Candidate Name: _____ Class _____ Index No. _____

FUHUA SECONDARY SCHOOL

Secondary One Express and
Normal (Academic) SBB

End-of-Year Examination 2023

1E/NA (SBB)

Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary
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SCIENCE

Booklet 1: Section A

13 October 2023
0800 – 1000
2 hours (for both booklets)

Additional material: OMR sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A (30 marks)

There are **thirty** questions in this section. 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 OMR sheet provided.

The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page **10**.
The use of an approved scientific calculator is expected, where appropriate.

Setters: **Vetter:**

This paper consists of **10** printed pages including this page.

Section A [30 marks]

Answer **all** the questions in this section.
Shade your answer in **soft pencil** on the OMR sheet provided.

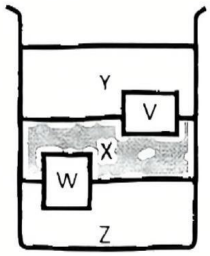
A1 A material can bend without breaking and return to its original size and shape after bending. What is the physical property that is being described?

A flexibility
B hardness
C durability
D strength

A2 A ball of plasticine was rolled out on a baking sheet by a rolling pin. Which of the following is true about the rolled plasticine?

A Its mass and density have increased.
B Its mass and density have decreased.
C Its mass and density remain the same.
D Its mass remains the same but the density changed.

A3 The following diagram shows two objects V and W placed in a mixture of immiscible liquids X, Y and Z.



Which of the following gives the correct densities of the objects and liquids?
(All values are given in g/cm^3.)

	V	W	X	Y	Z
A	0.20	1.51	0.96	0.20	2.11
B	0.50	0.96	1.51	0.20	2.11
C	0.50	1.51	0.96	0.20	2.11
D	0.20	0.96	1.51	2.11	0.20

A4 Which of the following are possible uses of digital calipers?

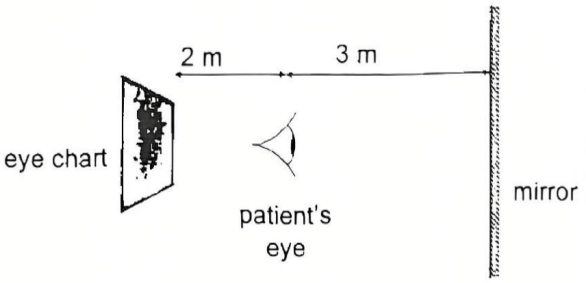
I To measure the internal diameter of a bottle.
II To measure the diameter of a ping pong ball.
III To measure the depth of liquid in a cup.
IV To measure the length of an iPad.

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

A5 Which statement best explains why we are able to see a non-luminous object?

A Light given off by the object travels into our eyes.
B Light given off by our eyes falls on the object.
C Light reflected by the object travels into our eyes.
D Light reflected by our eyes falls on the object.

In the diagram below, a patient takes an eye test. He stands at a distance of 3 m in front of a mirror and views the image of an eye chart that is placed 2 m behind him. Use the diagram below to answer questions **A6** and **A7**.



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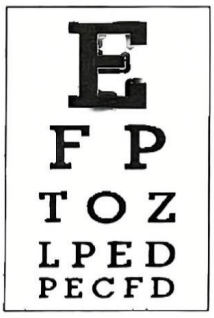
A6 What is the distance between the patient and the image of the eye chart formed in the mirror?

A 2 m
B 3 m
C 8 m
D 10 m

A7 Which of the following shows the eye chart used for the eye test that is placed behind the patient?

A



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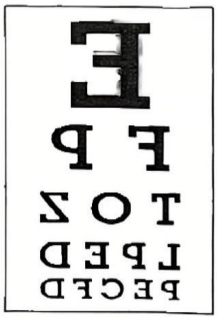
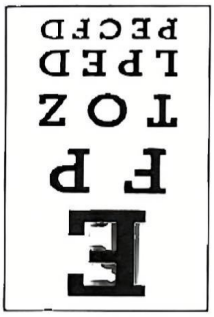


C



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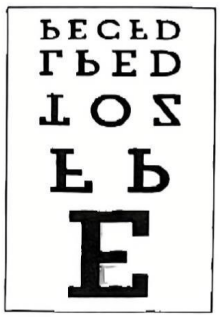


A8 Which of the following statements is **incorrect** about light?

A Light of different colours refract at different angles.
B Light of different colours travel at the same speed in a prism.
C The splitting of the seven colours of white light is called dispersion.
D White light splits into seven different colours when it passes through a prism.

A9 Why is it easier to compress gas but not liquid?

A The gas particles are very small, but the liquid particles are larger.
B The gas particles move very quickly but the liquid particles can only slide over one another.
C There are a lot of empty spaces between the gas particles but there are very little empty spaces between the liquid particles.
D There are no forces of attraction between the gas particles but there are strong forces of attraction between the liquid particles.

