A	11	B	21	B
2	D	12	B	22	A
3	D	13	B	23	A
4	D	14	C	24	A
5	B	15	C	25	D
6	C	16	C	26	B
7	A	17	A	27	C
8	B	18	A	28	A
9	D	19	D	29	A
10	C	20	B	30	D

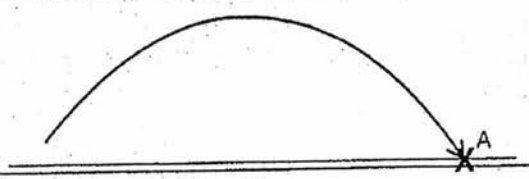
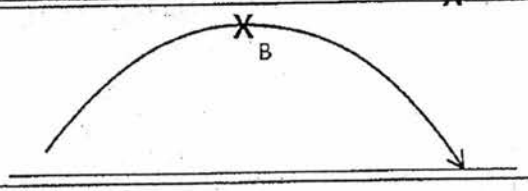
2016 End of Year Exam: Sec 1 Express Science Mark Scheme (Paper 2)				
Section A (30 marks)				
Q	Part	Answers	marks	Pre marking comments
1	a	3.20 cm [1]	1	rej if no unit or wrong d.p.
	b	8.7 cm^3 [1]	1	rej if no unit or wrong d.p. (accuracy of measuring cylinder is 0.1cm) rej: 8.70 cm^3
2	a	**Compound**, because the chemical formula of the substance indicates that it is made up of **3 elements / 2 or more chemically joined / combined** together [1]	1	both parts of answer must be correct to get 1 mark.
	b	Test for its **boiling point**. [1]* If it is contaminated, it will form a mixture. A mixture will have a **range of boiling points (not a fixed boiling point)** whereas a pure substance has fixed B.P. [1]	2	rej: testing for melting point by freezing rej: different boiling point * must state the measuring of boiling point. (can accept distillation but must state measuring of boiling point)

3		Circle: drinking in the lab Correction: No consumption of food or drinks in the science lab. [1] Circle: hand holding test tube Correction: use a test tube holder to hold the test tube. [1] Circle: not using goggles. Correction: use goggles when heating contents in a test tube. [1] Any 2	2	
4	a	Work done = 180 N × 15 m = 2700 J	1	unit must be J, reject Nm. Working must show numerical value (minimum: 180 x 15 = 2700 J)
	b	WD = Fd F=3800 J /10m = 380 N	1	unit must be J, reject Nm. Working must show numerical value
5	ai	**Paper chromatography** [1]	1	
	aii	Blue dye is **more soluble** than the yellow dye in water thus it travels faster and hence further away. [1]	1	rej: dissolve faster
	bi	**A**: Blue dye, **B**: Yellow dye [1]	1	all answers must be correct to get the 1 mark
	bii	This is to **prevent** the dye on the starting line from **dissolving directly into the solvent**. [1]	1	rej: ensure dye dissolves in solvent as it moves up the paper (no indirect answers)
6	a	Electrical energy → light energy + thermal energy [1]	1	accept: heat energy
	b	Elastic potential energy → kinetic energy + (sound energy) + thermal energy [1]	1	sound energy is optional

7		 1m mark for every 2 correct answers. (all tchrs agreed)	4	
8	a	Solution and suspensions are both mixtures [1] OR Solutions and suspensions are both impure substances [1] OR Solution and suspensions can both be separated by physical methods [1]	1	
	bi	**Ability** of solute that can dissolve in a solvent / **Amount** of solute that can dissolve in a **fixed volume** of solvent at a **fixed temperature** [1]	1	
	bii	Substance **Q** [1]	1	
	biii	The solubility of substance Q remains constant with increasing temperature [1] while the solubility of substance P continue to rise with increasing temperature [1]	2	
9	ai	It has a cell wall [1] It carries out photosynthesis. [1] Any **1** correct answer	1	
	aii	It does not have a **large (central) vacuole** [1] It does not have a nucleus [1] It does not have chloroplasts [1] Any **2** correct answers	2	"central" is optional
	b	Cell membrane, nucleus drawn [1] Labelling of cell membrane, nucleus, cytoplasm [2]	3	rej: if sketch (-1m) cell membrane and nucleus must be drawn with 1

		(2m for 3 correct labels, 1m for 2 or less correct labels)  		single continuous line

