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	Class	Index No.
Candidate Name: _____		



FUHUA SECONDARY SCHOOL

Secondary Two Express

End-of-Year Examination 2017

2E

[illegible]

SCIENCE

9 October 2017

0750 - 0950

2 hours

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.

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 22.

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

Setter: Miss Choo Hui En

Vetters: Mr Ng Wei Ping
Mrs Wong Kexin

Section A [30 marks]

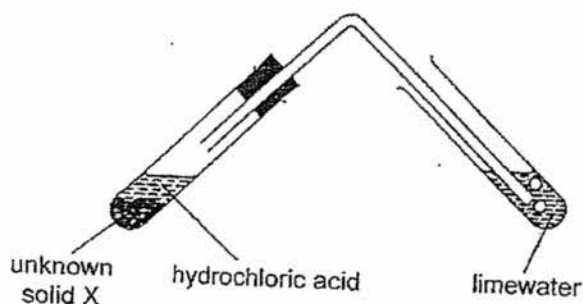
Answer all the questions in this section. Record your answer in soft pencil on the OMR sheet provided.

- A1 The table below shows some information of three acid base indicators, methyl orange, bromothymol blue and phenolphthalein.

indicator	colour in acidic solution	pH at which colour changes	colour in alkaline solution
methyl orange	red	4.0	yellow
bromothymol blue	yellow	6.0	blue
phenolphthalein	colourless	9.0	pink

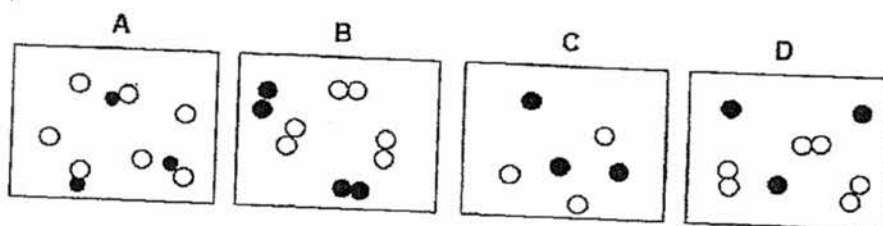
A solution was tested with all three indicators in one test tube, and the resulting mixture was yellow. Which is the most likely pH of the solution?

- A pH 2
 B pH 5
 C pH 7
 D pH 10
- A2 An unknown solid X reacts with hydrochloric acid to produce magnesium chloride and a colourless gas which forms white precipitate in lime water.



What is the unknown solid X?

- A manganese metal
 B manganese carbonate
 C magnesium metal
 D magnesium carbonate
- A3 Which of the following diagrams represents a mixture of neon gas, Ne and fluorine gas, F₂?



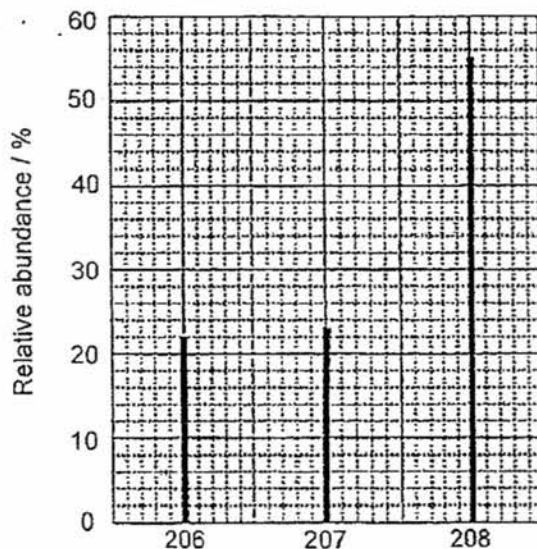
- A4 The elements P, Q and R have atomic numbers that are increasing consecutively. Given that Q is a noble gas, which of the following represent the ions of elements P and R?

	ion of P	ion of R
A	P^+	R^-
B	P^{7+}	R^+
C	P^-	R^+
D	P^{7-}	R^-

- A5 The electronic configuration of an ion of an element is 2,8. Given that the ion has a charge of +3, which group and period does this element belong?

	group	period
A	0	2
B	III	2
C	0	3
D	III	3

- A6 An element X has three isotopes, ^{206}X , ^{207}X and ^{208}X . The graph below shows the relative abundance of the isotopes.



What is the relative atomic mass of X?

- A 206.8
 B 207.1
 C 207.3
 D 207.5
- A7 Which of the following statements about the atom is false?
- A The nucleus is lightest part of the atom.
 B The nucleus consists of protons and neutrons.
 C Electrons are lost to form positively-charged ions.
 D Electrons are gained to form negatively-charged ions.

A8 ^1_1H and ^2_1D are isotopes of hydrogen. Which of the following statement(s) is/are incorrect?

- 1 Both isotopes have the same mass number.
- 2 Both H_2 and D_2 have same chemical properties.
- 3 Both isotopes have the same electronic configuration.
- 4 Both H_2 and D_2 will cause a glowing splint to relight.

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

A9 Hydrogen can form both H^+ and H^- ions. Which statement about these two ions is correct?

- A A H^+ ion has more protons than a H^- ion.
 B A H^+ ion has no electron in its shell.
 C A H^- ion has one more electron than a H^+ ion.
 D A H^- ion is formed when a hydrogen atom loses an electron.

A10 The sulfate of metal Y has the formula YSO_4 . What is the formula of the nitrate of Y?

- A YNO_3
 B $\text{Y}(\text{NO}_3)_2$
 C Y_2NO_3
 D $\text{Y}_2(\text{NO}_3)_3$

A11 Which of the following substances will conduct electricity in the aqueous state?

- A copper
 B magnesium chloride
 C chlorine
 D carbon monoxide

A12 The properties of four substances are shown below.