A10 Brownian motion proves that particles are in constant random motion.
Which of the following **cannot** be used to demonstrate Brownian motion?

A Motion of pollen grains in still air.
B Movement of dust particles in a sealed room.
C Movement of molten wax of a burning candle.
D Spreading of a drop of ink in a beaker of water.

A11 Three substances have the following properties:

- substance 1 boils at 910 °C
- substance 2 melts at 5 °C and boils at 150 °C
- substance 3 melts at 800 °C

Which of the following correctly shows the physical state of the substances at 25 °C?

	substance 1	substance 2	substance 3
A	gas	liquid	solid
B	solid	gas	solid
C	solid	liquid	solid
D	solid	gas	gas

A12 Which of the following statements is true about the particles in a solid object during expansion?

A The particles expand in size.
B The mass of the particles increases.
C The distance between the particles increases.
D The speed of the particles decreases.

A13 Which of the following statements describes a suspension?

A It contains a soluble solute.
B It is a homogenous mixture.
C It allows light to pass through.
D It has particles that settle at the bottom upon standing.

A14 Which of the following statements describes a pure compound?

A The substance exists either as an atom or a molecule.
B The substance dissolves in water to form a coloured solution.
C The substance is separated into its constituent elements easily.
D The substance is formed through a chemical reaction and melts at a fixed temperature.

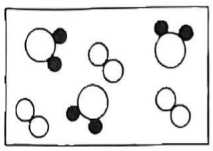
A15 The table below shows the different conditions used to dissolve a given salt.

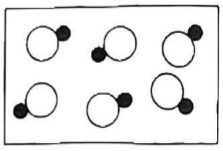
beaker	temperature / °C	solution stirred	size of salt particles used
W	30	yes	large
X	30	no	large
Y	60	yes	large
Z	60	yes	small

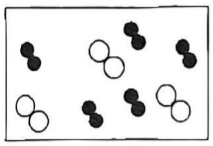
Which of the following arranges the beakers in order of increasing rate of solubility?

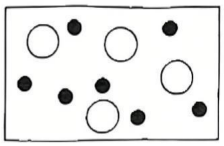
A W, X, Y, Z
B X, W, Y, Z
C X, W, Z, Y
D Z, Y, W, X

A16 Which of the following correctly represents a mixture of an element and a compound?

A 

B 

C 

D 

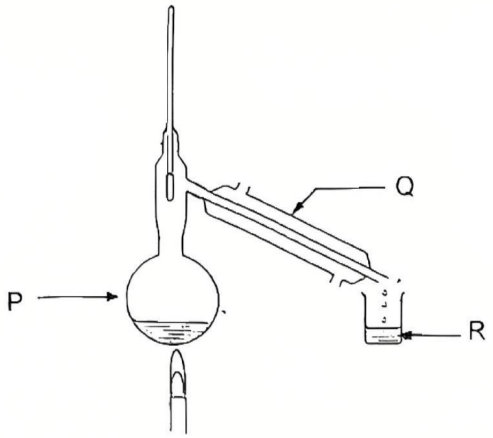
A17 A student is given a mixture of substances P, Q and R.
The table shows some of the properties of P, Q and R.

substance	state	solubility in water	solubility in ethanol
P	solid	yes	no
Q	liquid	no	yes
R	solid	no	no

Which method describes how a pure sample of substance Q can be separated from the original mixture?

A add water, filter, dry the residue
B add ethanol, filter, distil the filtrate
C add ethanol, filter, add water to residue, filter
D add water, filter, add ethanol to residue, filter

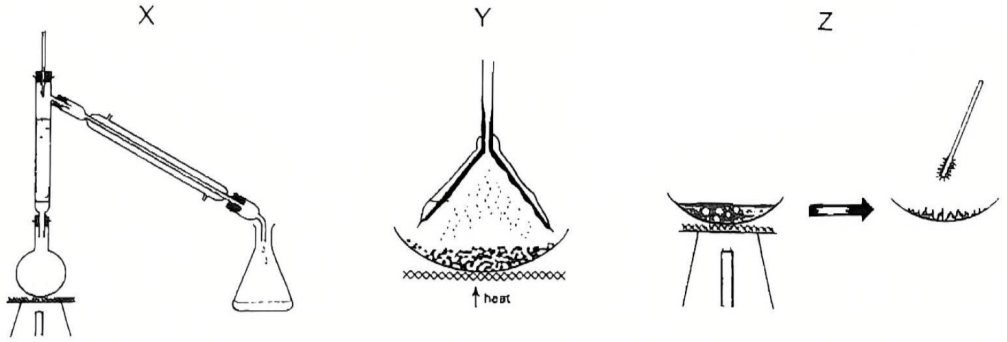
A18 A student sets up the following apparatus for an experiment.



What are P, Q and R?

