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**Preliminary Examination 2019
Secondary Four Express
Chemistry
Paper 1 (6092/1)**

Date of Examination: 4 September 2019

Duration: 1 hour

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Name : _____ ()

Class : _____

Instructions to Candidates

Write in soft pencil.

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

Write your name, index number and class on the answer sheet provided.

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 Optical Answer Sheet (**OAS**).

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

Any rough working should be done on this paper.

A copy of the Periodic Table is printed on page **20**.

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

Paper	Marks
1	40

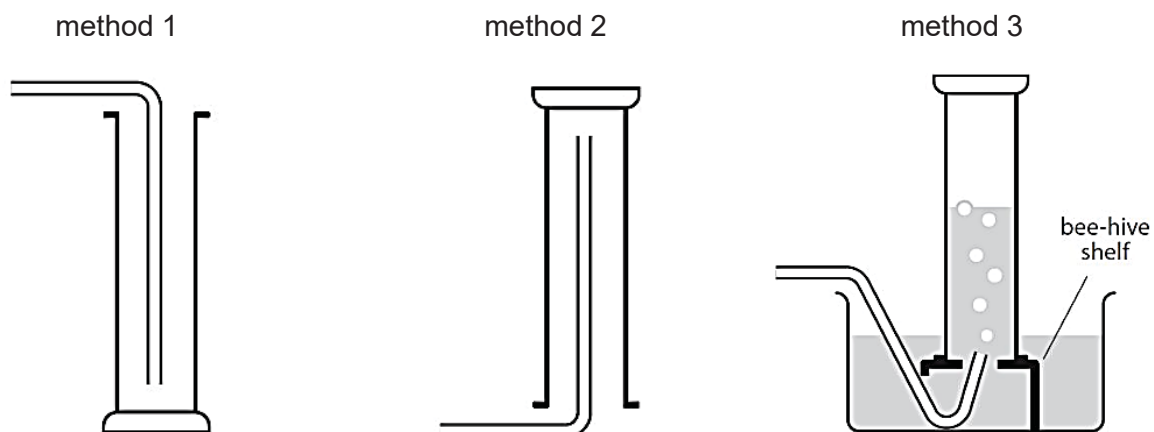
Set by: Mdm Asmahan Aman

Vetted by: Mr Benjamin Pooi, Mdm Fiona Tay and Mrs Shaima Anshad

This Paper consists of **20** printed pages, including the cover page.

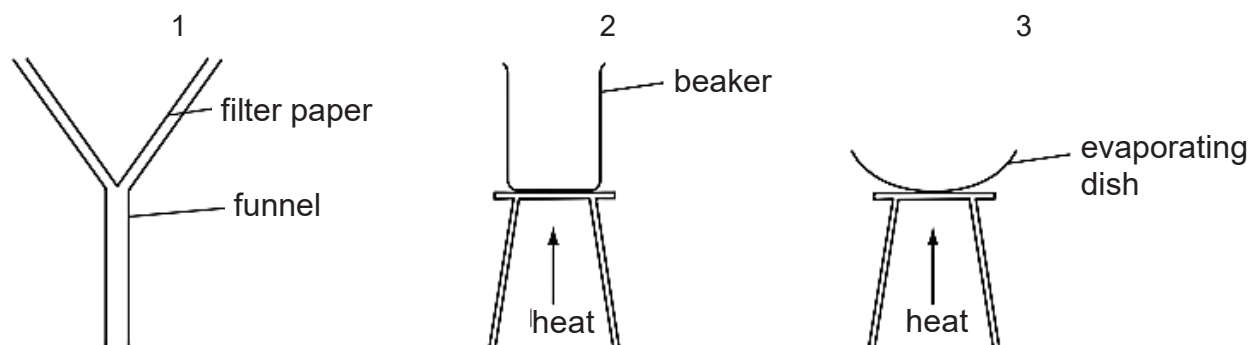
- 1 Magnesium carbonate was reacted with excess dilute hydrochloric acid.

The diagram below shows the methods to collect gaseous products.



Which method(s) can be used to collect the gas evolved from the reaction?