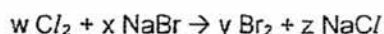
Which of the substances is most likely an ionic compound?

substance	solubility in water	melting point / $^{\circ}\text{C}$
A	soluble	1200
B	soluble	-120
C	insoluble	3000
D	slightly soluble	40

A13 A metal X and a non-metal Y forms an ionic compound X_2Y_3 . Which of the following statements about the formation of this compound is correct?

- A Each atom of X gives away 2 electrons.
 B Each atom of X gives away 3 electrons.
 C Each atom of Y gives away 2 electrons.
 D Each atom of Y gives away 3 electrons.

A14 What are the values of w, x, y and z in the following equation?



	w	x	y	z
A	1	2	1	2
B	1	2	2	1
C	2	1	2	1
D	2	2	1	1

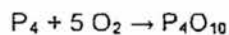
A15 A compound M reacts with potassium iodide to produce lead(II) iodide and potassium nitrate. What are the possible elements found in M?

- A potassium, nitrogen and oxygen
- B lead, iodine and nitrogen
- C potassium, nitrogen and iodine
- D lead, nitrogen and oxygen

A16 Which of the following is a correct chemical equation when sodium metal reacts with steam to give solid sodium oxide and hydrogen?

- A $\text{Na (s)} + \text{H}_2\text{O (g)} \rightarrow \text{NaO (s)} + \text{H}_2 \text{ (g)}$
- B $\text{Na (s)} + \text{H}_2\text{O (l)} \rightarrow \text{NaO (s)} + \text{H}_2 \text{ (g)}$
- C $2\text{Na (s)} + \text{H}_2\text{O (g)} \rightarrow \text{Na}_2\text{O (s)} + \text{H}_2 \text{ (g)}$
- D $2\text{Na (s)} + \text{H}_2\text{O (l)} \rightarrow \text{Na}_2\text{O (s)} + \text{H}_2 \text{ (g)}$

A17 Phosphorus can react with oxygen to produce phosphorus pentoxide according to the equation below. How many elements and atoms are there in 3 molecules of phosphorus pentoxide?



	elements	atoms
A	2	14
B	2	42
C	3	14
D	3	42

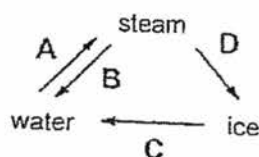
A18 The table below shows the melting and boiling point of four substances.

substance	melting point / °C	boiling point / °C
W	-179	14
X	-49	55
Y	47	270
Z	230	985

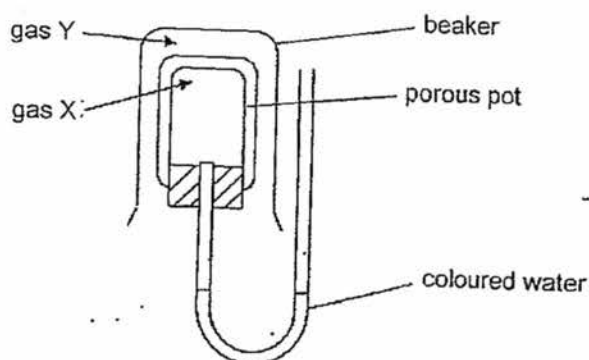
Which substance(s) is/are a liquid at room temperature of 25 °C?

- A W only
- B X only
- C X and Y only
- D W and Z only

- A19 Which process, A, B, C or D, involves the smallest increase in distance between the H_2O molecules?



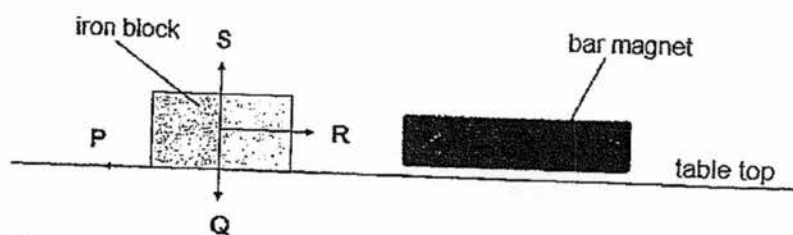
- A20 The apparatus below can be used to show the diffusion of gases.



Which pair of gases, X and Y, would not cause the level of coloured water to change?

	X	Y
A	CO	NO_2
B	CO_2	NO
C	C_2H_4	C_2H_6
D	C_2H_4	N_2

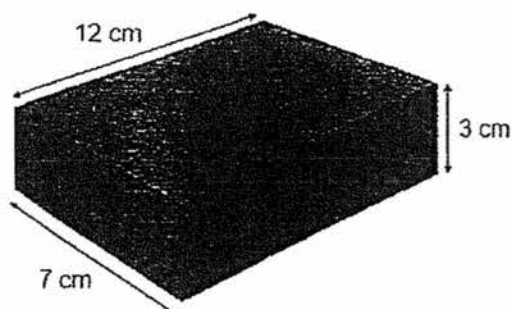
- A21 The diagram below shows four forces, P, Q, R and S acting on an iron block which is attracted to the bar magnet.



What are the names of these four forces?

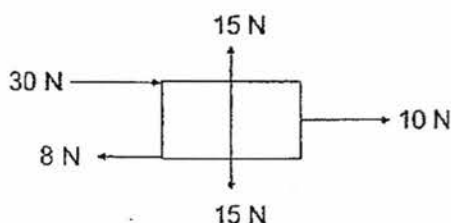
	P	Q	R	S
A	frictional force	gravitational force	magnetic force	normal force
B	frictional force	normal force	magnetic force	gravitational force
C	magnetic force	normal force	frictional force	gravitational force
D	magnetic force	gravitational force	frictional force	normal force

- A22 The diagram below shows a cuboid of dimensions $12 \times 7 \times 3$ cm. The mass of the cuboid is 400 g. (gravitational field strength = 10 N/kg)



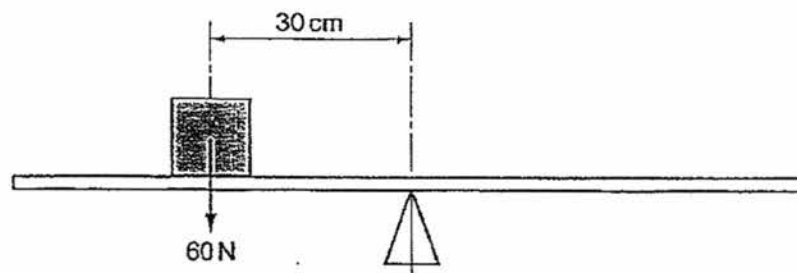
What is the greatest pressure that can be exerted by the cuboid on a surface?