	P	Q	R
A	conical flask	fractionating column	filtrate
B	distillation flask	condenser	filtrate
C	fractionating column	distillation flask	distillate
D	distillation flask	condenser	distillate

A19 The diagrams show three methods of separation.



What are the three methods called?

	X	Y	Z
A	distillation	filtration	evaporation to dryness
B	distillation	sublimation	crystallisation
C	fractional distillation	filtration	evaporation to dryness
D	fractional distillation	sublimation	crystallisation

A20 Two atoms of the same element have different nucleon numbers.
Which row is correct for the two atoms?

	number of electrons	number of neutrons	number of protons
A	same	different	same
B	same	same	different
C	different	different	same
D	different	same	different

A21 What are the relative charges of the particles in an atom?

	electron	neutron	proton
A	0	−1	+1
B	−1	0	+1
C	+1	−1	0
D	+1	0	−1

A22 One isotope of sulfur is represented by the symbol $^{34}_{16}S$.

Which symbol represents another isotope of sulfur?

A $^{34}_{14}S$

B $^{32}_{15}S$

C $^{34}_{15}S$

D $^{32}_{16}S$

A23 Three statements related to the Periodic Table are given.

Statement 1: Elements in Group 17 are metals.
Statement 2: Elements are arranged according to their atomic number.
Statement 3: Elements in the same period have similar chemical properties.

Which of the statements is/are correct?

A Statement 1 only
B Statement 2 only
C Statement 1 and 3
D Statement 2 and 3

A24 The electronic configuration of element X is 2,8,6.
Which statement about element X is **not** true?

A Element X is oxygen.
B Element X is a non-metal.
C Element X is in Group 16.
D Element X has 3 electron shells.

A25 A man noticed that after several rounds of washing, some of his T-shirts shrank in size. He then conducted a scientific investigation.

I	He measured the size of the T-shirts after the wash and recorded the measurement in a table.
II	He concluded that the cotton material used in T-shirts results in greater shrinking.
III	He chose two T-shirts, made of cotton and polyester respectively, and washed them under the same conditions.
IV	He predicted that the material of the T-shirts affect whether they would shrink in size after washing.

Which of the following correctly corresponds with the key elements of the scientific method?

	formulating hypothesis	carrying out experiment	collecting data	interpreting data
A	II	I	III	IV
B	IV	III	I	II
C	IV	I	III	II
D	III	IV	I	II

A26 A substance is delivered to the laboratory. The following symbols are printed on the container that contains the substance.

X

Y

Z

Which of the following correctly describes the hazardous nature of the substance?

	X	Y	Z
A	corrosive	explosive	flammable
B	corrosive	irritating	oxidising
C	irritating	explosive	oxidising
D	toxic	irritating	flammable

A27 Which of the following correctly matches the physical quantities and their respective SI units?

	length	mass	temperature
A	kilometer	kilogram	degree celsius
B	kilometer	gram	kelvin
C	metre	gram	kelvin
D	metre	kilogram	kelvin

A28 Which of the following sentences about chloroplasts is **not** true?

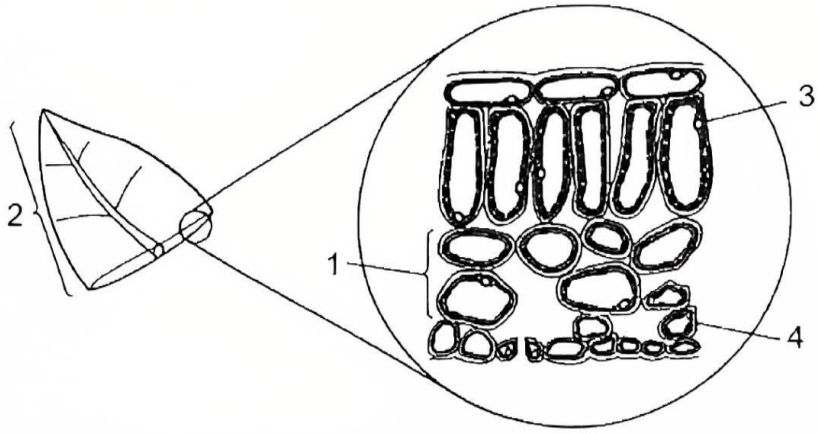
A All plant cells have chloroplasts.
B Chloroplasts contain the green pigment chlorophyll.
C Plants cannot make their own food without chloroplasts.
D They are found in the cytoplasm of the plant cell.

A29 Cancer is caused by the uncontrolled growth of cells in the body.

Which part of a cell is **not** functioning appropriately in patients suffering from cancer?

A cell surface membrane
B cytoplasm
C nucleus
D vacuole

A30 The diagram shows the structure of a leaf.



