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Paya Lebar Methodist Girls' School (Secondary)
Preliminary 2 Examination 2014
Secondary 4 Express

CANDIDATE
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INDEX NUMBER

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CHEMISTRY

5073/01

Paper 1 Multiple Choice

30 July 2014 (Wednesday)

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on 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 Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 2.

The use of an approved scientific calculator is expected, where appropriate.

The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
																	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	98 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	210 Po polonium 84	210 At astatine 85	222 Rn radon 86
Fr francium 87	Ra radium 88	Ac actinium 89															

*58-71 Lanthanoid series

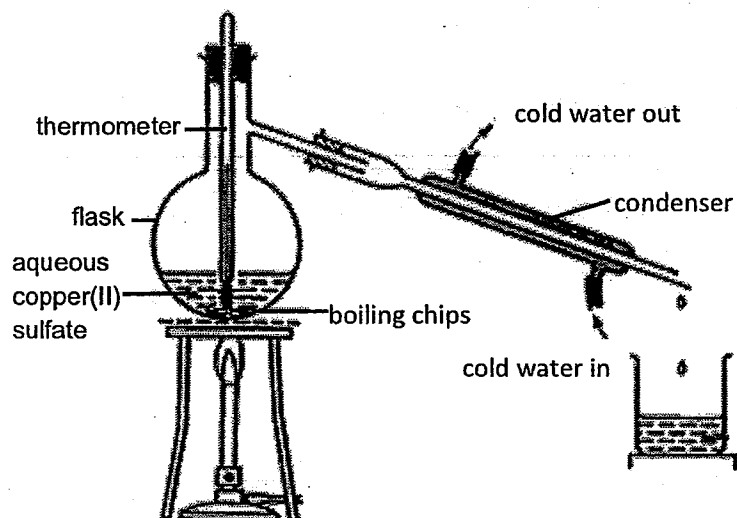
†90-103 Actinoid series

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

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	147 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	234 Pa protactinium 91	238 U uranium 92	237 Np neptunium 93	244 Pu plutonium 94	247 Am americium 95	251 Cm curium 96	259 Bk berkelium 97	261 Cf californium 98	265 Es einsteinium 99	267 Fm fermium 100	271 Md mendelevium 101	277 No nobelium 102	289 Lr lawrencium 103

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

- 1 An aqueous solution of copper(II) sulfate is distilled.



At which temperature does the aqueous solution of copper(II) sulfate begin to boil if the thermometer is dipped into the solution, and what is left in the distillation flask?

	temperature at which solution begins to boil if thermometer is dipped into solution	final contents of distillation flask
A	96 °C	blue residue
B	99 °C	white residue
C	100 °C	no residue
D	105 °C	white residue

- 2 Hexane and water are immiscible liquids.

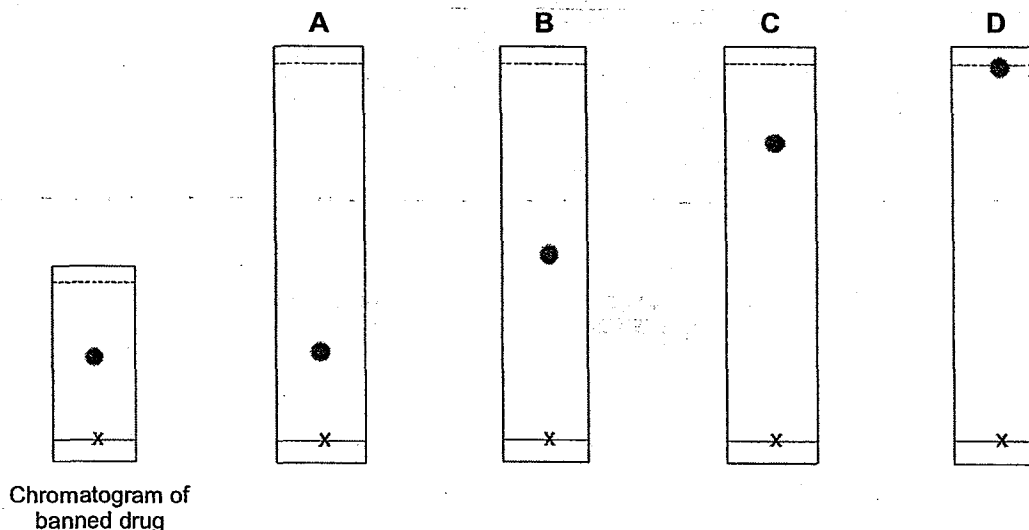
Which method could be used to separate a mixture of hexane and water and how is the purity of hexane determined after the separation?

	method of separation	purity check
A	filtration	determine the boiling point
B	distillation	obtain a chromatography
C	use a separating funnel	determine the boiling point
D	use a separating funnel	obtain a chromatography

- 3 The diagram shows a chromatogram for a drug that is banned for use by athletes.

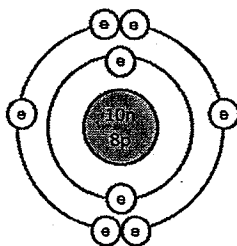
A second chromatogram is conducted on the same drug using the same solvent on a longer sheet of paper.

Which chromatogram shows the correct results?

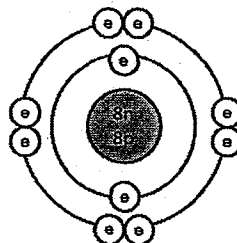


- 4 The diagrams below show the electronic structures of two particles of the **same** element.

particle X



particle Y



key

e electrons

n neutrons

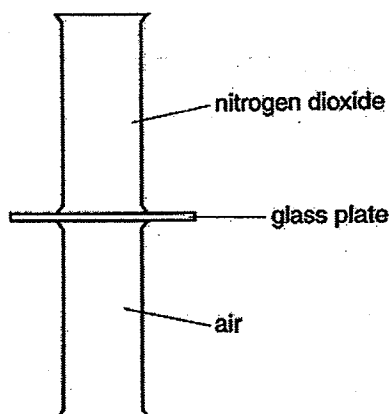
p protons

Which of the following shows the correct identities of particle X and particle Y?

	particle X	particle Y
A	isotope of oxygen	ion of oxygen
B	ion of oxygen	isotope of oxygen
C	ion of neon	ion of oxygen
D	isotope of neon	atom of neon

- 5 Nitrogen dioxide is a dark brown gas and its relative molecular mass is 46.

A gas jar containing nitrogen dioxide is sealed with a glass plate and is then inverted on top of a gas jar containing air.



The glass plate is removed.

Which of the following correctly describes the colours inside the gas jar after a long period of time and the reason for the observation?

	upper gas jar	lower gas jar	reason for the observation
A	brown	brown	Nitrogen dioxide and air diffuse evenly through both gas jars.
B	colourless	dark brown	Nitrogen dioxide sinks into the lower gas jar while air rises into the upper gas jar.
C	dark brown	light brown	Some nitrogen dioxide diffuses slowly into the lower gas jar as gas particles move slowly.
D	light brown	dark brown	Nitrogen dioxide and air diffuse through both gas jars, but nitrogen dioxide is heavier so more molecules sink into the lower jar.

- 6 The melting point of sodium chloride is much lower than the melting point of magnesium oxide.

Which statement explains this?

- A** Sodium is more reactive than magnesium.
- B** The melting point of sodium is lower than that of magnesium.
- C** A chloride ion has more protons than an oxide ion.
- D** The attraction between Na^+ and Cl^- is weaker than that between Mg^{2+} and O^{2-} .

7 Element Q has an electronic structure 2,4.

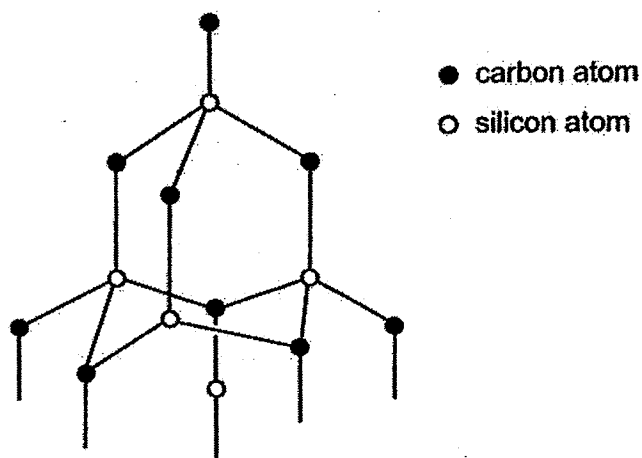
Element R has an electronic structure 2,8,6.

Element Q reacts with element R to form a new compound.

Which of the following correctly shows how element Q reacts with element R and the mass of 1 mole of the new compound formed?