- A 0.11 N/cm^2
 - B 0.19 N/cm^2
 - C 11 N/cm^2
 - D 19 N/cm^2
- A23 The diagram below shows some forces acting on a stationary box.



What is the magnitude of the resultant force acting on the box, and in which direction will the box move?

- A 32 N, move to the left
 - B 32 N, move to the right
 - C 28 N, move to the left
 - D 28 N, move to the right
- A24 A uniform beam is balanced at its midpoint. An object is placed on the beam as shown in the diagram.



Which force will balance the system?

- A 40 N upward force, 30 cm to the left of the midpoint.
- B 30 N upward force, 60 cm to the left of the midpoint.
- C 30 N downward force, 30 cm to the right of the midpoint.
- D 40 N downward force, 60 cm to the right of the midpoint.

- A25 In a hydroelectric power station, water flows down from a high reservoir to turn turbines to generate electricity.

Which of the following shows the energy conversions that take place?

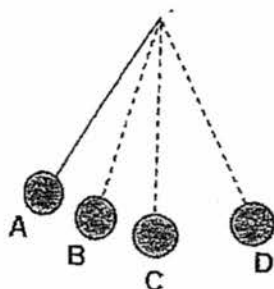
- A kinetic $\rightarrow$ chemical potential $\rightarrow$ electrical
- B kinetic $\rightarrow$ gravitational potential $\rightarrow$ electrical
- C gravitational potential $\rightarrow$ kinetic $\rightarrow$ electrical
- D gravitational $\rightarrow$ chemical potential $\rightarrow$ electrical

- A26 A ball of mass 2.0 kg is balanced on the edge of a cliff 100 m above the ground. It rolls off the cliff and falls.

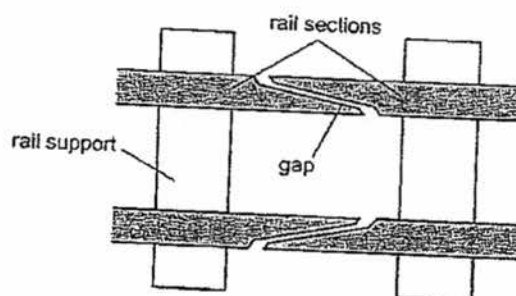
What is the amount of gravitational potential energy converted to other forms of energy when the ball hits the ground? (take gravitational field strength = 10 N/kg)

- A 1 000 J
- B 2 000 J
- C 10 000 J
- D 20 000 J

- A27 The diagram below shows different positions of a swinging pendulum. At which position does the pendulum have the greatest speed?



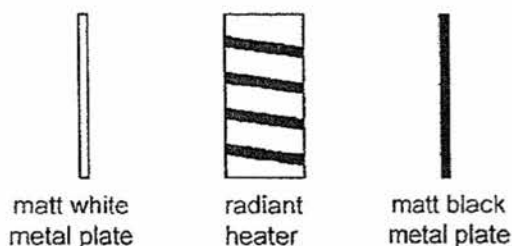
- A28 The diagram below shows a railway track with gaps between rail sections.



Which of the following is the purpose of having gaps between rail sections?

- A to increase space for contraction of the rail sections during cold weather
- B to allow the rail sections to vibrate when the train passes over
- C to enable rain water to drain off from the rail sections
- D to give space for expansion of the rail sections during hot weather

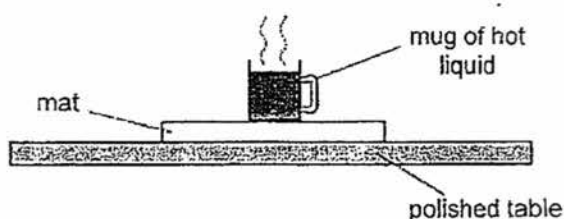
- A29 Two identical metal plates are painted one matt white, while the other matt black. The plates are placed at equal distances from a radiant heater as shown.



Which metal plate will absorb more energy and which metal plate will emit more energy?

	absorbs more	emits more
A	black	black
B	white	white
C	black	white
D	white	black

- A30 A mat may be placed on the polished table underneath a mug of hot liquid to protect the polished table from the high temperature.



Which of the following is a suitable material for the mat and why?

- A The mat should be made of rubber as it is a poor conductor of thermal energy.
- B The mat should be made of rubber as it is a poor radiator of thermal energy.
- C The mat should be made of metal as it is a good conductor of thermal energy.
- D The mat should be made of metal as it is a good radiator of thermal energy.

Section B [40 marks]

Answer all the questions in this section.

- B1 An unknown mixture containing white powder A and silvery-grey solid B was tested in the school laboratory with the procedures shown in Fig. B1.1.