Which row correctly identifies a cell, a tissue and an organ?

	cell	tissue	organ
A	1	3	4
B	1	3	2
C	4	2	4
D	4	1	2

- End of Section A -

The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		proton (atomic) number atomic symbol name relative atomic mass : nucleon number									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24	3	4	5	6	7	8	9	10	11	12	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

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SCIENCE

Booklet 2: Section B & C

13 October 2023
0800 – 1000
2 hours (for both booklets)

Additional material: OMR sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section B (40 marks)
Answer **all** questions. Write your answers in the spaces provided.
Section C (30 marks)
Answer **all** questions. Write your answers in the spaces provided.

The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page **10** of Booklet 1.
The use of an approved scientific calculator is expected, where appropriate.

PARENT'S SIGNATURE	FOR EXAMINER'S USE							
	Section A		Section B		Section C		Total	
		30		40		30		100

Setters: **Vetter:**

This paper consists of **16** printed pages including this page.

Section B [40 marks]

Answer all the questions in this section.

B1 The viscosity of a liquid is a measure of its resistance to flow. A liquid has high viscosity if it does not flow easily.

A student investigated the viscosity of four different liquids by dropping a marble through the liquid and calculating the speed of the marble falling through the liquid.

Fig. B1.1 shows the setup the student used.

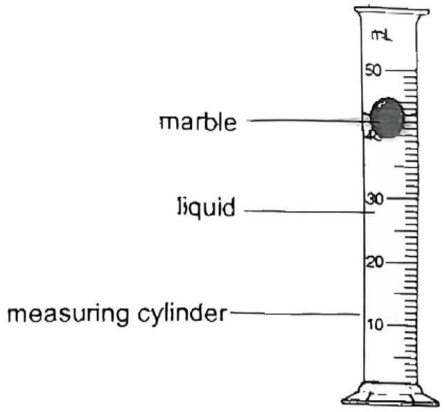


Fig. B1.1

The table below shows the calculated results.

Table B1.1

liquid	speed of marble falling through liquid / cm/s
corn syrup	6.4
honey	3.3
molasses	2.1
olive oil	18.2

(a) Identify the variables in the experiment:

(i) independent variable

.....

[1]

(ii) dependent variable

.....

[1]

(b) State a hypothesis for this experiment.

.....

.....

[1]

(c) Describe one precaution the student should take to ensure that the readings are precise.

.....

..... [1]

[Total: 4]

B2 Four solid materials below went through a 'scratch test'.

copper glass plastic steel

The results of the test were as follows:

- Copper scratched all the other materials except steel.
- Steel scratched all the other materials.
- Plastic scratched the glass, but not the copper.
- Glass would not scratch any of the other materials.

(a) State the physical property that the 'scratch test' determines.

..... [1]

(b) Based on your answer in part **(a)**, arrange the four materials in increasing order of the property.

..... [1]

(c) An electrical appliance manufacturer is selecting the material for the handle of a clothing iron. Suggest the **most** suitable material from the four given materials and explain your answer.

.....

..... [2]

[Total: 4]

B3 A student wanted to find the density of a pebble.

(a) She used a displacement can to measure its volume as shown below in Fig. B3.1.

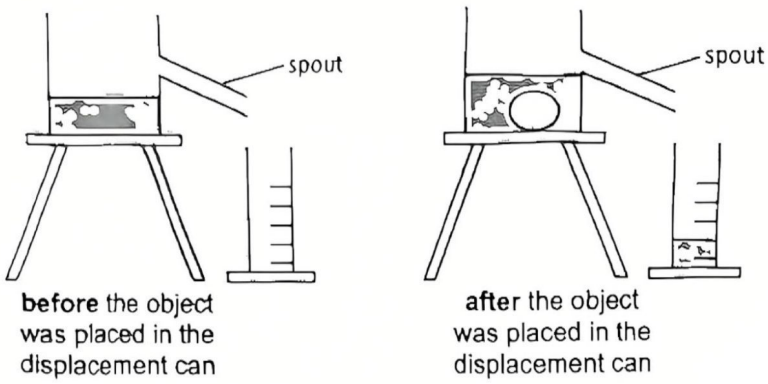


Fig. B3.1

Identify one error in her experiment and state how it would affect the volume measured.

.....

.....

..... [2]

(b) Given that the pebble has a volume of 50 cm^3 and a mass of 10 g, calculate its density.

density: ..... g/cm^3 [1]

(c) The same student wanted to measure the volume of a ping pong ball.

(i) Explain why the method in part **(a)** would not work.

.....

..... [1]

(ii) Briefly describe one modification to the method in part **(a)** to measure the volume of a ping pong ball.

.....

..... [1]

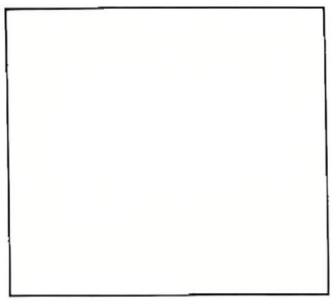
[Total: 5]

B4 Table B4.1 below shows the melting and boiling points of substances X and Y. Substance X has a melting point of 13 °C and a boiling point of 66 °C.