	Reaction between Q and R	mass of 1 mole of new compound / g
A	two electrons are shared between an atom of Q and an atom of R	76
B	four electrons are shared between an atom of Q and an atom of R	38
C	four electrons are shared between an atom of Q and an atom of R	76
D	two electrons are transferred from an atom of Q to an atom of R	76

8 The diagram shows the structure of silicon carbide, $(\text{SiC})_n$.



Which set of properties does silicon carbide have?

	physical property	products of combustion of $(\text{SiC})_n$
A	acts as a lubricant	a solid residue only
B	insoluble in water	a colourless gas only
C	conducts electricity	a solid residue and a colourless gas
D	high melting point	a solid residue and a colourless gas

- 9 The properties of W, X, Y and Z are shown in the table.

property	W	X	Y	Z
melting point (°C)	1728	-183	114	approx. 3500
boiling point (°C)	2230	-162	184	approx. 4800
electrical conductivity	no	no	no	yes

What are the correct identities of W, X, Y and Z?

	methane	silicon dioxide	iodine	graphite
A	W	X	Y	Z
B	X	W	Y	Z
C	Y	Z	W	X
D	Z	W	X	Y

- 10 Metals have positive ions in a 'sea of delocalised electrons'.

Which metal atom provides the most number of moles of electrons for the 'sea'?

- A aluminium
- B copper
- C magnesium
- D sodium

- 11 In the extraction of sodium by electrolysis of molten sodium oxide, 57.5 g of sodium is collected at the cathode.

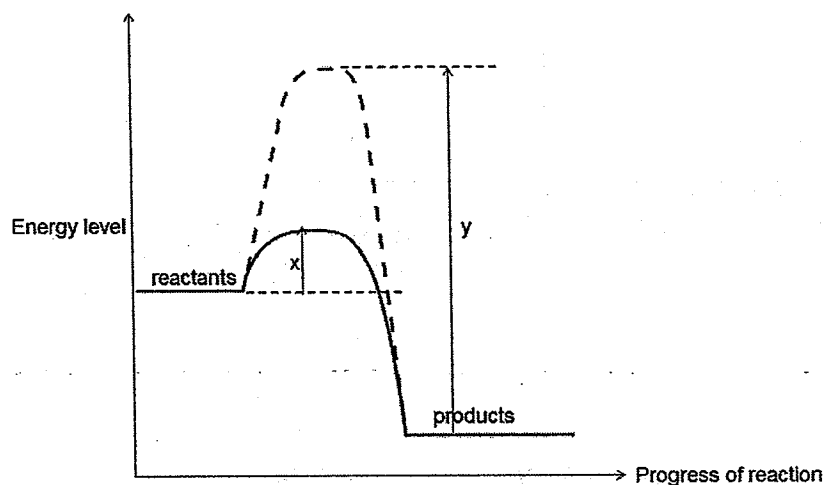
What is the volume of oxygen gas formed at the anode?

- A 15 dm³ B 30 dm³ C 60 dm³ D 90 dm³

- 12 Which substance would give a neutral solution when added to 25 cm³ of 0.2 mol/dm³ phosphoric acid, H₃PO₄?

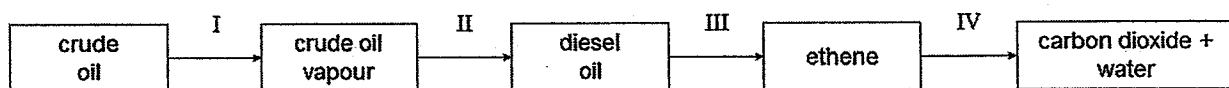
- A 10 cm³ of 1.0 mol/dm³ sodium hydroxide
- B 30 cm³ of 1.0 mol/dm³ sodium hydroxide
- C 30 cm³ of 0.5 mol/dm³ sodium hydroxide
- D 20 cm³ of 0.5 mol/dm³ sodium hydroxide

- 13 The energy profile diagram for a chemical reaction is shown.



Which statement/s is/are correct?

- 1 The number of bonds formed is greater than the number of bonds broken.
 - 2 The value of x shows the activation energy in the presence of a catalyst.
 - 3 The value of y shows the overall enthalpy change.
 - 4 The total energy change in bond formation is greater than that in bond breaking.
- A 1 and 2 only
B 1 and 3 only
C 2 and 4 only
D 1, 2 and 3 only
- 14 The scheme shows four stages, I to IV, by which crude oil is purified and eventually converted to carbon dioxide and water.



Which stages are exothermic?

- A I and II only
B II and IV only
C I, II and IV only
D All of the stages

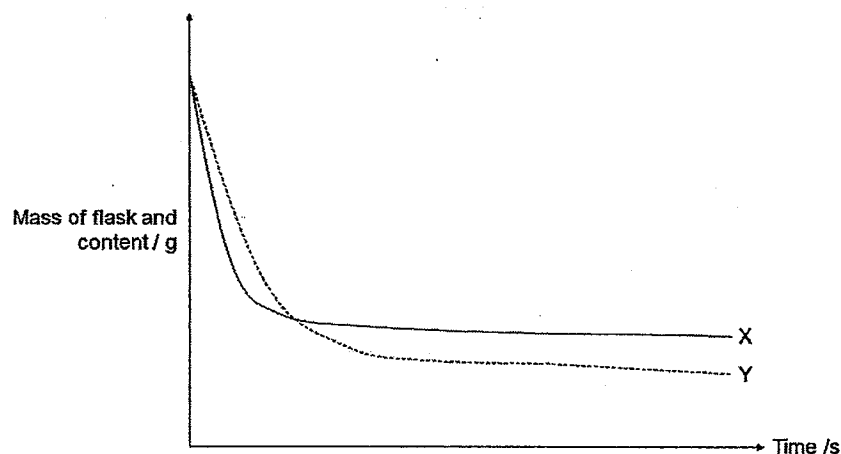
- 15 The list shows reactions in which copper(II) sulfate is either a reactant or a product.

1	addition of iron metal to aqueous copper(II) sulfate
2	addition of aqueous copper(II) sulfate to aqueous ammonium carbonate
3	electrolysis of aqueous copper(II) sulfate using copper electrodes
4	formation of copper(II) sulfate from copper(II) oxide

In which reactions are there **no** changes in the oxidation state of copper?

- A 1 and 3 only
 B 2 and 4 only
 C 2 and 3 only
 D 3 and 4 only
- 16 Excess zinc reacts with 20 cm³ of 0.1 mol/dm³ nitric acid to give off hydrogen gas.

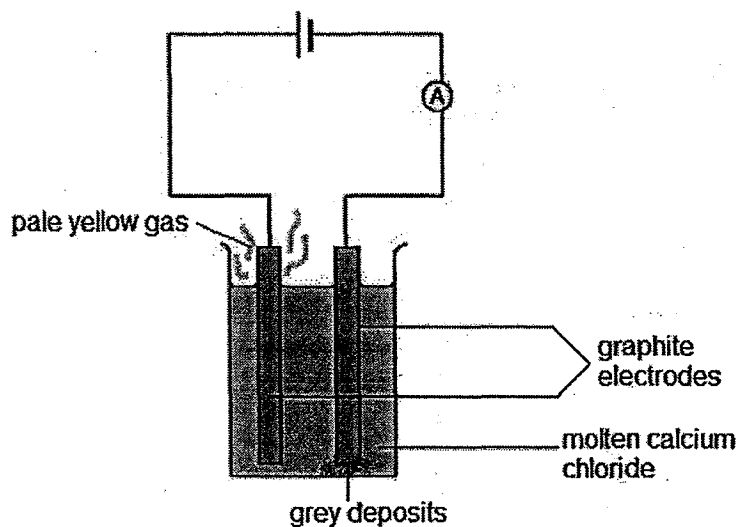
The mass of the flask and its content against time was plotted as shown by curve X in the graph below.



Which set of conditions will result in a change in the graph shown by curve Y?

	metal	acid
A	iron	15 cm ³ of 0.1 mol/dm ³ nitric acid
B	iron	25 cm ³ of 0.1 mol/dm ³ nitric acid
C	magnesium	20 cm ³ of 0.1 mol/dm ³ nitric acid
D	magnesium	25 cm ³ of 0.1 mol/dm ³ nitric acid

- 17 Which product is formed at the anode when concentrated aqueous lead(II) bromide is electrolysed?
- A lead atoms
B hydrogen molecules
C oxygen molecules
D bromine molecules
- 18 The diagram shows the electrolysis of molten calcium chloride.



The following students make conclusions about what happened during electrolysis.

Matthew: Calcium is oxidised.

Jewel: The pale yellow gas and grey deposits are new elements formed.