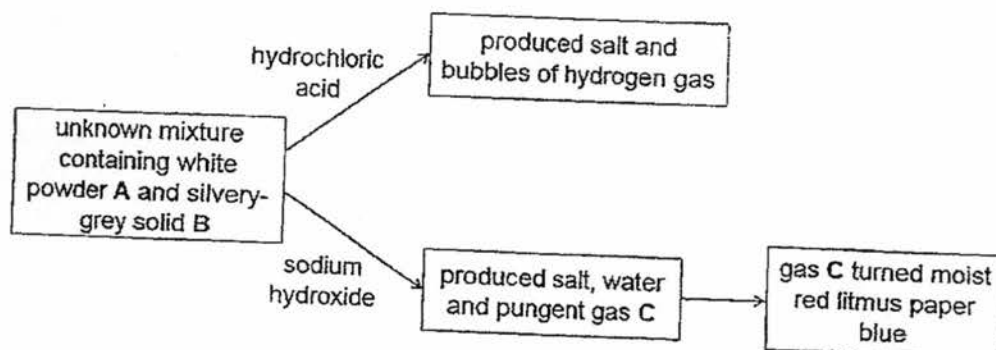


Fig. B1.1

- (a) Choose from the list below the best possible identity of each of the substances and explain your answer. [3]

copper sodium chloride zinc potassium carbon dioxide
 ammonia oxygen ammonium nitrate calcium carbonate

	substance	identity of substance	explanation
(i)	white powder A		
(ii)	silvery-grey solid B		
(iii)	gas C		

- (b) Write a balanced chemical equation for the reaction of white powder A and sodium hydroxide. [1]

- (c) Describe the confirmatory test for hydrogen gas. [2]

- (d) Hydrochloric acid found in the stomach is used to digest food. Indigestion is usually due to excess acid in the stomach, causing discomfort. Indigestion tablets, which is mainly made up of magnesium hydroxide, can be taken to ease the discomfort.

- (i) Write a balanced chemical equation for the reaction of hydrochloric acid [1] and magnesium hydroxide.

- (ii) Magnesium carbonate also reacts with hydrochloric acid. Suggest why [1] magnesium carbonate is not suitable to be used in indigestion tablets.

[Total: 8]

- B2 Table B2.1 shows the atomic number and nucleon number of six atoms of elements, represented by the letters P to U. The letters are not the symbols of the elements.

atom	P	Q	R	S	T	U
atomic number	2	7	7	10	13	19
nucleon number	4	14	15	20	27	39

Table. B2.1

Use the letters P to U to answer the following questions. You may use the letter once, more than once, or not at all.

- (a) State the atom(s) [4]

- (i) with a stable electronic configuration.

- (ii) which are metallic elements.

- (iii) with the same electronic configuration as a fluoride ion.

- (iv) which are isotopes.

- (b) State the electronic configuration and draw the electronic structure of atom R. [2]

Electronic configuration: _____

Electronic structure:

[Total: 6]

B3 A list of substances is given below.

aluminium	carbon dioxide	neon	steel
sodium nitrate	crude oil	ammonia	ammonium chloride

- (a) Each substance can be used once, more than once, or not at all. Name all of the above substances which [3]

(i) are mixtures.

(ii) are molecules.

(iii) are salts.

- (b) Complete the table below. [2]

substance	chemical formula	elements present	ratio
carbon monoxide	CO	carbon, oxygen	C:O = 1:1
sodium sulfate		sodium, sulfur, oxygen	
potassium manganate	KMnO ₄		

[Total: 5]

B4 The apparatus shown in the diagram was set up.

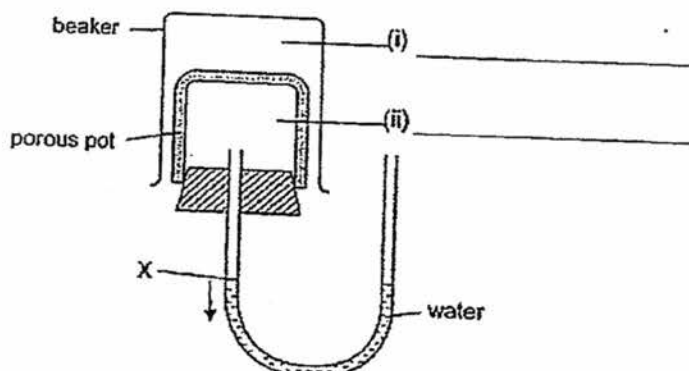


Fig. B4.1

- (a) Define *diffusion*. [1]

- (b) Label on Fig. B4.1, the two gases carbon dioxide, CO₂, and nitrogen, N₂ that should be filled in the (i) beaker and (ii) porous pot to cause the water level at X to fall. [1]

- (c) Explain how the gases in the set up causes the water level at X to fall. [2]

[Total: 4]

- B5 Fig. B5.1 shows a boy doing push-up. A force F_1 acts upwards on his hands, and a force F_2 acts upwards on his toes. The weight of the boy is 600 N and this force acts downwards from his stomach (centre of mass).

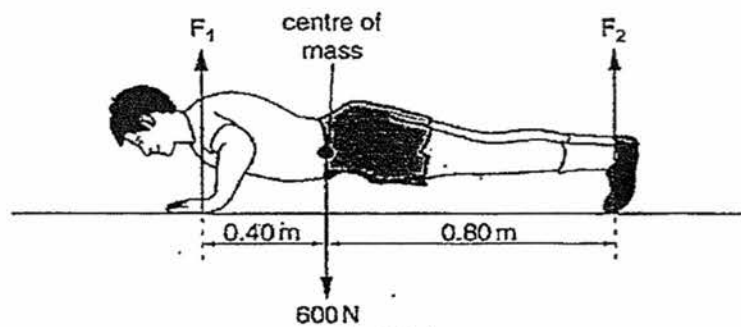


Fig. B5.1

- (a) At the position shown in Fig. B5.1, the boy is stationary. Taking his toes as the pivot,
- (i) calculate and state the direction of the moment of his weight about his toes. Show your working clearly.

moment = _____ [2]
 direction = _____

- (ii) Hence, determine the force F_1 . Show your working clearly.

force = _____ [2]

- (b) The boy pushes himself down by 10 cm. Calculate the work done by him in joules. State clearly the formula used.

work done = _____ [2]

[Total: 6]

- B6 Fig. B6.1 shows some meat placed on top of a barbeque pit.