Table B4.1

substance	melting point / °C	boiling point / °C
X	13	66
Y	5-8	50-53

(a) In the box below, draw the particles of substance X at 50 °C.



[1]

(b) Describe the changes in the arrangement and movement of the particles in substance X when it is heated from 50 °C to 80 °C.

.....

.....

..... [2]

(c) On the axes given below, sketch the cooling curve of substance X as it is cooled from 80 °C to 0 °C.

[3]

(d) On your sketch, indicate the part(s) where substance X is in two physical states. [1]

(e) State whether substance Y is pure or impure. Explain your answer.

.....

.....

..... [2]

[Total: 9]

B5 Fig. B5.1 shows a simplified outline of the Periodic Table with elements indicated by letters **B** to **G**.

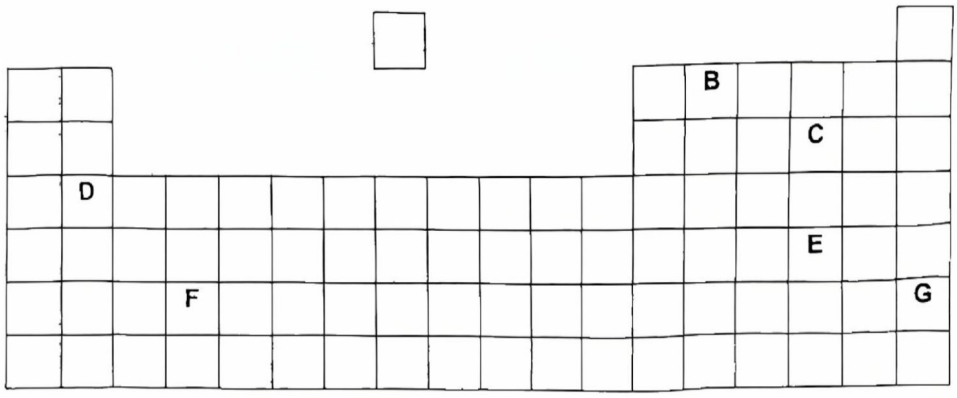


Fig. B5.1

Using the letters **B** to **G**, answer the following questions. You may use each letter once, more than once or not at all.

(a) Complete Table B5.2 to show which of the elements, **B** to **G** are metals and non-metals.

Table B5.2

metals	
non-metals	

[2]

(b) State the elements with the same number of valence electrons.

..... [1]

(c) State the number of electron shells present in element **D**.

..... [1]

(d) Draw the electronic structure of element **B**.

[1]

(e) Write the electronic configuration for element **D**.

.....

[1]

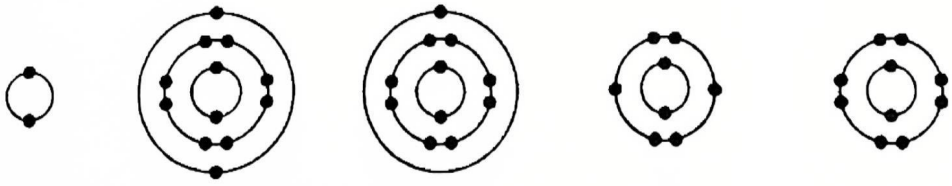
(f) The chemical symbol for a helium atom is $^{4}_{2}He$.
Using the Periodic Table of the Elements and the information from Fig. B5.1, write the chemical symbol for atom **C**.

.....

[1]

[Total: 7]

B6 (a) The electronic configurations of five atoms are shown.



State which of the atoms, **P**, **Q**, **R**, **S** or **T** represents

(i) a monoatomic gas that belongs to Period 1,

.....

[1]

(ii) an atom with a proton number of 11.

.....

[1]

(b) Table B6.1 shows the number of sub-atomic particles in X, Y and Z.

Table B6.1

unknown	number of protons	number of neutrons	number of electrons
X	12	10	10
Y	12	11	12
Z	12	12	10

Two different students commented on the information in Table B6.1.

Student 1: X, Y and Z are atoms as they have the same number of protons and neutrons.

Student 2: X, Y and Z are different elements as the number of neutrons are different.

Do you agree with any student? Explain your answer using the information in Table B6.1.

.....

.....

.....

..... [2]

[Total: 4]

B7 (a) Fig. B7.1 shows how the mass of solute dissolved in 100 cm^3 of water varied with temperature.