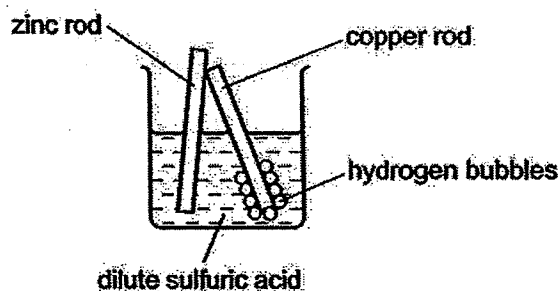
Jonah: The overall equation is $\text{Ca}^{2+} + 2\text{Cl}^- \rightarrow \text{CaCl}_2$

Who is/are correct?

- A Jewel only
B Jonah only
C Matthew and Jewel
D Jewel and Jonah

- 19 In an experiment, rods of copper and zinc are dipped into dilute sulfuric acid, with their top ends touching.

Hydrogen bubbles collect around the copper rod.



- Which statement about the experiment is correct?
- A Copper reacts with the acid.
 - B Protective layer prevents zinc from reacting with acid.
 - C Electrons flow from zinc to copper.
 - D The zinc becomes coated with copper.
- 20 Fertilisers can be manufactured on a large scale using the Haber process.
- The reaction can be represented by the equation below.
- $$\text{N}_2 (\text{g}) + 3\text{H}_2 (\text{g}) \leftrightarrow 2\text{NH}_3 (\text{g}) \quad \Delta H = -92 \text{ kJ/mol}$$
- Which of the following statement is correct?
- A Using iron as a catalyst increases the yield of ammonia.
 - B An increase in temperature will increase the rate and yield of the forward reaction.
 - C 115 kJ of energy is given off when 30 dm³ of nitrogen gas is used.
 - D The ammonia produced is separated from the unreacted hydrogen and nitrogen by fractional distillation.
- 21 Which of the following reagents could be used to distinguish between potassium sulfate and sodium chloride?
- A hydrochloric acid
 - B aqueous ammonia
 - C aqueous lead(II) nitrate
 - D aqueous barium nitrate

- 22 One mole of compound R gives two moles of ions in an aqueous solution. R reacts with ammonium carbonate to give an alkaline gas.

What is compound R?

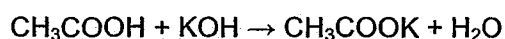
- A calcium hydroxide
- B ethanoic acid
- C sodium hydroxide
- D sulfuric acid

- 23 Which statement/s is/are true about hydrogen chloride?

- 1 It reacts with magnesium to give off hydrogen gas when dissolved in dry methylbenzene.
- 2 It dissociates partially into ions when bubbled into distilled water.
- 3 It turns moist blue litmus paper red.

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

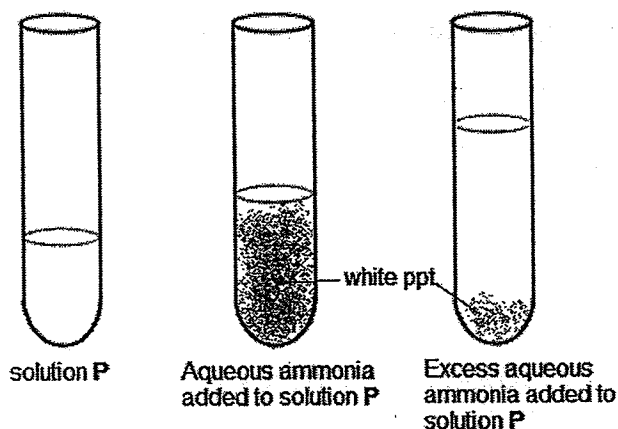
- 24 Potassium ethanoate, CH_3COOK , can be prepared by mixing ethanoic acid and potassium hydroxide.



Which of the following shows the correct mixture to form the salt, CH_3COOK ?

	ethanoic acid	potassium hydroxide
A	15 cm ³ of 1 mol/dm ³ CH_3COOH	15 cm ³ of 0.5 mol/dm ³ KOH
B	25 cm ³ of 1 mol/dm ³ CH_3COOH	30 cm ³ of 0.5 mol/dm ³ KOH
C	10 cm ³ of 2 mol/dm ³ CH_3COOH	25 cm ³ of 1 mol/dm ³ KOH
D	20 cm ³ of 2 mol/dm ³ CH_3COOH	40 cm ³ of 1 mol/dm ³ KOH

- 25 Solution P contains a cation of a metal M and aqueous ammonia was added to it. The results are seen below.



Which of the following is correct about metal M?

	when reacted with oxygen	when dropped into aqueous lead(II) nitrate
A	forms a basic oxide	no visible reaction
B	forms an amphoteric oxide	no visible reaction
C	forms a basic oxide	grey deposits formed
D	forms an amphoteric oxide	grey deposits formed

- 26 Which statement describes the changes in the element from left to right across a period of the Periodic Table?
- A The ability to conduct electricity decreases.
 - B The ability to gain electrons decreases.
 - C The elements form acidic to basic oxides.
 - D The number of neutrons in an atom decreases.
- 27 Which statement about groups in the Periodic Table is correct?
- A All groups contain both metals and non-metals.
 - B Atoms of elements in the same group have the same total number of electrons.
 - C In Group I, reactivity decreases with increasing proton number.
 - D In Group VII, the melting point of the elements increases with proton number.

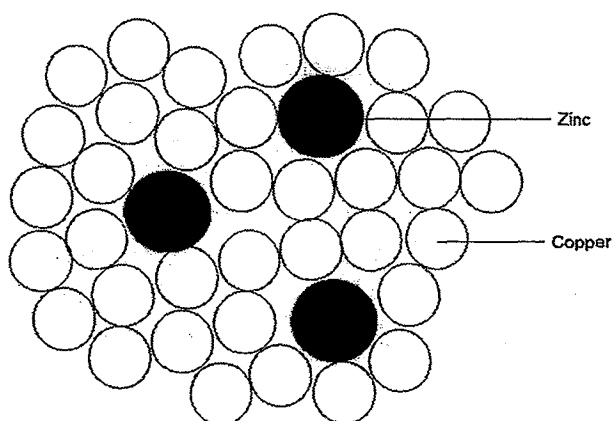
28 X, Y and Z are in the same period of the Periodic Table.

X is used to fill light bulbs. Y floats and reacts violently with water. Z gives a brown solution when reacted with potassium iodide.

What is the order of these three elements across the Periodic Table?

- A XYZ
- B YZX
- C YXZ
- D ZYX

29 The diagram shows the structure of brass.



Why is brass harder than pure copper?

- A The zinc atoms form strong electrostatic bonds with copper atoms.
- B There are fewer zinc atoms than copper atoms.
- C The zinc atoms prevent the layers of copper atoms from slipping over each other easily.
- D Zinc atoms contribute more electrons to the 'sea of delocalised electrons'.

30 How does the mass of a sample of copper(I) oxide change when it is heated in hydrogen and in oxygen?

	mass after heating in hydrogen	mass after heating in oxygen
A	unchanged	increases
B	unchanged	unchanged
C	decreases	increases
D	decreases	unchanged

31 Which metal carbonate decomposes on heating to give a yellow solid when hot and a white solid when cold?

- A** aluminium carbonate
- B** iron(III) carbonate
- C** lead(II) carbonate
- D** zinc carbonate

32 The table below shows the observations when three different metals, P, Q and R are reacted with hydrochloric acid and water.

Experiment	P	Q	R
Metal + hydrochloric acid	Effervescence	No effervescence	Effervescence
Metal + water	No effervescence	No effervescence	Effervescence

Which of the following statement about the three metals is correct?

- A** Metal P can be extracted by electrolysis of an aqueous solution of its salt.
- B** Metal R can be extracted by electrolysis of its molten ore.
- C** Metal P can be obtained easily by heating its ore with metal Q.
- D** Metal Q can displace both metal P and R from aqueous solution of their salts.

33 Which of the following statements about the extraction of iron are correct?

- 1 Carbon monoxide acts as the reducing agent.
- 2 Limestone is added to remove basic impurities.
- 3 Iron floats on top of slag when they are collected at the bottom of the Blast Furnace.

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

- 34 Sulfur dioxide is an air pollutant that causes acid rain.

Which of the following about sulfur dioxide is correct?

	source of sulfur dioxide	use of sulfur dioxide
A	combustion of fossil fuels	in car batteries
B	photochemical activities	as food preservative
C	volcanic eruptions	in the manufacture of fertilisers
D	volcanic eruptions	as food preservative

- 35 The table shows the composition of four different types of petroleum (crude oil).

fraction	Types of petroleum			
	Arabian Light / %	Iranian Light / %	South Sea / %	North Sea / %
Gasoline	18	23	21	23
Naphtha	11.5	18	13	24
Diesel oil	18	35	20	15
Bitumen	52.5	24	46	38

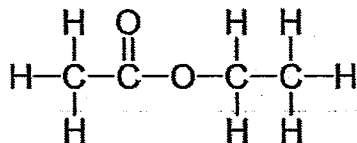
Which type of petroleum produces the most pollution due to combustion of fossil fuels in vehicles?