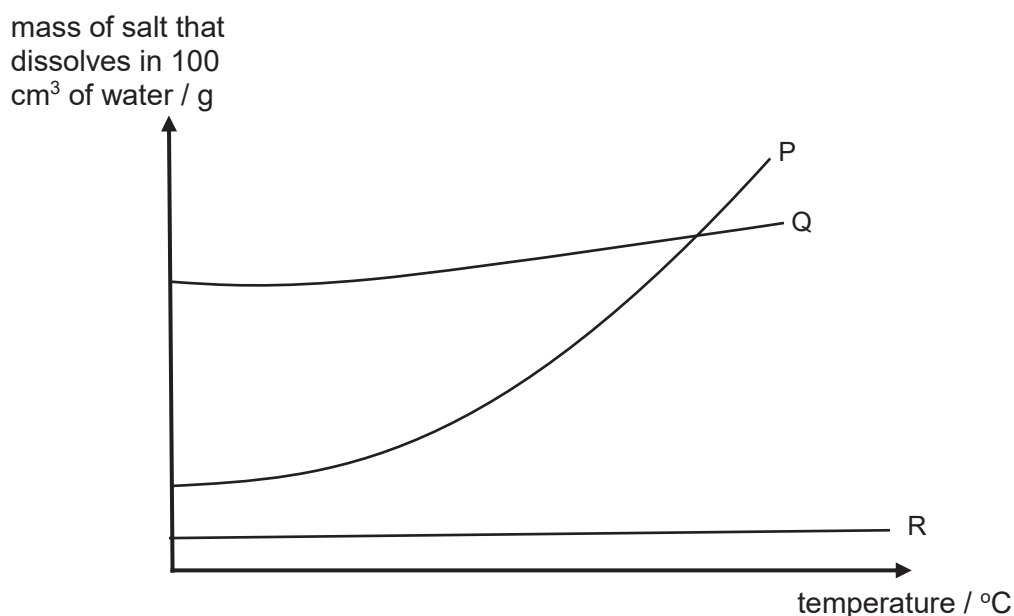
- A** 1 only
B 2 only
C 1 and 3
D 2 and 3
- 2 The diagram shows three sets of apparatus.



Which apparatus could be used to separate a mixture of copper(II) chloride and copper(II) oxide and obtain a pure sample of each solid?

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

- 3 The diagram below shows the solubility curves of 3 salts, P, Q and R over a range of temperatures. P, Q and R are added to separate beakers of water.



Which of the following shows the best method of obtaining a solid sample from the mixture?

	salt P	salt Q	salt R
A	crystallisation	filtration	evaporate to dryness
B	evaporate to dryness	evaporate to dryness	filtration
C	evaporate to dryness	crystallisation	evaporate to dryness
D	crystallisation	evaporate to dryness	filtration

- 4 The following reactions are carried out on solid T.



Which conclusion is correct?

- A** solution Y is a mixture
- B** brown liquid X is a compound
- C** solid T is a mixture
- D** solid T is a compound

- 5 The gases making up dry air can be separated by fractional distillation of liquid air.

The boiling points of five of the gases in dry air are given below.

gas	boiling point / °C
N ₂	– 210
O ₂	– 220
Ar	– 186
Ne	– 246
Kr	– 152

In the fractional distillation of liquid air, which gas will distil off first and which gas will distil off last?

	first	last
A	N ₂	O ₂
B	O ₂	Ne
C	Ar	N ₂
D	Ne	Kr

- 6 Z has the atomic number 8 and mass number 18.

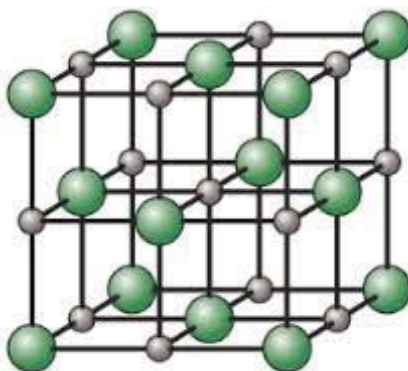
What are the particles present in a Z²⁻ ion?

	electrons	neutrons
A	8	8
B	8	10
C	10	18
D	10	10

- 7 When sucrose is heated, it melts at 192 °C. At this temperature it starts to decompose, and the liquid sucrose turns dark brown.