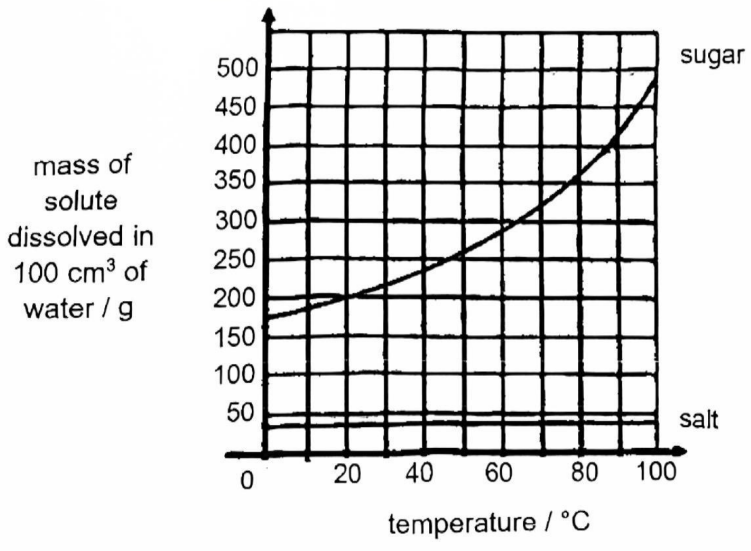


Fig. B7.1

Describe how the solubility of salt and sugar is affected by the temperature of the solvent.

.....

.....

..... [2]

(b) Fig. B7.2 shows 200 g of salt and 200 g of sugar added into separate beakers of 100 cm^3 of water at 30 °C.

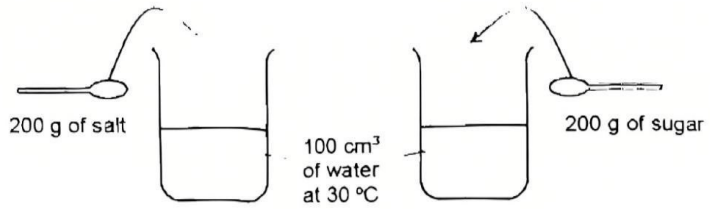


Fig. B7.2

(i) With reference to Fig. B7.1 and B7.2, determine if the salt or sugar solution will be saturated. Explain your answer.

.....

.....

..... [2]

(ii) Besides increasing the temperature, suggest one other way to increase the rate of dissolving the sugar in the beaker of water.

.....

..... [1]

(c) Glucose, $C_6H_{12}O_6$, is a form of sugar found in our blood. It is used by our body cells to release energy required for movement, growth and reproduction.

(i) Name all elements that can be found in glucose.

..... [1]

(ii) State the number of atoms in two molecules of glucose.

number of atoms: _____ [1]

[Total: 7]

Section C [30 marks]

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

C1 **(a)** Refraction is the bending of light as it passes from one medium to another, such as from air to water or from air to glass. This occurs due to the change in speed of light when it passes through materials with different optical densities.

The refractive index (n) of a material is defined as the ratio of the speed of light in vacuum (c) to the speed of light in the material (v) and can be calculated using the formula below:

$$n = \frac{c}{v}$$

Hence the speed of light passing through a transparent material can be calculated as:

$$v = \frac{c}{n}$$

Table C1.1 shows the refractive index, angle of refraction and the speed of light travelling through three transparent mediums.

Table C1.1

medium	refractive index	speed of light in medium / m/s	angle of incidence / °	angle of refraction / °
air	1.00	3.0×10^8	20.0	20.0
water	1.33	2.3×10^8	20.0	14.9
diamond	2.40	1.3×10^8	20.0	8.2

(i) From the data given, state the relationship between the refractive index and the angle of refraction.

.....

..... [1]

(ii) Hence, state the relationship between the refractive index and the optical density of a material.

.....

..... [1]

(iii) Zircon is a transparent medium that is often used in jewellery, as a cheaper alternative to diamond. Given that zircon has a refractive index of 1.9, use the formula given to calculate the speed of light that passes through zircon.

speed of light = ... m/s [1]

(iv) Fig. C1.1 shows the path of a light ray travelling through the three transparent mediums stated in table C1.1.
One of the mediums have been identified as water. Using the information in table C1.1, fill in the boxes provided with the appropriate mediums.

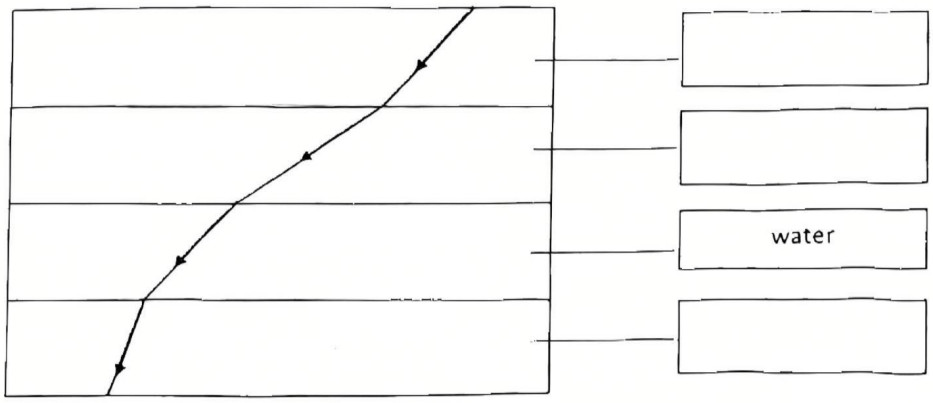


Fig. C1.1

[2]

(b) Fig C1.2 below shows a rod-shaped lamp hanging in front of a plane mirror.