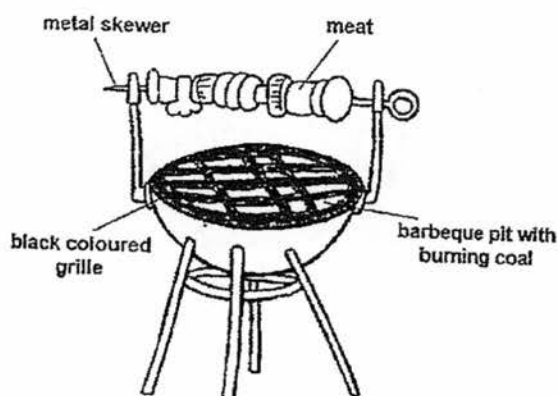
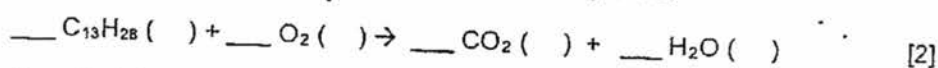


Fig. B6.1

- (a) Coal is mainly made up of a chemical substance with formula $C_{13}H_{28}$. When coal is burnt in oxygen, carbon dioxide and water vapour are produced. Balance the chemical equation and fill in the state symbols.



- (b) (i) Explain why the skewer is made of metal. [2]

- (ii) Explain how the set-up above allows thermal energy from the coal to be transferred to the meat through radiation. [1]

[Total: 5]

- B7 Fig. B7.1 shows some copper(II) sulfate crystals in a beaker of water that is being heated. After some time, the whole beaker of water turned dark blue.

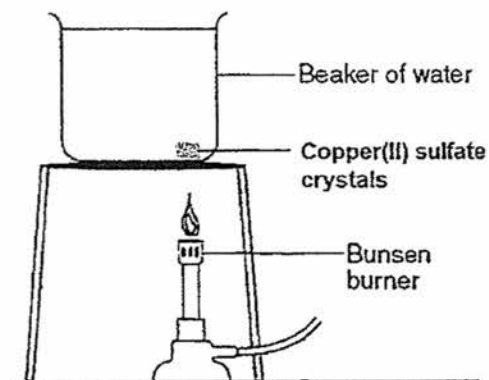


Fig. B7.1

- (a) (i) On Fig. B7.1, draw arrows to show the convection currents in the beaker. [1]
 (ii) Describe how the entire beaker of water gets heated up. [2]

- (b) Fig. B7.2 shows a graph of solubility of copper(II) sulfate per 100 mL of water against temperature / °C.

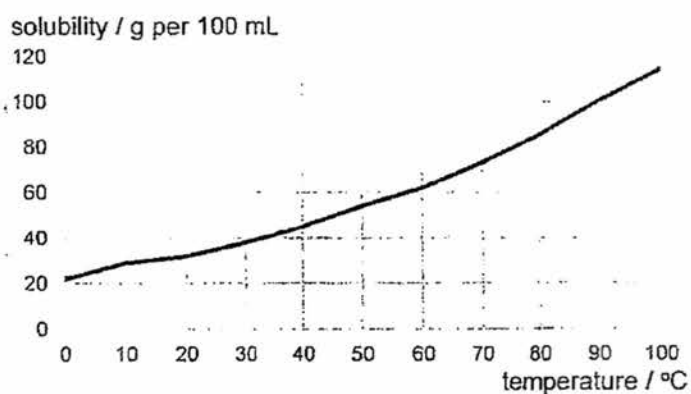


Fig. B7.2

- (i) State the solubility of copper(II) sulfate when the temperature is 90 °C. [1]
 (ii) Using the graph, describe how the solubility of copper(II) sulfate varies with temperature. [1]

- (iii) Other than temperature, state another factor which affects the solubility of copper(II) sulfate. [1]

[Total: 6]

Section C: Free Response Question [30 marks]

Answer all the questions in this section.

- C1 Table C1.1 shows some information of substances commonly used in food. Use the information to answer the questions that follow.

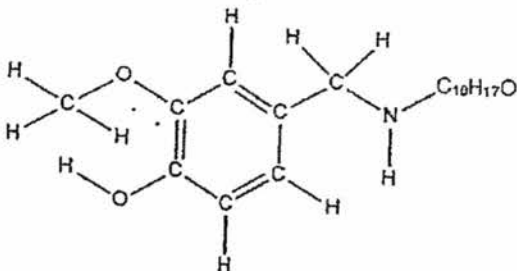
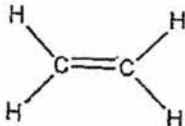
Substance	Uses and explanation
Baking powder	Baking powder contains sodium hydrogen carbonate (NaHCO_3). Upon heating, it decomposes to form solid sodium carbonate (Na_2CO_3), water vapour and carbon dioxide. Baking powder is added in bread and cake dough as the carbon dioxide produced will create holes in the dough, making it expand and fluffy.
Vinegar	Vinegar contains about 5 – 20% of acetic acid (CH_3COOH), water and some flavouring. It is often used in food preparation for extra flavour, to make pickles and to inhibit growth of bacteria. Fruit vinegars are also said to have health benefits such as weight loss and controlling diabetes.
Capsaicin	Capsaicin is the substance in chilli pepper that causes the burning sensation on the tongue. The nerve receptors on the tongue can detect very small amount of capsaicin. Capsaicin is insoluble in water but is soluble in milk and vegetable oil. The structure of capsaicin is shown below.  The diagram shows the chemical structure of capsaicin. It consists of a vanillyl group (a benzene ring with two methoxy groups and a hydroxyl group) attached to a propyl chain, which is further attached to a long aliphatic chain ending in a tertiary amine group ($\text{N}(\text{H})\text{C}_{10}\text{H}_{17}\text{O}$).
Ethene	Bananas turn brown after some time as it contains a hormone that triggers the release of ethene gas. Ethene gas speeds up the ripening process. The structure of ethene is shown below.  The diagram shows the chemical structure of ethene, which consists of two carbon atoms connected by a double bond, with each carbon atom also bonded to two hydrogen atoms.