Which conclusion is correct?

- A the covalent bonds are stronger than the intermolecular forces
 B the intermolecular forces, and some covalent bonds, are about the same strength
 C the intermolecular forces are stronger than the covalent bonds
 D the structure of the solid is a lattice structure
- 8 The diagram shows the arrangement of the ions in an ionic crystal.



Which compound **cannot** have this arrangement of its ions?

- A lithium nitrate
 B zinc sulfate
 C sodium oxide
 D lead(II) sulfate
- 9 Nitrogen forms compounds with the elements fluorine, oxygen, calcium and sodium. These compounds have the formulae NQ_2 , X_3N , Y_3N_2 and NZ_3 , where N represents nitrogen.

What are the identities of Q, X, Y and Z?

	F	O	Ca	Na
A	Q	X	Y	Z
B	X	Y	Z	Q
C	Y	Z	X	Q
D	Z	Q	Y	X

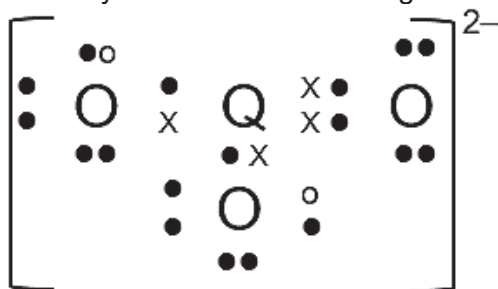
- 10 The diagram below shows the valence electrons of elements X and Y.



Which of the following correctly shows the type of bonds and chemical formula of the compound formed between X and Y?

	type of bonds	chemical formula
A	covalent	XY_2
B	ionic	XY
C	ionic	X_2Y_3
D	covalent	X_3Y_2

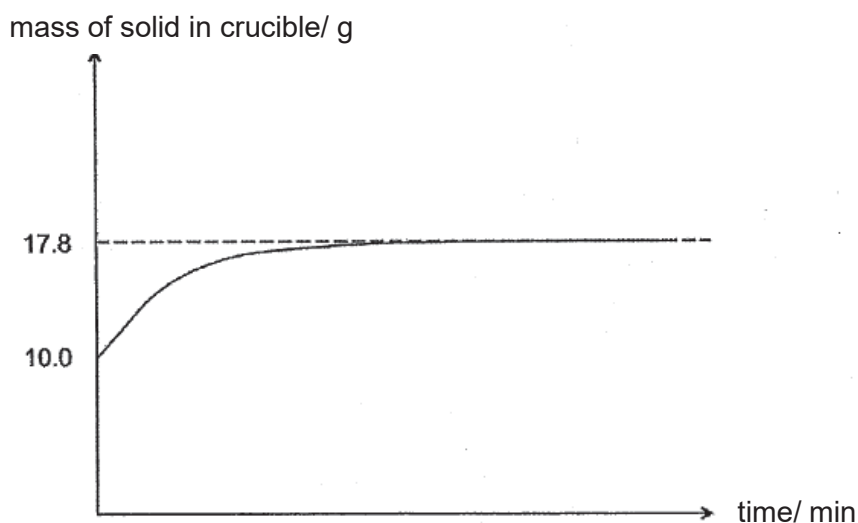
- 11 The ion QO_3^{2-} can be represented by the dot-and-cross diagram shown.



Which Group in the Periodic Table does Q belong to?

- A** I
B III
C IV
D VI

- 12 Which statement about the substance formed when a given mass of an element burns in excess oxygen is **always** correct?
- A denser than the element
- B greater mass than the element
- C soluble in water
- D white in colour
- 13 10.0 g of vanadium was placed in a crucible and heated strongly in excess oxygen to produce an oxide of vanadium of unknown chemical formula. The mass of the sample in the crucible was recorded over time as shown in the graph below.



What is the formula of the oxide obtained?

- A VO
- B VO₂
- C V₂O₃
- D V₂O₅
- 14 A solution contains a mixture of 0.2 mol of sodium chloride and 0.2 mol of another metal chloride. The solution contains 0.6 mol of chloride ions.

Which of the following is the other metal chloride?