(i) Draw the image of the lamp. [1]

(ii) Draw a ray diagram to show how the eye sees the image of the lamp in the plane mirror. [2]

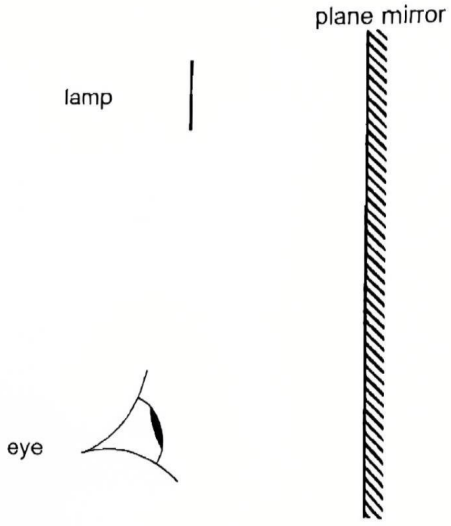


Fig C1.2

(iii) A funhouse mirror has an irregular surface, unlike a plane mirror. The image below shows an example of a funhouse mirror.

Explain why the image we see is a distorted reflection of the object.

.....

.....

..... [2]

[Total:10]

C2 (a) Charlie conducted two paper chromatography experiments on a black marker ink using two different solvents, ethanol and hexane.

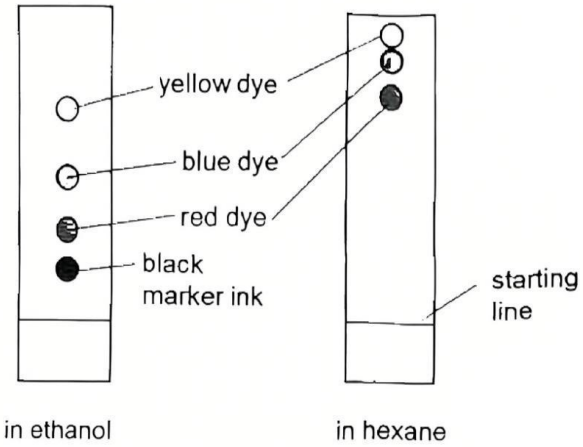


Fig. C2.1

Fig. C2.1 shows the results of the two experiments.

(i) Charlie observed that when hexane was used as a solvent, the black marker ink disappears completely from the starting line. Explain this observation.

.....

[1]

(ii) Which dye is most soluble in the two solvents? Explain your answer.

.....

.....

.....

[2]

(iii) Would you expect the R_f value of the yellow dye to change if the experiment is repeated with a longer run time? Explain your answer.

.....

.....

.....

[2]

(b) A mixture of alcohol and water is used as the solvent. The coloured dyes travel different distances on the chromatogram depending on the percentage of alcohol used in the solvent as shown in Fig. C2.2. All other experimental conditions are assumed to be constant.

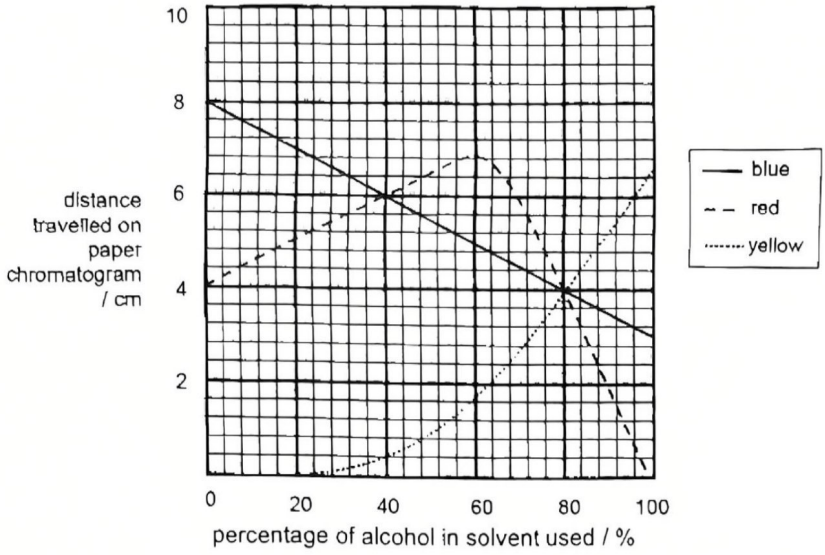


Fig. C2.2

(i) Determine the distance travelled on the paper chromatogram by the yellow dye when the percentage of alcohol in solvent used is 60%.