Table. C1.1

- (a) (i) Write a balanced chemical equation with state symbols for the decomposition of sodium hydrogen carbonate upon heating. [2]
- _____
- _____
- (ii) Describe what will be observed when vinegar is added to sodium carbonate. [1]
- _____
- _____
- (iii) Describe a test which can confirm that vinegar is acidic and state the observation. [1]
- _____
- _____
- (b) A hydrocarbon is a compound which contains hydrogen and carbon only.
- (i) Explain what is meant by a *compound*. [1]
- _____
- _____
- (ii) State the chemical formula of capsaicin. [1]
- _____
- (iii) Between capsaicin and ethene, state and explain which is a hydrocarbon. [2]
- _____
- _____
- (iv) After eating a bowl of spicy curry, a student drank water to relieve the burning sensation but it did not help. [2]
Explain why water does not help to relieve the burn caused by capsaicin.
Suggest a method that will help to relieve the burn.
- _____
- _____
- _____

[Total: 10]

C2 Sodium chloride is an ionic compound with a melting point of 801°C . It is found in large quantities in seawater. Sodium chloride is often used as a preservative and flavouring in food products. It is essential to the normal functioning of the human body.

- (a) (i) Fig. C2.1 shows the crystal lattice structure of sodium chloride. By [1]
considering the number of electron shells of the ions in sodium chloride,
label the sodium ions and chloride ions in Fig. C2.1.

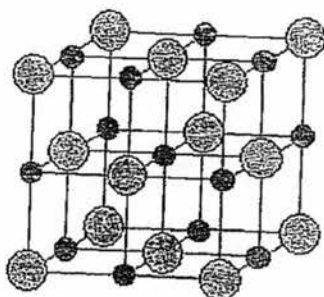


Fig. C2.1

- (ii) Sodium chloride can also be represented in terms of dot-and-cross diagram. Draw the dot-and-cross diagram for sodium chloride, showing [2]
only the valence electrons.

- (iii) Explain why sodium chloride has a high melting point. [2]

- (iv) Sodium chloride crystals are described as brittle. Explain why sodium [2]
chloride is brittle.

- (b) Sodium chloride is produced by evaporation of seawater under the sun. Fig. C2.2 shows a seawater evaporation pond.



Fig. C2.2

- (i) Using the Kinetic Particle Theory, describe what happens to the water molecules as the seawater is evaporated. [2]

- (ii) Describe how you will determine if the salt produced is pure sodium chloride. [1]

[Total: 10]

C3 The hydraulic brake system for a car is shown in Fig. C3.1.

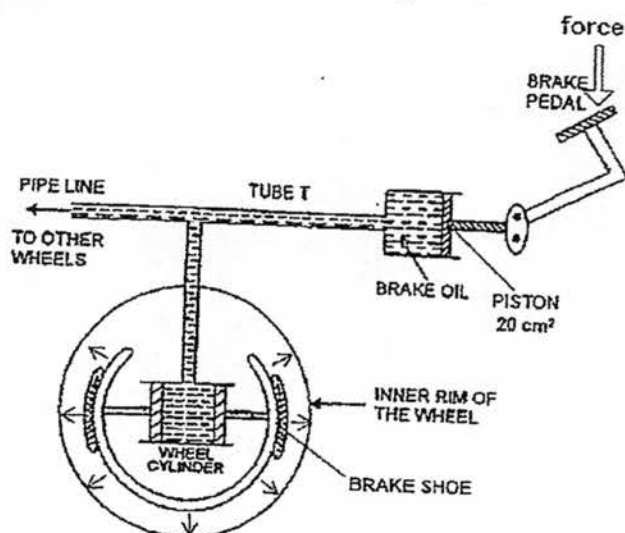


Fig. C3.1

When the pedal is stepped on, the force is transmitted to the piston, which causes the brake oil (fluid) to be displaced. The brake shoes are pushed outwards by the brake fluid and pressed against the inner rim of the car wheel. This results in the car slowing down and coming to a stop.

- (a) (i) State the property of a liquid which allows this brake system to work. [1]

- (ii) Explain this property in terms of the arrangement of the particles in a liquid. [1]

- (iii) Over time, the hydraulic brake system may have air bubbles in the brake fluid, causing the brake system to become less effective. Hence "bleeding", which means removing air bubbles in the brake fluid, must be done regularly. [2]

Explain, in terms of the arrangement of particles in air, why "bleeding" is necessary for the smooth operation of the hydraulic brake system.

- (b) Given that the cross-sectional area of the piston is 0.0020 m^2 , and a force of 80 N is applied by the driver on the brake pedal, calculate the pressure on the brake fluid in pascal.

pressure = _____ [2]

- (c) The force applied caused the piston to move by 10 cm , calculate the volume of brake fluid displaced.

volume = _____ [1]

- (d) The car has a mass of 1200 kg , and it was moving at a speed of 15 m/s . Calculate the kinetic energy possessed by the car, stating the formula used clearly.

kinetic energy = _____ [2]

- (e) In an emergency, the driver steps on the brake pedal causing the car to come to a stop with a screech. State the energy conversion in the car wheel when the brake is pressed, until the car comes to a stop. [1]

[Total: 10]