2016 End of Year Exam: Sec 1 Express Science Mark Scheme (Paper 2)				
Section B (Q10 + 3 questions: 40 out of 50 marks)				
Q	Part	Answers	marks	Pre marking comments
10	a	Mass of container needed = 0.99565 × 12 = 11.9478 [1] Mass of sand needed = 11.9478 – 2 = 9.948 (to 3 d.p.) [1]	2	Working must show numerical value
	b	Vessels ABC grouped together at bottom of container [1] Vessels E near water surface and vessel D in between ABC and E [1] (don't need to break the water surface, award marks as long as they are close to water surface) Allow for slight variations in depth within each group 	2	accept E if it is half-submerged, reject E if it is toally on water surface.
	c	Vessels ABC have a **density greater** than water **at 30 °C**, so they would **sink** to the bottom [1] Vessels E have a **density less** than **water at 30 °C**, so they would **float** to the top of the water / water surface. [1] Vessel D has the **same density** of **water at 30 °C,** so it **neither floats nor sinks** [1]	3	do not accept error carry forward.
	d	Put both vessels in a container of water and add some ice **to lower the temperature** of the water. [1] As the water cools **below 25 °C**, the **first vessel to rise would be vessel B.** [1]	2	rej: heating (density of water decreases and all vessels will sink to bottom.)
	e	3 vessels (22.5 °C, 27.5 °C, 32.5 °C)	1	
11	ai	Mass of sugar cube [1] Volume of water. [1] Type of sugar [1] size/ surface area of sugar cube* [1] (Accept **any 2** reasonable answers)	2	rej: Identical beaker size and surface area = 1 mark only, no double count
	aii	Temperature of water [1]	1	
	aiii	Time taken for the sugar to dissolve completely in water [1]	1	
	aiv	Stir each setup at a constant rate. [1] **OR** Use fine sugar crystals/granules instead [1]	1	

	bi	Distillation / simple distillation [1]	1	
	bii	To allow **condensation** of vapour [1]	1	rej: cooling of vapour (vapour can be cooled but not condensed)
	biii	When Y is heated to **68 °C, Y will boil first to become gaseous Y,** as Y has a lower boiling point [1] **Gaseous Y will condense** and be collected in the test tube. [1] When the temperature rises **above 68 °C,** only **liquid X remains in the boiling tube**[1]	3	accept: heating till 359°C
12	ai	Weight of Jeffery = 48 ×10 = 480 N Surface area of shoe = 30 × 1/10000 = 0.003 m^2 Pressure = **480** / 0.003 [M1] = **160 000** Pa [A1]	2	[M1]: pressure = **480** N / any area value with "3" and "0" only [1]
	aii	Surface area = **100/10 × 0.003** = **0.03 m^2** [B1] Pressure = **480/0.03** = 16 000 Pa [A1]	2	[B1]: student must calculate the surface area correctly
	aiii	The studs would allow him to **exert higher pressure** on the field due to **smaller surface area.** [B1] AND This allows his studs to **sink into to ground** [B1] OR Providing a **firm grip** on the ground [B1] (**Pressure** must be mentioned)	2	rej: 'higher pressure' alone
	bi		1	must have mark "X" and label "A"
	bii		1	must have mark "X" and label "B"

	biii	Speed = 40/1.34 m/s [1] =.29.8507 m/s = (29.8507 /1000) × 3600 = 107 km/h [1, 3 s.f.]	2	
13	ai	An alkali	1	
	aii	It tastes bitter. [1] **ANY TWO** It has a soapy feel. [1] It is an electrical conductor. [1] It turns Universal Indicator indigo or violet. [1]	2	rej: It is corrosive.
	aiii	Salt and water	1	
	aiv	Neutralisation / Neutralization	1	
	bi	Carbon dioxide	1	
	bii	calcium carbonate + hydrochloric acid [1] → calcium chloride + carbon dioxide + water [1]	2	correct reagents [1] ; correct products [1]
	biii	**red to green** [1] ; **all** hydrochloric **acid** has been **reacted / used up** & **salt and water are neutral.** [1]	2	
14	ai	Heat is transferred from **the hot plate to the iron saucepan to water** by **conduction**. [1] **Convection: convection currents of water** are set up as the water is **heated up, expands** (increase in volume) becomes **less dense** and **rises.** [1] Heat then reaches X through **convection currents of the air** above the water and (radiation). [1. #3]	3	mark #3: must have convection of air, radiation alone has no mark.
	aii	Shiny surfaces are **poor radiators** or **emitters** of heat, thus heat lost through radiation is reduced.	1	
	aiii	Plastic is an **insulator** of heat, iron is a good **conductor** of heat.[1]	1	
	b	The tiles have expanded and there was not enough space in between the tiles, causing them to pop up. [1]	2	

		Leave more gap in between the tiles [1]		
	ci	The higher the thermal conductivity of metal, the shorter the duration for the cork to drop [1] Higher thermal conductivity allows heat to be more easily transferred from the heater to the wax. [1]	2	
	cii	Stainless Steel, Iron, Brass, Copper and Silver	1	