.....

[1]

(ii) A student makes the following claim: "When the solvent contains 40% of alcohol, the blue dye and red dye have the same solubility."
Do you agree Using the information provided in Fig. C2.2, state evidence to explain your reasoning.

.....

.....

.....

[2]

(iii) Another student commented that the blue dye is always the most soluble regardless of the percentage of alcohol found in the solvent.
Do you agree? Using the information provided in Fig. C2.2, state evidence to explain your reasoning.

.....

.....

.....

[2]

[Total: 10]

C3 **(a)** The outline drawn in Fig. C3.1 represents the cell surface membrane of a plant cell.

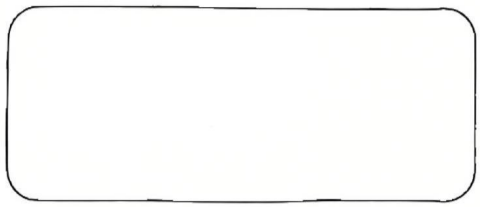


Fig. C3.1

On Fig. C3.1, draw and label

(i) a structure that gives the plant cell a regular shape, [1]

(ii) a structure that contains genetic material, [1]

(iii) a structure that contains varying amount of water and nutrients. [1]

(b) The simplified diagrams of two unicellular organisms are shown in Fig. C3.2. Unlike the Amoeba, the Euglena has a flagellum that enables it to move around. High activities of aerobic respiration occur in the flagellum.

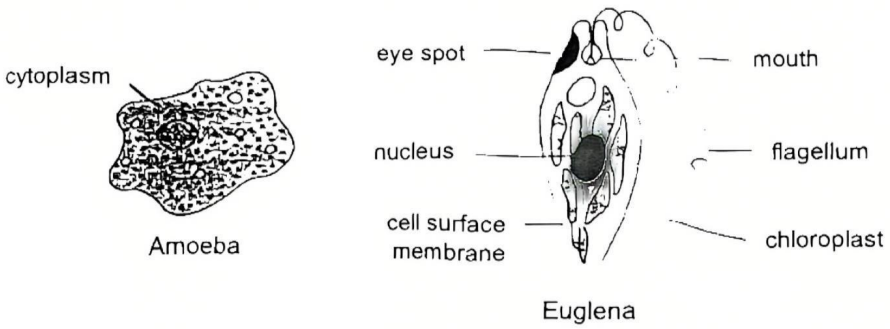


Fig. C3.2

(i) Based on Fig. C3.2, state one similarity and one difference in structure, apart from the flagellum, between the Amoeba and the Euglena.

.....

.....

.....

..... [2]

(ii) Suggest how chloroplasts in the Euglena enable the movement of the flagellum.

.....

.....

.....

..... [2]

(c) Fig. C3.3 shows yeast undergoing reproduction as seen under a microscope.

The magnification of the eye piece used was 50.0 X while the objective lens used was 100.0 X.

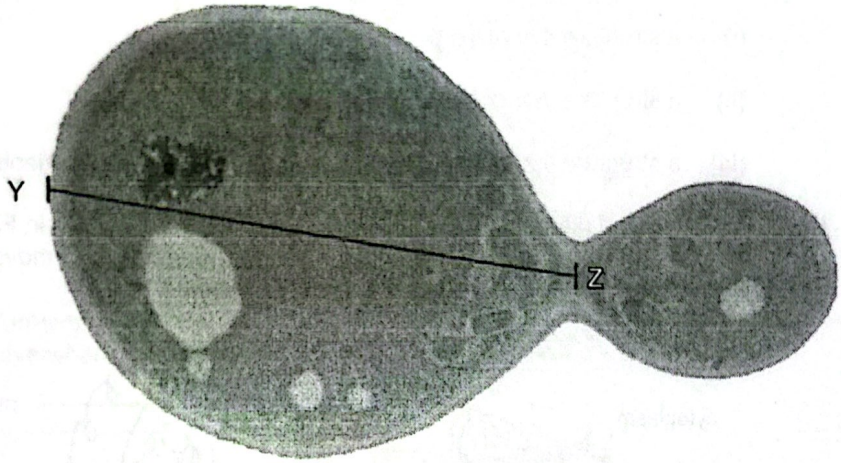


Fig. C3.3

(i) Calculate the total magnification of the yeast cell in Fig. C3.3.

total magnification = ... X [1]

(ii) Calculate the actual length of the larger yeast cell along Y to Z, in Fig. C3.3. Leave your answer in mm.

actual length of yeast cell = ... mm [2]

[Total: 10]

-END OF PAPER-