~ END OF PAPER ~

The Periodic Table of Elements

The Periodic Table of Elements

Group

I	II											III	IV	V	VI	VII	0
								</									

lanthanoids

actinoids

...^a volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

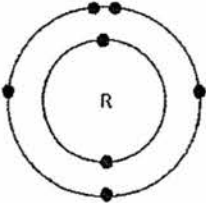
Fuhua Secondary School

Sec 2E Science End-of-year Exams 2017 Answer Key

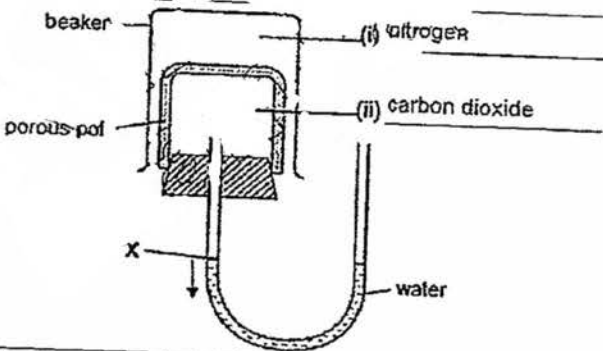
Section A [30 marks]

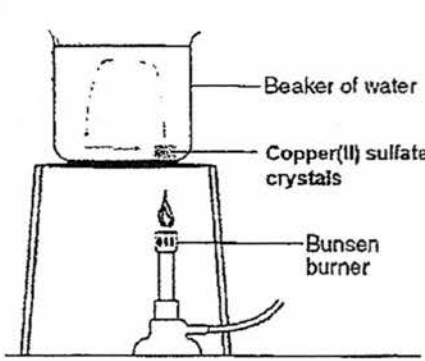
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
B	D	D	C	D	C	A	B	B	B
A11	A12	A13	A14	A15	A16	A17	A18	A19	A20
B	A	B	A	D	C	B	B	C	D
A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
A	B	B	B	C	B	C	D	A	A

Section B [40 marks]

B1	(a)	(i)	white powder A: ammonium nitrate as it reacts with sodium hydroxide to give ammonia gas	[3]
		(ii)	silvery-grey solid B: zinc as it is a metal, reacting with hydrochloric acid to give salt and hydrogen gas [R: potassium]	
		(iii)	gas C: ammonia as it is a pungent gas which is alkaline / turns moist red litmus blue 1m for each answer. If justification does not make sense at all, no mark is awarded.	
	(b)		$\text{NH}_4\text{NO}_3 + \text{NaOH} \rightarrow \text{NaNO}_3 + \text{H}_2\text{O} + \text{NH}_3$	[1]
	(c)		Place a lighted splint at the mouth of the test tube [1], lighted splint extinguish / goes off with a "pop" sound [1]	[2]
	(d)	(i)	$2\text{HCl} + \text{Mg}(\text{OH})_2 \rightarrow \text{MgCl}_2 + 2\text{H}_2\text{O}$	[1]
		(ii)	Magnesium carbonate produces carbon dioxide gas when reacting with hydrochloric acid, which may cause patient to feel bloated or uncomfortable.	[1]
				[Total: 8]
B2	(a)	(i)	atom(s) with a stable electronic configuration. P and S	[1]
		(ii)	atom(s) which are metallic elements. T and	[1]
		(iii)	atoms(s) with the same electronic configuration as a fluoride ion (F^-). S	[1]
		(ii)	atoms(s) which are isotopes. Q and R	[1]
	(b)		electronic structure of atom R  electronic configuration: 2,5 [1] diagram [1] electronic configuration	[2]
				[Total: 6]

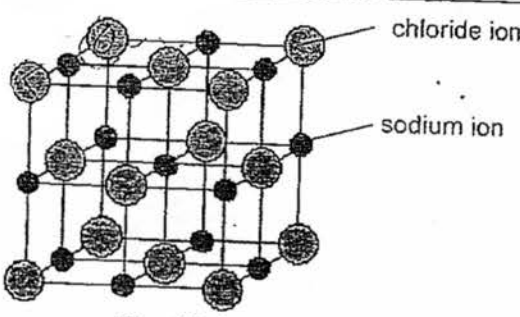
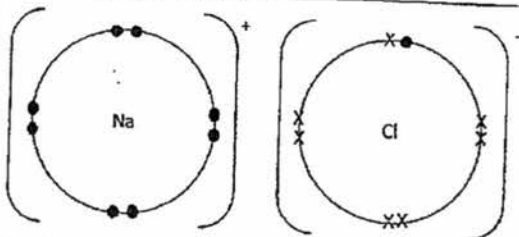
B3	(a)	Each substance can be used once, more than once, or not at all. Name all of the above substances which	[3]																
	(i)	Is/are a mixture(s). crude oil, steel																	
	(ii)	is/are molecules(s). carbon dioxide, ammonia																	
	(iii)	is/are a salt(s). Sodium nitrate, ammonium chloride																	
	(b)	Complete the table below.	[2]																
<table border="1"> <thead> <tr> <th>substance</th><th>chemical formula</th><th>elements present</th><th>ratio</th></tr> </thead> <tbody> <tr> <td>carbon monoxide</td><td>CO</td><td>carbon, oxygen</td><td>C:O = 1:1</td></tr> <tr> <td>sodium sulfate</td><td>Na₂SO₄</td><td>sodium, sulfur, oxygen</td><td>Na:S:O = 2:1:4</td></tr> <tr> <td>potassium manganate</td><td>KMnO₄</td><td>Potassium, manganese oxygen</td><td>K:Mn:O = 1:1:4</td></tr> </tbody> </table>				substance	chemical formula	elements present	ratio	carbon monoxide	CO	carbon, oxygen	C:O = 1:1	sodium sulfate	Na ₂ SO ₄	sodium, sulfur, oxygen	Na:S:O = 2:1:4	potassium manganate	KMnO ₄	Potassium, manganese oxygen	K:Mn:O = 1:1:4
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		2 – 3 correct [1] All correct [1]																	
			[Total: 5]																