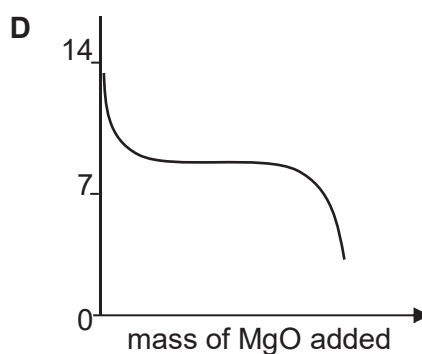
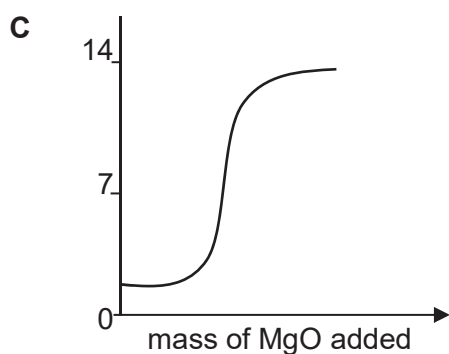
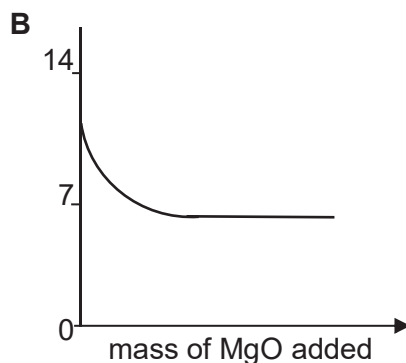
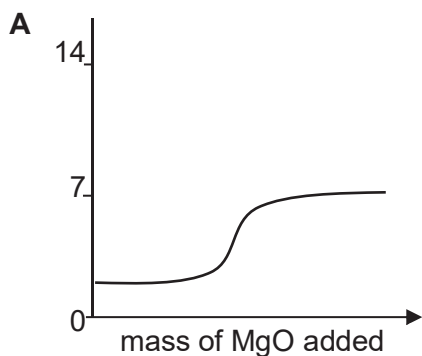
- A potassium chloride
- B magnesium chloride
- C aluminium chloride
- D lead(IV) chloride

- 15 The gaseous hydride of a certain element X has a chemical formula XH_4 . At room temperature and pressure, 7.2 dm^3 of this hydride has a mass of 9.6 g.

What is the relative atomic mass of element X?

- A 12
- B 24
- C 28
- D 32
- 16 In which pair does neither of the gases change the colour of damp blue litmus paper?
- A ammonia and chlorine
- B ammonia and hydrogen chloride
- C carbon monoxide and hydrogen
- D carbon dioxide and sulfur dioxide
- 17 An unlabelled bottle is known to contain either aqueous sodium chloride or aqueous ammonium carbonate.
- How should the solution be tested in order to determine which compound is present?
- A by adding aqueous barium nitrate
- B by adding aqueous silver nitrate
- C by adding aqueous potassium manganate(VII)
- D by adding aqueous ammonia

- 18 Which graph shows the changes in pH as an excess magnesium oxide, MgO is added to hydrochloric acid?



- 19 Which pair of substances would **not** be suitable for producing a large quantity of carbon dioxide?

- A** iron(II) carbonate and hydrochloric acid
B lead(II) carbonate and hydrochloric acid
C sodium carbonate and sulfuric acid
D calcium carbonate and nitric acid

- 20 Propanoic acid, ethanoic acid, hydrochloric acid and sulfuric acid each dissociate in solution.

If Universal Indicator is placed in 0.1 mol/dm^3 of each solution, which solution will produce a colour indicating the lowest pH?

- A** sulfuric acid
B ethanoic acid
C hydrochloric acid
D propanoic acid

- 21 An atmospheric pollutant can be removed by the process of oxidation.

Which pollutant is removed by this process?

- A carbon monoxide in a catalytic converter
- B nitrogen dioxide in acid rain by reaction with calcium carbonate
- C nitrogen dioxide in a catalytic converter
- D sulfur dioxide from the flue gases by reaction with calcium carbonate

- 22 A student investigated the effect of heat on copper(II) nitrate crystals in a test-tube. She observed that a brown gas P was given off, and a black solid Q remained in the test-tube. The black solid was hard to clean off the glass. She added solution S to dissolve the solid.