- A Arabian Light
B Iranian Light
C South Sea
D North Sea
- 36 How many different alcohols have the molecular formula C_4H_9OH ?
A 2 B 3 C 4 D 5
- 37 1 mole of ethane reacts with 2 moles of chlorine in the presence of UV light.

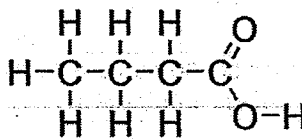
What is the formula of the organic product in this reaction?

- A C_2H_5Cl
B $C_2H_4Cl_2$
C $C_2H_2Cl_4$
D $C_2H_2Cl_2$

- 38 Which of the following reagents cannot be used to distinguish between compound P and compound Q?

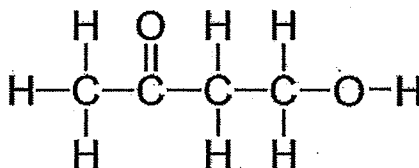


compound P



compound Q

- A aqueous bromine
 - B aluminium metal
 - C sodium carbonate
 - D methyl orange
- 39 An organic compound has the structure as shown below.



- Which of the following about the compound is correct?
- A It decolourises aqueous bromine.
 - B It decolourises acidified potassium manganate(VII).
 - C It oxidises potassium iodide and causes the solution to turn brown.
 - D It undergoes condensation polymerisation on its own.
- 40 Which of the following monomers cannot form polymers with itself?
- A $\text{CH}_3\text{CHOHCOOH}$
 - B $\text{CH}_2=\text{CHCOOCH}_3$
 - C $\text{CH}_3\text{CHNH}_2\text{COOH}$
 - D $\text{HOOCCH}_2\text{COOH}$

Answer for Pure Chemistry Prelim 2 2014

QN	ANS	EXPLANATION
1	D	Temperature of the solution will be higher than 100 °C as it is near to the heat source. When water is removed by distillation, the copper(II) sulfate will eventually become the anhydrous form, which is a white solid.
2	C	Immiscible liquids are separated by separating funnel. As hexane is colourless, the spot on the chromatogram may not be obvious. Determining the boiling point will be a better method to determine its purity.
3	B	The R_f value of the same substance remains the same regardless of the length of the paper if the same solvent is used to carry out the chromatography.
4	A	The element is oxygen as the proton number is 8. X is the isotope as it has different number of neutrons as compared to an oxygen atom. Y is an ion as it has gained 2 electrons.
5	A	Nitrogen dioxide is heavier than nitrogen in air, it moves faster to fill the bottom jar. However after some time, the concentration of gases in both jars will even out.
6	D	Since the attraction is weaker, the amount of energy needed to overcome the attraction will be lesser. This will result in a lower melting point for sodium chloride.
7	C	Q and R will form covalent compound as both are non-metals. Q needs to form 4 bonds while R needs to form 2 bonds to achieve the stable electronic configuration. Hence they will form the compound, QR_2 , with Q forming a double bond with each R (4 electrons). Mass of 1 mole of $QR_2 = 12+32+32 = 76$
8	D	Silicon carbide will undergo thermal oxidation to form SiO_2 (solid) and CO_2 (gas). It is also insoluble in water, has high melting point and does not conduct electricity.
9	B	W and Z have high melting and boiling points hence they have giant molecular structures. But since only Z conducts electricity, Z is graphite and W is silicon dioxide. X and Y have low melting and boiling points hence they have simple molecular structures. But as iodine is a bigger molecule with larger surface area for contact, it will have a higher melting and boiling point. Hence X is methane and Y is iodine.
10	A	Aluminium forms a charge of +3, so it loses 3 electrons to the 'sea', which is more than the 2 electrons for copper and magnesium and 1 electron for sodium.
11	A	No of moles of sodium = $57.5 / 23 = 2.5$ $Na^+(aq) + e \rightarrow Na(s)$ $2O^{2-}(aq) \rightarrow O_2(g) + 4e$ no of moles of electrons = 2.5 no of moles of oxygen gas = $2.5/4 = 0.625$ Volume of oxygen gas = $0.625 \times 24 = 15dm^3$
12	C	no of moles of $H_3PO_4 = 25/1000 \times 0.2 = 0.005$ no of moles of NaOH needed = $0.015 (30/1000 \times 0.5)$
13	C	It is an exothermic reaction, hence the total amount of energy given off during bond formation is greater than the total amount of energy absorbed during bond breaking. Catalyst provides an alternative pathway with lower activation energy, hence X shows the lowered activation energy.
14	B	I – evaporation, endothermic. II – condensation, exothermic. III – cracking, endothermic. IV – combustion, exothermic
15	B	In 1, copper is reduced from Cu^{2+} to Cu. In 3, copper is oxidised at the anode and reduced at the cathode. In 2 and 4, copper's oxidation state remains as +2.
16	B	The reaction is slower, hence a less reactive metal is used. The amount of product formed is greater as seen from the greater loss in mass, hence more limiting reagent is used.
17	D	Bromide ions are attracted to the anode and discharged as bromine molecules.
18	A	Calcium ions are reduced to calcium metal. Chlorine gas and calcium metal formed are elements. Overall equation gives Ca and Cl_2 as products.
19	C	Zinc is more reactive, hence it loses electrons which flows to copper.
20	C	no of moles of $N_2 = 30 / 24 = 1.25$ Amount of energy given off = $1.25 \times 92 = 115 \text{ kJ}$

21	D	Barium sulfate is a white precipitate while barium chloride is soluble and gives a colourless solution.
22	C	R is an alkali as it gives ammonia when reacted with ammonium carbonate. 1 sodium hydroxide dissociates to give 2 ions, Na^+ and OH^- .
23	B	Hydrogen chloride must dissolve in water in order to react like an acid and it dissociates completely in water. Hence statement 1 and 2 are wrong. Being an acidic gas, it turns moist blue litmus paper red.
24	D	Potassium ethanoate is a soluble salt with soluble starting materials, hence it is prepared by titration. Exact amount of both starting materials are needed.
25	D	M is zinc, hence it forms an amphoteric oxide. It will also displace lead from lead(II) nitrate, so a grey deposits formed.
26	A	From left to right, the elements change from metal to non-metal. Hence the ability to conduct electricity decreases.
27	D	As the proton number increases, the molecules become bigger. The surface area for contact increases hence the forces of attraction between the molecules increases. This results in higher melting points down the group.
28	B	X is a noble gas, Y is a Group I metal, Z is a halogen.
29	C	Zinc atoms disrupt the orderly arrangement in copper, preventing them from slipping over each other.
30	C	Copper(I) oxide is reduced to hydrogen to form copper metal, hence there is a decrease in mass. Copper(I) oxide is oxidised when heated in oxide to form copper(II) oxide, resulting to an increase in mass.
31	D	Zinc oxide is yellow when hot and white when cold.
32	B	R is the most reactive metal that can only be extracted by electrolysis of its molten ore.
33	A	Carbon monoxide reduces iron ore to iron. Limestone is used to remove acidic oxide. And iron is denser, hence it sinks.
34	D	Source of sulfur dioxide is volcanic eruptions and burning of sulfur-containing fossil fuels. Sulfur dioxide is used as food preservatives.
35	B	Iranian Light contains the higher percentage of gasoline and diesel, which are used as fuel for cars and heavy vehicles respectively.
36	C	4 isomers formed by shifting the position of the $-\text{OH}$ functional group and by branching.
37	B	With 2 moles of chlorine, 2 hydrogen atoms are replaced by 2 chlorine atoms with hydrogen chloride formed as side product.
38	A	There is no c-c double bond in both compounds, hence there will be no decolouration of bromine for both.
39	B	It undergoes oxidation to form carboxylic acid, decolourising acidified potassium manganate(VII).
40	D	It does not have c-c double bond or 2 different functional groups that can react to form amide or ester linkage.



Paya Lebar Methodist Girls' School (Secondary)
Preliminary 2 Examination 2014
Secondary 4 Express

CANDIDATE
NAME

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CENTRE
NUMBER

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INDEX
NUMBER

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CHEMISTRY

5073/02

Paper 2

30 July 2014 (Wednesday)

1 hour 45 minutes

READ THESE INSTRUCTIONS FIRST

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

Section A

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

Section B

Answer **all three** questions, the last question is in the form either/or.
Write your answers on the lined paper provided and, if necessary, continue on separate answer paper.