B4	(a)	Diffusion is the net movement of particles from a region of higher concentration to a region of lower concentration.	[1]
	(b)		[1]
	(c)	As <u>nitrogen</u> has a lower relative molecular mass ($M_r = 28$) than carbon dioxide ($M_r = 44$), <u>nitrogen diffuses into the porous pot faster than carbon dioxide diffuses out</u> [1] of the porous pot. The <u>increase in number of gas molecules in the porous pot increases the pressure</u> [1] in the pot, pushing down the water level at X.	[2]
			[Total: 4]

B5	(a)	(i)	Moment = $F \times d$ = 600×0.80 = 480 Nm [1] (anti-clockwise) [1]	[2]
		(ii)	Sum of clockwise moment = sum of anti-clockwise moment $F_1 \times 1.2 = 480$ [1] $F_1 = 400 \text{ N}$ [1] e.c.f of 2m is allowed if (i) is wrong.	[2]
	(b)		Work done = $F \times d$ [1] = 600×0.10 = 60 J [1]	[2]
				[Total: 6]
B6	(a)		$\text{C}_{13}\text{H}_{28} (\text{s}) + \underline{20} \text{ O}_2 (\text{g}) \rightarrow \underline{13} \text{ CO}_2 (\text{g}) + \underline{14} \text{ H}_2\text{O} (\text{g})$ [2] 1m for balancing 1m for correct state symbols	
	(b)	(i)	Metal is a good conductor of heat [1] it will allow the heat from the burning coal to be transferred/conducted quickly [1] to cook the meat.	[2]
		(ii)	The grille is black which is a good absorber and emitter of thermal radiation [1]. It will absorb thermal energy from the coal quickly and emit it to cook the meat.	[1]
				[Total: 5]
B7	(a)	(i)	On Fig. B7.1 draw arrows to show the convection currents in the beaker. Direction and starting position of arrows should be correct to get 1m	[1]
 Beaker of water Copper(II) sulfate crystals Bunsen burner				
		(ii)	The water near the Bunsen burner gets <u>heated up, expands, become less dense and rises</u> [1m]. This causes the <u>cooler water at the top to sink</u> down to replace the water. The process repeats, forming convection currents. [1m]	[2]
	(b)	(i)	100 g/100 mL OR 1g/mL no units or wrong units – 0	[1]
		(ii)	The solubility of copper(II) sulfate increases with increasing temperature.	[1]
		(iii)	The type of solvent used.	[1]

Section C: Free Response Question [30 marks]

[Total: 6]

C1	(a)	(i)	$2\text{NaHCO}_3(\text{s}) \rightarrow \text{Na}_2\text{CO}_3(\text{s}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{g})$ 1m – balanced equation 1m – correct state symbols	[2]
		(ii)	<u>Effervescence / bubbles</u> will be observed, as carbon dioxide gas is produced. Reject a gas is observed.	[1]
		(iii)	Put a piece of (moist) <u>blue litmus paper</u> into vinegar, it will <u>turn red</u> . Add <u>universal indicator</u> to vinegar, it will turn <u>orange/red</u> . Use a <u>pH meter</u> to measure the pH of vinegar, it will be <u>less than 7</u> . Any other acceptable test to show that vinegar is an <u>acid</u> . Reject: use litmus paper/universal indicator/pH meter without stating result.	[1]
	(b)	(i)	A compound is a <u>pure substance made up of two or more elements</u> chemically combined in a <u>fixed ratio</u> .	[1]
		(ii)	$\text{C}_{16}\text{H}_{27}\text{O}_3\text{N}$ The order of chemical symbols is not penalised.	[1]
		(iii)	Ethene is a hydrocarbon as it consists of only carbon and hydrogen atoms.	[2]
		(iv)	Capsaicin is insoluble in water [1]. He should drink milk or vegetable oil to relieve the burn. [1]	[2]
[Total: 10]				
C2	(a)	(i)	 chloride ion sodium ion Fig. C2.1	[1]
		(ii)	 1m for sodium 1m for chloride	[2]

		(iii)	Strong electrostatic forces of attraction hold the sodium cations and chloride anions (oppositely-charged ions) [1] together in a giant ionic crystal lattice structure. A large amount of energy is required [1] to overcome the forces of attraction, hence it has a high melting point.	[2]
		(iv)	When a large force is applied, the layers of ions can slide [1]. This causes ions of like charges to come into direct contact / near each other, experiencing repulsion. [1]	[2]
	(b)	(i)	The more energetic molecules on the surface of the seawater overcome the attractive forces [1] of other water molecules and escape from the seawater into the atmosphere. The less energetic molecules are left behind OR the particles change from sliding over one another to moving randomly at high speed [1]	[2]
		(ii)	Test the melting point of the salt, if it melts at 801°C the salt is pure sodium chloride.	[1]
				[Total: 10]
C3.	(a)	(i)	Liquid cannot be compressed / liquid has fixed volume	[1]
		(ii)	Liquid particles are closely packed.	[1]
		(iii)	Air particles are far apart from one another hence all can be compressed . [1] If "bleeding" is not done the amount of brake fluid displaced will be lesser and the brake shoe will not move out as much to stop the wheel. [1]	[2]
	(b)		$P = F/A$ $= 80 / (0.0020) [1]$ $= 40\,000 \text{ Pa} [1]$	[2]
	(c)		$\text{Volume} = 20 \times 10$ $= 200 \text{ cm}^3$	[1]
	(d)		$KE = \frac{1}{2} mv^2 [1]$ $= \frac{1}{2} \times 1200 \times 15^2$ $= 135\,000 \text{ J} [1]$ if any of the calculation questions do not contain statement or formula, only pure numbers, -1 from either (b), (c), (d) question for poor presentation, provided student got the question correct.	[2]
	(e)		Kinetic energy converted to thermal and sound energy.	[1]
				[Total: 10]