Which of the following correctly identifies substances P, Q and S?

	brown gas P	black solid Q	solution S
A	nitrogen	copper	sodium hydroxide
B	nitrogen	copper(II) oxide	hydrochloric acid
C	nitrogen dioxide	copper	sodium hydroxide
D	nitrogen dioxide	copper(II) oxide	hydrochloric acid

- 23 Four elements identified only as W, X, Y and Z are all found in the third period of the Periodic Table.

- 1 The atomic size of Z is less than X.
- 2 The energy required to remove the first electron from atom Y is greater than that from the atom of Z.
- 3 W forms an ion which has a larger size than an atom of W.
- 4 X, Y and Z form ions which are smaller than their parent atoms.

Using the information, what is the most likely order of arrangement of these elements from left to right in the third period?

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

24 Three types of steel have different properties.

steel 1 is easily shaped

steel 2 is brittle

steel 3 is resistant to corrosion

What are the names of these three types of steel?

	steel 1	steel 2	steel 3
A	high carbon	mild	stainless
B	high carbon	stainless	mild
C	mild	high carbon	stainless
D	mild	stainless	high carbon

25 The following shows some of the results when metals W, X and Y were added to cold water, steam and hydrochloric acid separately.

1. Only metal X does not react with cold water.
2. Metal W reacts with steam.
3. Metals W and Y react with hydrochloric acid.

Which conclusion is **not** correct?

- A W is more reactive than X.
- B X reacts with steam.
- C Y is more reactive than X.
- D Y reacts with steam.

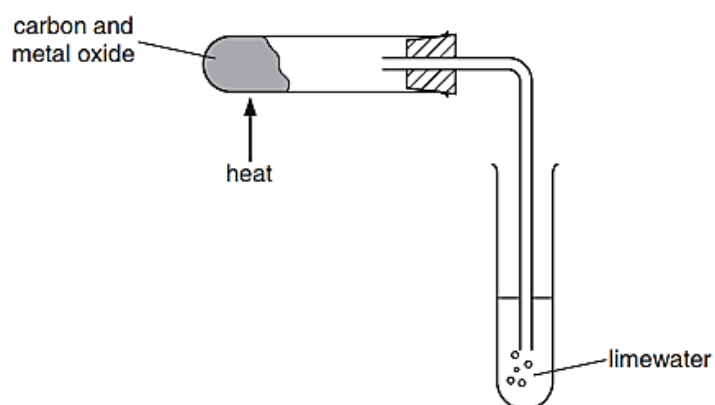
26 Three stages in making steel from iron ore are listed.

- 1 carbon dioxide reacts with carbon
- 2 metal oxides and oxygen are added
- 3 haematite is reduced

In which order do these stages occur?

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

27 A metal oxide is mixed with carbon and heated as shown.



The limewater turns cloudy.

Which of the following **cannot** be the metal oxide?

- A zinc oxide
- B magnesium oxide
- C copper(II) oxide
- D iron(III) oxide

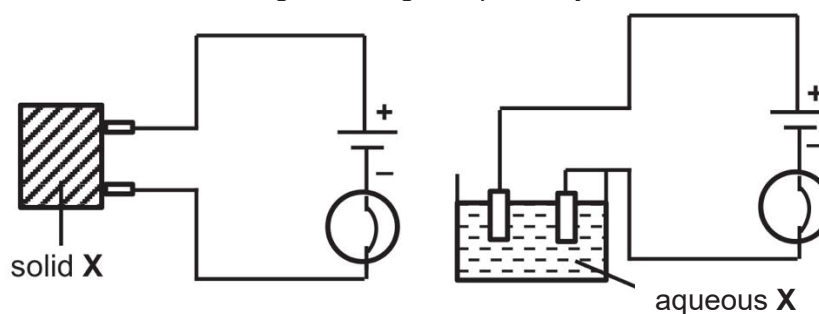
28 Limestone can be changed into slake lime in two chemical reactions.

- 1 When limestone is heated it decomposes into lime, CaO .
- 2 Water is slowly dripped onto the cooled lime. The lime appears to expand and steam is produced. Slaked lime, $\text{Ca}(\text{OH})_2$, is formed.