At the end of the examination, fasten all your work securely.
The number of marks is given in the brackets [] at the end of each question or part question.
A copy of the Periodic Table is printed on page 2.
The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use	
Section A	/50
B8	
B9	
B10	
Total	/80

This document consists of 20 printed pages.

The Periodic Table of the Elements

Group																								
I	II													III	IV	V	VI	VII	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	— Ra radium 88	— Ac actinium 89																						

*58-71 Lanthanoid series

†90-103 Actinoid series

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

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

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

*For
Examiner's
Use*

A1 The diagram shows the outline of part of the Periodic Table.

[illegible]

(a) Which elements exist as diatomic molecules?

.....[1]

(b) Which elements form basic oxides?

.....[1]

(c) Which element has a stable electronic configuration?

.....[1]

(d) Which element has a giant molecular structure?

.....[1]

(e) Which element combines with chlorine to form a liquid compound with formula XCl_2 ?

.....[1]

(f) Which element has low melting and boiling point, but is also a good electrical conductor?

.....[1]

(g) Which element and its compounds are commonly used as catalysts for reactions?

.....[1]

[Total: 7]

A2 Methanoic acid can be produced by the oxidation of methanol with oxygen in the presence of bacteria.

For
Examiner's
Use

- (a) Write the balanced chemical equation for the reaction, showing the **full** structural formulae of the reactants and products.

[1]

- (b) Use the bond energies given below to calculate the energy change for this reaction.

Bond	Bond energy in kJ
C – H	413
C = O	745
O = O	495
O – H	467
C – O	358

[2]

- (c) Based on your answer in part (b), sketch the energy profile diagram for the reaction.

[2]

- (d) Draw a 'dot-and-cross' diagram to show the bonding in methanoic acid.

Show the outer shell electrons only.

[2]

- (e) Methanoic acid reacts with sodium hydroxide to form a salt, sodium methanoate and water.

Draw a 'dot-and-cross' diagram to show the bonding in the salt formed.

Show the outer shell electrons only.

[2]

[Total: 9]

- A3** An unknown metal M does not react with steam and reacts very slowly with dilute hydrochloric acid.

A strip of iron was dropped into a solution of $M(NO_3)_2$.

- (a) Predict the observation and explain your answer.

.....
.....[2]

- (b) The experiment was repeated using iron filings instead.

Explain, using ideas about particles colliding, if the rate of reaction increased or decreased.

.....
.....
.....[2]

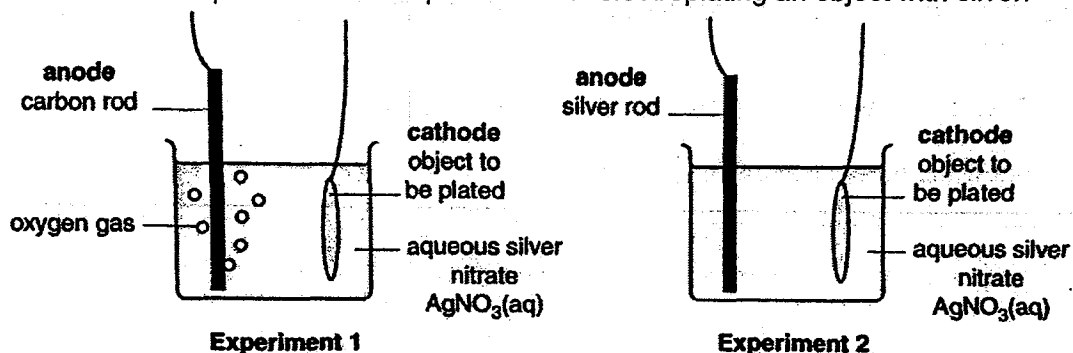
- (c) The resulting mixture was filtered and acidified potassium manganate(VII) was added to it.

Predict the observation and explain your answer.

.....
.....[2]

[Total: 6]

A4 A student sets up two different experiments for electroplating an object with silver.



(a) Write equations, with state symbols, to show the reactions that happen at the anode in each experiment.

Experiment 1:

Experiment 2:[2]

(b) Predict what will happen to the concentration of silver ions in both experiments. Explain your answer.

.....

.....

.....

.....

.....[3]

(c) The student made the following modifications to Experiment 2.

(1) A gold object is placed at the cathode.

(2) The battery is replaced with a voltmeter.

Do you think the gold object will be plated with silver? Explain your answer.

.....

.....

.....

.....[2]

[Total: 7]

A5 Rainwater is weakly acidic as it contains dissolved hydrogen ions.

For
Examiner's
Use

Hard water, which contains calcium or magnesium ions, is formed when the acidic rainwater flows over rocks that contain calcium carbonate or magnesium carbonate

- (a) Write a balanced ionic equation to show how magnesium ions are released in hard water.

.....[1]

- (b) In heavily industrialised areas, it is found that sulfate ions are present in water.

- (i) Suggest a reason for this observation.

.....[1]

- (ii) Describe a simple test to show the presence of sulfate ions.

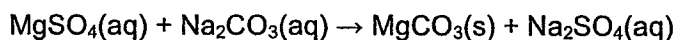
.....[1]

- (iii) A student predicts that the water from heavily industrialised areas is strongly acidic as compared to normal rainwater.

Describe how the student can use indicator to test her prediction.

.....[2]

- (iv) The equation shows how sodium carbonate removes hardness from the water.



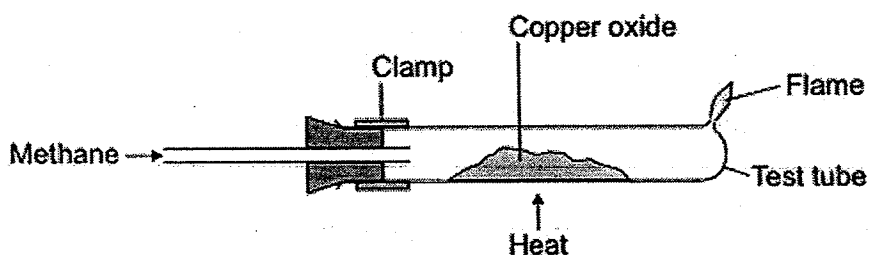
With reference to the above equation, suggest how the hardness from water can be removed.

.....[2]

[Total: 7]

A6 The apparatus below is used for the reaction of copper(II) oxide with methane.

For
Examiner's
Use



(a) Explain why a flame is set to burn at the end of the tube.

.....
.....[1]

(b) The experiment was repeated three times.

The mass of copper(II) oxide used and the mass of copper produced were measured each time.

The results are shown in the table.

Experiment	1	2	3
Mass of copper(II) oxide used / g	4.0	4.0	4.0
Mass of copper produced / g	3.3	3.5	3.1

(i) Calculate the average mass of copper produced and hence, calculate the volume of methane gas needed for the reaction.

[3]

- (ii) The student explained that the mass of copper produced was higher in the second experiment because he turned off the supply of methane before the copper produced was cooled down.

Do you agree with him? Explain your answer.

.....
.....[1]

- (c) If aluminium oxide was used in the reaction above, there will be no change in mass.

Explain why this statement is true.

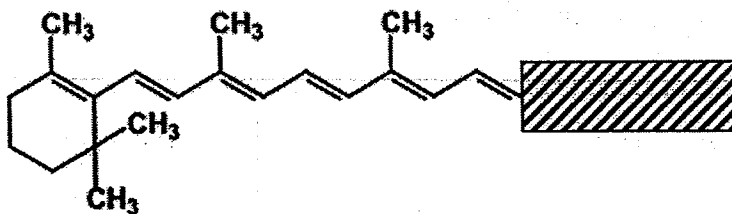
.....
.....
.....[2]

[Total: 7]

- A7** Beta-carotene, a pigment found in yellow and orange fruits and vegetables, protects the body from free radicals and help to boost the body's immune system.

For
Examiner's
Use

The diagram below shows the structure of beta-carotene.



- (a) Beta-carotene is polyunsaturated.

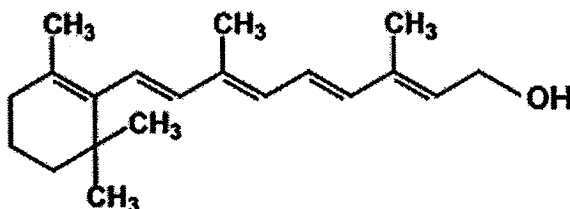
Explain the term '**polyunsaturated**' and describe a test to confirm the presence of unsaturation in beta-carotene.

.....