Which row shows the correct description of each of the chemical reactions?

	reaction 1	reaction 2
A	endothermic	endothermic
B	endothermic	exothermic
C	exothermic	endothermic
D	exothermic	exothermic

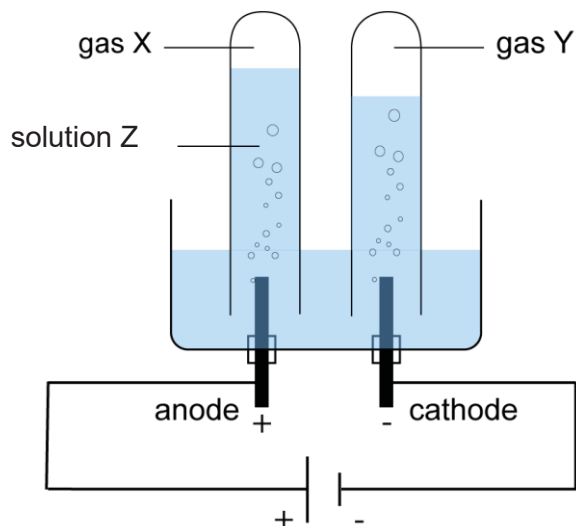
29 Two circuits are shown below. The light bulb lights up in only one of the circuits.



What is the identity of X?

- A** lead(II) chloride
- B** sugar
- C** poly(ethene)
- D** sodium oxide

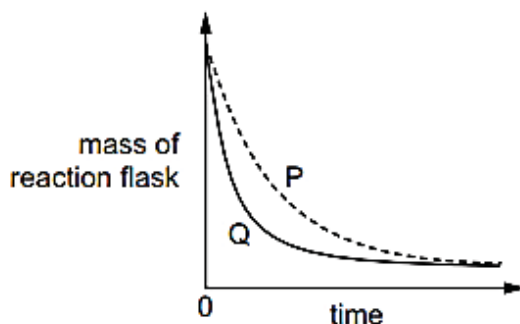
30 The diagram below is a typical electrolysis set-up that collects gaseous products.



Which of the following correctly shows the identities of solution Z, gas X and Y?

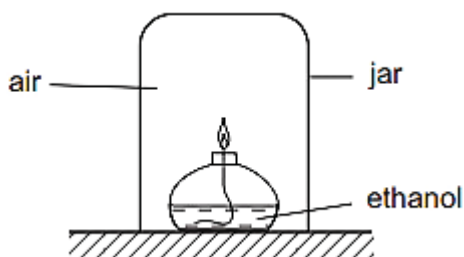
	solution Z	gas X	gas Y
A	hydrochloric acid	chlorine	hydrogen
B	sodium sulfate	hydrogen	oxygen
C	sulfuric acid	oxygen	hydrogen
D	concentrated sodium chloride	chlorine	hydrogen

- 31 A student investigates the rate of reaction between marble chips and hydrochloric acid. The mass of the reaction flask is measured. The graph shows the results of two experiments, P and Q.



Which change explains the difference between P and Q?

- A A catalyst is added in P.
 - B A higher temperature is used in P.
 - C Bigger marble chips are used in Q.
 - D Hydrochloric acid is more concentrated in Q.
- 32 The diagram shows ethanol burning inside a sealed jar.



The mass of one gas in the jar does not change.

Which gas is this?

- A carbon dioxide
- B nitrogen
- C oxygen
- D water vapour

- 33 Which one of the following conversion is an industrial process catalysed by nickel?
- A ethene and hydrogen into ethane
 - B nitrogen monoxide into nitrogen
 - C nitrogen and hydrogen into ammonia
 - D hydrogen and chlorine into hydrogen chloride
- 34 Which of the following could **not** be produced when methane reacts with chlorine in the presence of ultraviolet light?
- A hydrogen chloride
 - B tetrachloromethane
 - C chloromethane
 - D hydrogen

- 35 The structures of two isomers of butane, C_4H_8 , are given below.



How many of the statements about these two isomers are correct?