[2]

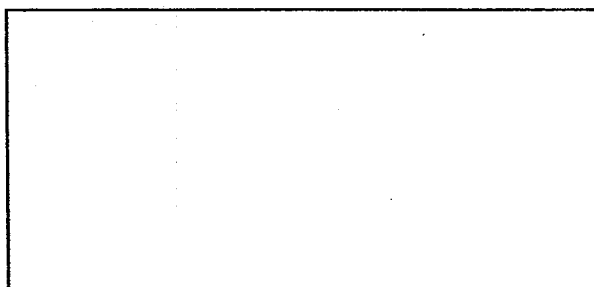
- (b) Beta-carotene is broken down in the human body to give Vitamin A and a product X.

The diagram below shows Vitamin A.



- (i) Describe how the body breaks down beta-carotene and draw the structure of the product X formed in the process.

.....
[1]



[1]

(ii) Beta-carotene can also undergo hydration reaction in the laboratory.

State the conditions needed for this reaction.

.....[1]

(c) A student predicts that Vitamin A will have a higher melting point than beta-carotene.

Do you agree with her? Explain your answer.

.....
.....
.....
.....[2]

[Total: 7]

For
Examiner's
Use

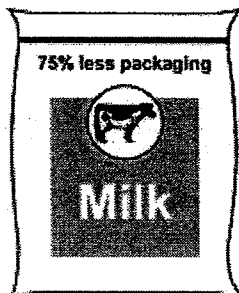
Section B

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

The last question is in the form of an either/or and only one of the alternatives should be attempted.

B8 Read the information about milk bottles.

Supermarkets launch eco-friendly plastic milk bags. Could this be the end of milk bottle?



Milk bottles are made from glass or from plastic.

Glass milk bottles contain 0.5 litres of milk. When the milk is used up, the empty bottles are returned to be re-used. Glass milk bottles are re-used 24 times on average. The glass to make new milk bottles is produced when a mixture of sand, limestone, soda and recycled glass is heated to about 1600 °C in a furnace. There are almost unlimited amounts of the raw material needed to produce this glass. About 35% of used glass is recycled.

The most common plastic milk bottles contain 2 litres of milk. When the milk is used up, the empty bottles are discarded as waste. The plastic used to make these milk bottles is poly(ethene). Poly(ethene) is produced from crude oil by first using fractional distillation, then cracking the naphtha fraction and finally polymerising the ethene. About 5% of used poly(ethene) is recycled.

The new plastic milk bags contains 2 litres of milk. The milk bags are also made from poly(ethene). A milk bag uses 75% less poly(ethene) than is used to make the poly(ethene) milk bottles. When the milk is used up, the empty bags are discarded as waste.

(a) Sand, SiO_2 , is the main component of glass.

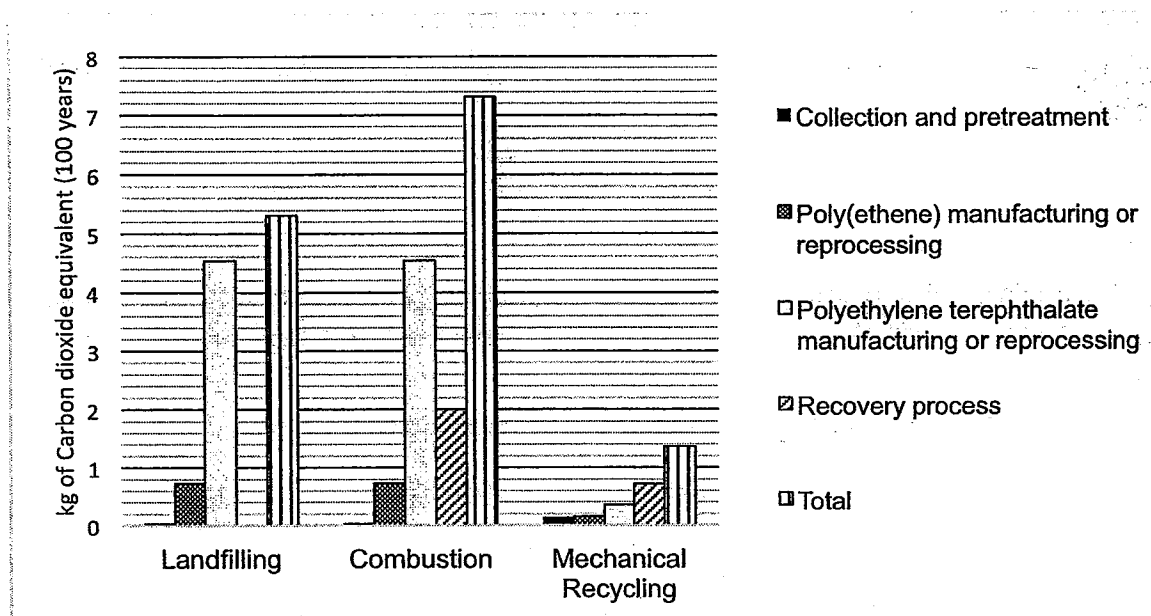
Explain why the mixture has to be heated to about 1600 °C in the recycling process. [2]

(b) Describe the process of obtaining naphtha by fractional distillation of crude oil. [3]

(c) Explain **two** advantages that make plastic milk bags eco-friendly as compared to using glass or plastic milk bottles. [2]

Another type of plastic, polyethylene terephthalate, is also used extensively in the manufacturing of plastic bottles.

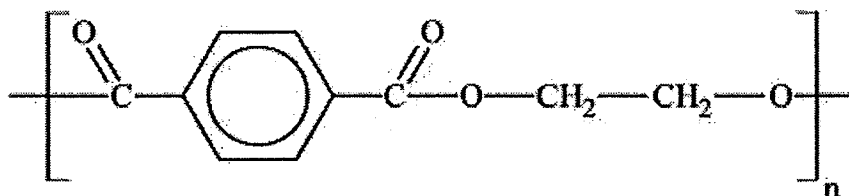
Landfilling and combustion represent the amount of carbon dioxide emitted from the production and transportation of new plastics, while mechanical recycling represents the amount emitted from the recycling of plastics.



(d) Which process emits the most amount of carbon dioxide? [1]

(e) Using data from the graph, explain why the recycling of plastics is important. [1]

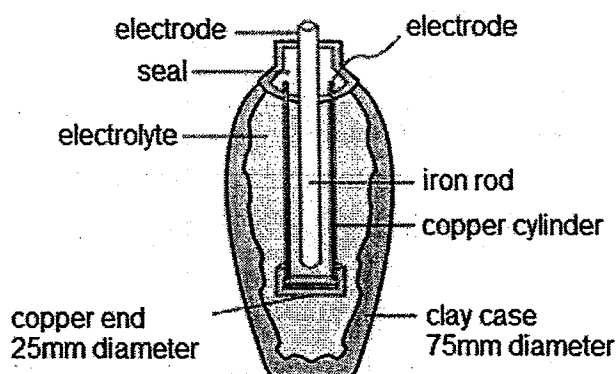
(f) Polyethylene terephthalate has the structure as shown below.



Draw the structures of its monomers and hence state one difference between the reactions that formed this plastic and poly(ethene) respectively. [3]

[Total: 12]

B9 The Baghdad battery was discovered near Iraq in 1936.



It consisted of a ceramic jar that housed a copper tube which contained an iron rod. When a simple acid like lime juice, wine or vinegar was added, an electric current would be produced.

(a) With the help of half equations, explain how the battery works. [2]

(b) Suggest why silver nitrate would not be a good electrolyte for this battery. [1]

(c) A student suggested a way to improve the battery is to replace the iron with zinc.

Do you agree with her? Explain your answer. [2]

(d) In the present society, the Baghdad battery is no longer in use.

Instead, fuel cells involving hydrogen and ethanol are commonly used to generate electric current.

(i) Both fuels have different effects on the environment when used as fuels.

Outline **one** environmental difference between the two fuels. [1]

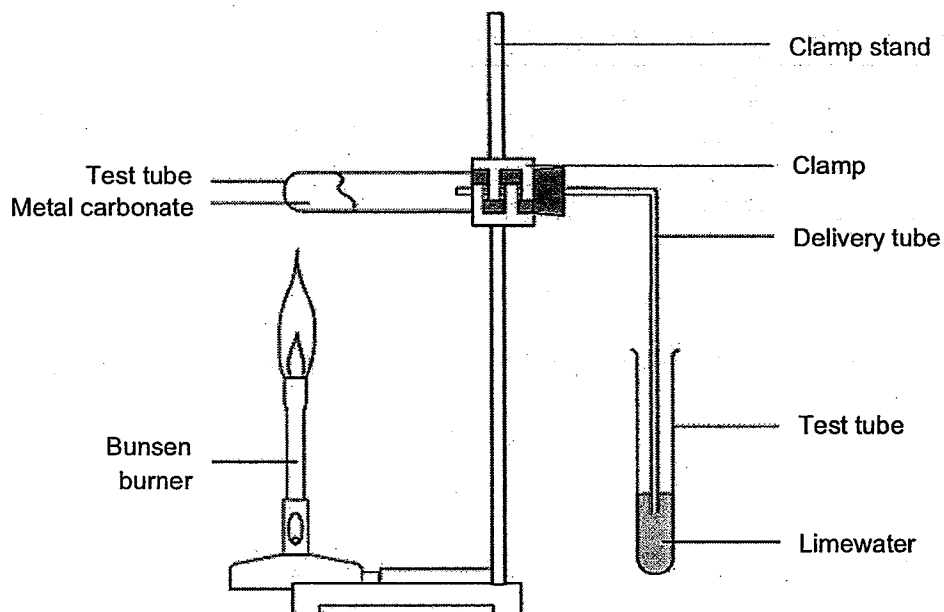
(ii) Ethanol can be obtained from sugar from sugar canes.