- Both will react with 1 mole of bromine to produce the same mass of products.
- Both produce the same molecule when reacted with steam.
- Both produce the same molecule when reacted with hydrogen.
- Combustion of 10 g of each isomer will produce the same volume of gas.

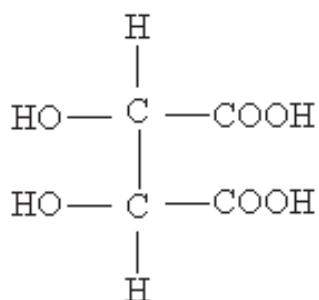
- A 1
- B 2
- C 3
- D 4

36 Compound P reacts with compound Q to form product R.

Which of the following correctly identifies P, Q and R?

	P	Q	product R
A	CH ₃ OH	CO ₂ H	HCO ₂ C ₂ H ₅
B	CH ₃ CO ₂ H	Na	CH ₃ CO ₂ Na
C	C ₃ H ₇ OH	KMnO ₄	C ₃ H ₇ COOH
D	CH ₃ CO ₂ H	CH ₃ OH	CH ₃ CO ₂ CH ₃

37 The diagram below shows the structural formula of tartaric acid.



Which of the following salt(s) could be formed upon reacting tartaric acid with potassium hydroxide?

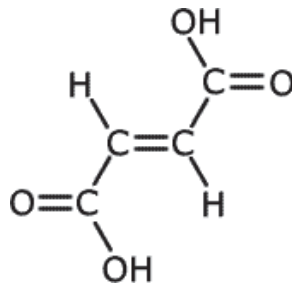
- 1 C₄H₅O₆K
- 2 C₄H₄O₆K₂
- 3 C₄H₃O₆K₃
- 4 C₄H₂O₆K₄

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

38 The diagrams show four monomers.

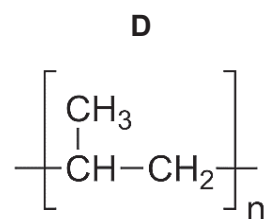
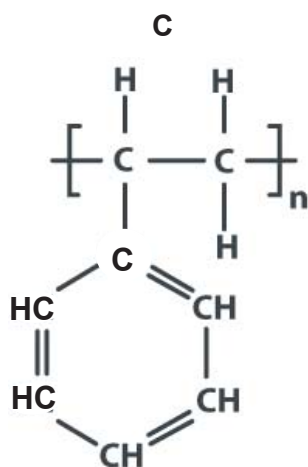
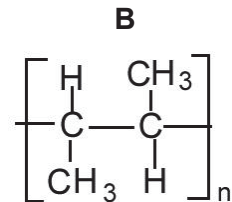
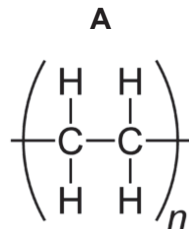


How many of these monomers would react with the molecule below to form a polymer?



- A 1
B 2
C 3
D 4

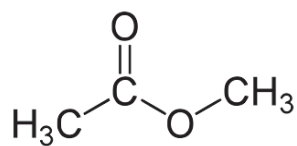
39 Which polymer does **not** have an empirical formula CH_2 ?



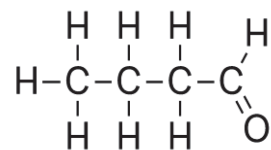
40 Ester methyl propanoate has the molecular formula $C_4H_8O_2$.

Which compound is an isomer of methyl propanoate?