Outline the steps to obtain pure ethanol from sugar. [2]

[Total: 8]

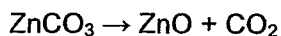
EITHER

B10 Using the set up below, a student decided to investigate the thermal stability of the carbonates of the four metals.



- (a) What would he observe as reaction proceeds? [1]
- (b) Describe how he can use his results to place the metal carbonates in order of thermal stability. [1]
- (c) He conducted the experiment using zinc carbonate, sodium carbonate and silver carbonate.
- (i) Predict the thermal stability of the three carbonates by ranking them in decreasing order of stability. Explain your answer. [3]
- (ii) The student used 1.2 g of zinc carbonate during the experiment.

After heating, he measured the mass of the remaining solid and found that the mass was 0.65 g.



Calculate the percentage purity of the original sample of zinc carbonate. [3]

- (d) When silver carbonate undergoes complete decomposition, silver metal is formed.

However, zinc metal cannot be obtained in the same way.

Describe a method to obtain pure zinc metal from its ore. [2]

[Total: 10]

OR

B10 Some nitrogen compounds are commonly used as fertilisers.

One of such compounds is urea.

The table shows the data from the analysis of a sample of urea.

Element present	% by mass
nitrogen	46.5
hydrogen	6.5
carbon	20.0
oxygen	27.0

(a) Use the data to work out the empirical formula of the urea. [3]

(b) Write a balanced chemical equation to show how urea can be formed from ammonia and carbon dioxide. [1]
(Take the empirical formula as the molecular formula of urea.)

(c) Farmers that grow crops often use large quantity of fertilisers.

Farmers also often add calcium hydroxide to soil to neutralise soil acidity.

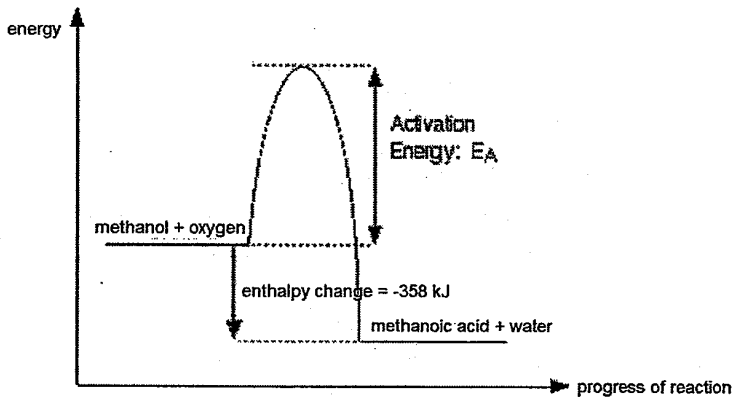
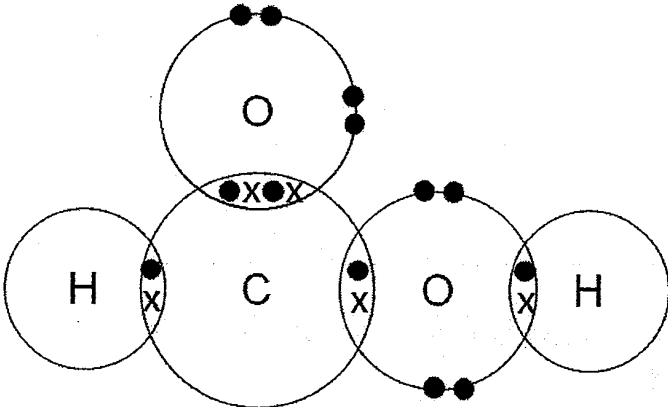
Why is it important not to add fertilisers to soils that have been recently treated with calcium hydroxide? [2]

(d) Another common fertiliser, ammonium nitrate, can be synthesized easily in the laboratory.

Describe the method to obtain ammonium nitrate. [4]

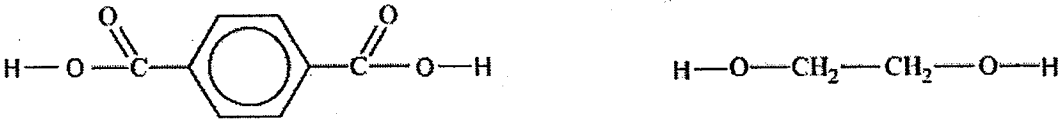
[Total: 10]

Answer for Pure Chemistry Prelim 2 2014

Qn	Answer	Mark
1(a)	F, H	1
1(b)	A, B, C	1
1(c)	I	1
1(d)	E	1
1(e)	G	1
1(f)	A	1
1(g)	C	1
2(a)	$ \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{O}-\text{H} \\ \\ \text{H} \end{array} + \text{O}=\text{O} \longrightarrow \begin{array}{c} \text{O} \\ \\ \text{H}-\text{C}-\text{O}-\text{H} \end{array} + \text{H}-\text{O}-\text{H} $	1
2(b)	$ \begin{aligned} \Delta H &= 2(413) + 495 + (-745) + 2(-467) \\ &= -358 \text{ kJ} \end{aligned} $	1; 1
2(c)		1; (shape) 1 (enthalpy and activation energy)
2(d)		1; (arrangement) 1 (configuration)

2(e)		1 for each ion
3(a)	A <u>grey deposit</u> is formed and the solution turns <u>green</u>. Metal becomes smaller or dissolves. <u>Iron reacts with steam</u>, hence it is <u>more reactive than M</u> and it will <u>displace M</u> from its nitrate solution.	1; 1
3(b)	The rate of reaction <u>increased</u> because as <u>iron filings are smaller in size than iron strip</u>. This results in a <u>larger surface area exposed for reaction</u>, leading to an <u>increase in the frequency of effective collisions</u> and a faster rate of reaction.	1; 1
3(c)	The solution turned from <u>green to brown/yellow</u>, (while potassium manganate(VII) is decolourised) <u>Fe²⁺ is oxidized to Fe³⁺ by oxidizing agent, potassium manganate(VII).</u>	1; 1
4(a)	In experiment 1 – $4\text{OH}^-(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g}) + 4\text{e}^-$ In experiment 2 – $\text{Ag}(\text{s}) \rightarrow \text{Ag}^+(\text{aq}) + \text{e}^-$	1; 1
4(b)	In experiment 1, the concentration of silver ions will <u>decrease</u>. In experiment 2, the concentration of silver ions will <u>remain the same</u>. This is because in experiment 1, <u>silver ions are discharged at the cathode</u>. This is because in experiment 2, for every one mole of silver ion that is discharged at the <u>cathode</u>, <u>one mole of silver metal is oxidised to form a silver ion at the anode</u>. Hence silver ions are constantly replaced.	1; 1; 1
4(c)	Yes it will be plated with silver. <u>Silver is more reactive than gold</u>. Hence it will lose electrons to form silver ions, <u>supplying electrons to the circuit</u> in the process. Silver ions will be attracted to the gold object and be <u>discharged to form silver metal</u>. The silver metal formed will coat the object.	1; 1
5(a)	$2\text{H}^+(\text{aq}) + \text{MgCO}_3(\text{s}) \rightarrow \text{Mg}^{2+}(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$	1
5(b)(i)	In heavily industrialised areas, there is high frequency of burning of fossil fuels. When <u>burning fossil fuels that contain sulfur</u>, <u>sulfur dioxide is formed</u>, which then <u>dissolves in rain</u> to form sulfurous acid. Sulfurous acid is oxidized to form sulfuric acid, which dissociates to give the sulfate ions.	1
5(b)(ii)	Add <u>dilute nitric acid and barium nitrate</u>. If <u>white precipitate</u> appears, sulfate ions are present.	1
5(b)(iii)	Add <u>Universal Indicator</u> to a sample of water from heavily industrialised areas and a sample of normal rainwater separately. The <u>Universal Indicator will turn red or orange</u> in the sample of <u>water from heavily industrialised areas</u> if it is <u>strongly acidic</u>, while it will turn <u>yellow</u> in the sample of <u>normal</u>	1; 1

	rainwater if it is weakly acidic.	
5(b)(iv)	Add sodium carbonate to the water until <u>no more precipitate is formed</u> . Filter to remove the <u>precipitate</u> which is magnesium carbonate.	1; 1
6(a)	The flame is used to burn off excess methane. OR To draw a constant supply of methane over CuO.	1
6(b)(i)	Average mass of copper produced = $(3.3 + 3.5 + 3.1) / 3$ = 3.3 g Number of moles of copper formed = $3.3 / 64$ = 0.0515625 mol Volume of methane gas needed = $0.0515625 / 4 \times 24$ = 0.309 dm ³ or 309cm ³	1; 1 1
6(b)(ii)	Yes I agree because without the constant supply of methane, <u>oxygen enters the tube and copper oxide may be formed</u> again, resulting in a higher mass than other experiments. OR Yes I agree because <u>some copper(II) oxide may not have been reduced by methane</u> . The mass of copper(II) oxide is higher than copper.	1
6(c)	Aluminium is more reactive than copper, hence <u>aluminium oxide formed will be very stable</u> . It <u>cannot be reduced by heating with methane</u> .	1; 1
7(a)	'Polyunsaturated' refers to the <u>presence of many C-C double bonds</u> . Add <u>aqueous bromine</u> to the beta-carotene, and it will <u>decolourise</u> to show the presence of unsaturation.	1; 1
7(b)(i)	The body breaks down beta-carotene by the reacting with water and breaking of the c-c double bond. H— 	1; 1
7(b)(ii)	60 atm, 300°C, phosphoric acid as catalyst (60-70 atm)	1
7(c)	No I do not agree. Both molecules have <u>simple molecular structure with weak intermolecular forces of attraction</u> between molecules. Vitamin A is a smaller molecule, hence the <u>surface area for contact decreases</u> , resulting in <u>less extensive intermolecular forces of attraction</u> formed between molecules. <u>Less heat</u> is then required to overcome these forces of attraction, resulting in lower melting points.	1; 1
8(a)	Silicon dioxide has a <u>giant molecular structure with an extensive network of strong covalent bonds</u> . Hence <u>a lot of energy is needed to break these bonds</u> before silicon dioxide can <u>undergo chemical reaction</u> to form glass. Heating to 1600 °C provides this amount of energy.	1; 1
8(b)	Crude oil is <u>first vapourised and passed into a fractionating column</u> . The hot vapour will <u>rise up the column</u> . The vapours with <u>lower boiling points</u> will be able to <u>reach the top of the column</u> while the vapours with <u>higher boiling points</u> will be collected near the bottom of the <u>column</u> . The vapours are then channeled out from the various levels in the fractionating	1; 1; 1

	column and condensed to be collected as liquids. <u>Naphtha is collected as one of the middle fractions.</u>	
8(c)	Making plastic milk bags <u>does not require as much raw materials as the production of glass and plastic milk bottles.</u> Making plastic milk bags also <u>requires lesser energy as compared to the amount of energy needed to maintain the high temperature in the production of glass bottles, and the amount of energy needed to obtain more ethene from cracking and fractional distillation.</u>	1; 1
8(d)	Combustion	1
8(e)	The mass of carbon dioxide produced during the production and transportation of new plastics 88.9% more than that needed for recycling. $(\frac{12.6-1.4}{12.6} \times 100\%)$ Hence it is important to recycle plastics in order to <u>reduce the amount of carbon dioxide, a greenhouse gas, given out.</u>	1
8(f)	 This plastic is a <u>condensation polymer</u> while poly(ethene) is an <u>addition polymer</u>. Hence in the reaction to form this plastic, a <u>side product</u>, water, was formed. In the reaction for form poly(ethene), <u>no side product</u> was formed.	1; 1; 1
9(a)	$\text{Fe(s)} \rightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{e}^-$ $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$ <u>Iron is more reactive than copper, hence it will lose electrons to become the negative terminal.</u> <u>Copper will then become the positive terminal where hydrogen ions are discharged to form hydrogen gas.</u> This results in a flow of electrons which constitute the electric current.	1; 1
9(b)	Silver is <u>less reactive than both iron and copper</u> , hence it <u>will be displaced</u> from its nitrate solution.	1
9(c)	Yes I agree. <u>Zinc is more reactive than iron, hence the potential difference between the electrodes will be larger.</u> A battery with a large potential difference will be more effective.	1; 1
9(d)(i)	Hydrogen burns in oxygen to give <u>water which is not a pollutant.</u> Ethanol burns in excess oxygen to give <u>water and carbon dioxide</u>. Carbon dioxide is a <u>greenhouse gas</u> which causes global warming.	1
9(d)(ii)	Sugar undergoes <u>fermentation in the presence of yeast at 37 °C</u> . The solution is then <u>filtered</u> and the filtrate is separated using <u>fractional distillation to obtain the pure ethanol.</u>	1; 1
Either 10(a)	He would observe that a <u>white precipitate is formed in limewater</u> . There may also be a <u>change in the colour of the residue in the test tube.</u>	1
10(b)	He needs to <u>measure and record the mass of metal carbonates before and after the reaction in order to calculate the decrease in mass.</u> The <u>smaller the decrease in mass, the</u>	1

	more stable the metal carbonate. (Vice versa)																										
10(c)(i)	sodium carbonate, zinc carbonate, silver carbonate The more reactive the metal, the more stable metal carbonate formed. Sodium, being the most reactive metal, forms the most stable metal carbonate, while silver, the least reactive metal, forms the least stable metal carbonate.	1; 1; 1																									
10(c)(ii)	No of moles of ZnO formed = $0.65 / (65+16)$ = 0.00802469 Mass of pure ZnCO₃ present = $0.00802469 \times (65+12+16 \times 3)$ = 1.00309 g Percentage purity of ZnCO₃ = $1.00309/1.2 \times 100$ = 83.6%	1; 1; 1																									
10(d)	Zinc metal must be obtained from the electrolysis of its molten ore. The electrolyte is molten zinc oxide, electrodes are graphite. $\text{Zn}^{2+}(\text{l}) + 2\text{e} \rightarrow \text{Zn}(\text{l})$ Zinc ions are attracted to the cathode where it gains electrons to form zinc metal, which then sinks to the bottom of the container and be tapped out. OR Zinc metal can be obtained from its ore by reduction with carbon. $2\text{ZnO} + 2\text{C} \rightarrow 2\text{Zn} + \text{CO}_2$ / $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$, $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$, $\text{ZnO} + \text{CO} \rightarrow \text{Zn} + \text{CO}_2$ Zinc oxide will be reduced as carbon gains the oxygen to form carbon dioxide.	1; 1																									
OR																											
10(a)	<table><tr><td></td><td>N</td><td>H</td><td>C</td><td>O</td></tr><tr><td>% by mass</td><td>46.5</td><td>6.5</td><td>20.0</td><td>27.0</td></tr><tr><td>divided by Ar</td><td>3.321429</td><td>6.5</td><td>1.666667</td><td>1.6875</td></tr><tr><td>divided by smallest no</td><td>1.99</td><td>3.90</td><td>1.00</td><td>1.01</td></tr><tr><td>ratio</td><td>2</td><td>4</td><td>1</td><td>1</td></tr></table> Empirical formula = N₂H₄CO		N	H	C	O	% by mass	46.5	6.5	20.0	27.0	divided by Ar	3.321429	6.5	1.666667	1.6875	divided by smallest no	1.99	3.90	1.00	1.01	ratio	2	4	1	1	1; 1; 1
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10(b)	$2\text{NH}_3 + \text{CO}_2 \rightarrow \text{N}_2\text{H}_4\text{CO} + \text{H}_2\text{O}$	1																									
10(c)	Fertilisers are made up of ammonium salts that react with calcium hydroxide to give off ammonia gas which escapes into the environment. This removes the element nitrogen, which is necessary for plant growth.	1; 1																									
10(d)	Fill the burette with dilute nitric acid. Pipette 25.0 cm³ of aqueous ammonia and transfer it into a conical flask. Add 2-3 drops of a suitable indicator to aqueous ammonia. Add dilute nitric acid from the burette dropwise till a colour change is observed. Record the volume of dilute nitric acid needed. Repeat the experiment without using the indicator. Heat the resulting solution to saturation. Cool to allow crystals to form. Filter to obtain the crystals. Wash with small amount of distilled water and pat dry with pieces of filter paper.	1; 1; 1; 1																									