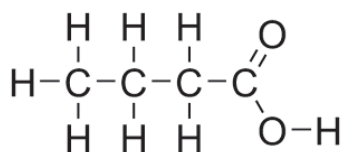
A



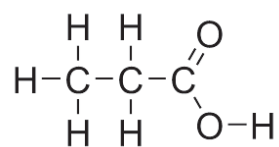
B



C



D



END OF PAPER 1

The Periodic Table of Elements

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3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	19 K potassium 39	20 Ca calcium 40	37 Rb rubidium 85	55 Cs caesium 133	87 Fr francium —	1 H hydrogen 1	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	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	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	57 – 71 lanthanoids —	58 Ba barium 137	59 La lanthanum 139	60 Ce cerium 140	61 Pr praseodymium 141	62 Nd neodymium 144	63 Pm promethium —	64 Sm samarium 150	65 Eu europium 152	66 Gd gadolinium 157	67 Tb terbium 159	68 Dy dysprosium 163	69 Ho holmium 165	70 Er erbium 167	71 Lu lutetium 175																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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 —	113 Nh nihonium —	114 Fl flerovium —	115 Lv livermorium —	116 Og oganeson —	117 Ts tennessine —	118 Uu ununoctium —	119 Uue unbinilium —	120 Uub unbihassium —	121 Uut untrium —	122 Uuq unquadium —	123 Uuq unquadium —	124 Uuq unquadium —	125 Uuq unquadium —	126 Uuq unquadium —	127 Uuq unquadium —	128 Uuq unquadium —	129 Uuq unquadium —	130 Uuq unquadium —	131 Uuq unquadium —	132 Uuq unquadium —	133 Uuq unquadium —	134 Uuq unquadium —	135 Uuq unquadium —	136 Uuq unquadium —	137 Uuq unquadium —	138 Uuq unquadium —	139 Uuq unquadium —	140 Uuq unquadium —	141 Uuq unquadium —	142 Uuq unquadium —	143 Uuq unquadium —	144 Uuq unquadium —	145 Uuq unquadium —	146 Uuq unquadium —	147 Uuq unquadium —	148 Uuq unquadium —	149 Uuq unquadium —	150 Uuq unquadium —	151 Uuq 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unquadium —	252 Uuq unquadium —	253 Uuq unquadium —	254 Uuq unquadium —	255 Uuq unquadium —	256 Uuq unquadium —	257 Uuq unquadium —	258 Uuq unquadium —	259 Uuq unquadium —	260 Uuq unquadium —	261 Uuq unquadium —	262 Uuq unquadium —	263 Uuq unquadium —	264 Uuq unquadium —	265 Uuq unquadium —	266 Uuq unquadium —	267 Uuq unquadium —	268 Uuq unquadium —	269 Uuq unquadium —	270 Uuq unquadium —	271 Uuq unquadium —	272 Uuq unquadium —	273 Uuq unquadium —	274 Uuq unquadium —	275 Uuq unquadium —	276 Uuq unquadium —	277 Uuq unquadium —	278 Uuq unquadium —	279 Uuq unquadium —	280 Uuq unquadium —	281 Uuq unquadium —	282 Uuq unquadium —	283 Uuq unquadium —	284 Uuq unquadium —	285 Uuq unquadium —	286 Uuq unquadium —	287 Uuq unquadium —	288 Uuq unquadium —	289 Uuq unquadium —	290 Uuq unquadium —	291 Uuq unquadium —	292 Uuq unquadium —	293 Uuq unquadium —	294 Uuq unquadium —	295 Uuq unquadium —	296 Uuq unquadium —	297 Uuq unquadium —	298 Uuq unquadium —	299 Uuq unquadium —	300 Uuq unquadium —	301 Uuq unquadium —	302 Uuq unquadium —	303 Uuq unquadium —	304 Uuq unquadium —	305 Uuq unquadium —	306 Uuq unquadium —	307 Uuq unquadium —	308 Uuq unquadium —	309 Uuq unquadium —	310 Uuq unquadium —	311 Uuq unquadium —	312 Uuq unquadium —	313 Uuq unquadium —	314 Uuq unquadium —	315 Uuq unquadium —	316 Uuq unquadium —	317 Uuq unquadium —	318 Uuq unquadium —	319 Uuq unquadium —	320 Uuq unquadium —	321 Uuq unquadium —	322 Uuq unquadium —	323 Uuq unquadium —	324 Uuq unquadium —	325 Uuq unquadium —	326 Uuq unquadium —	327 Uuq unquadium —	328 Uuq unquadium —	329 Uuq unquadium —	330 Uuq unquadium —	331 Uuq unquadium —	332 Uuq unquadium —	333 Uuq unquadium —	334 Uuq unquadium —	335 Uuq unquadium —	336 Uuq unquadium —	337 Uuq unquadium —	338 Uuq unquadium —	339 Uuq unquadium —	340 Uuq unquadium —	341 Uuq unquadium —	342 Uuq unquadium —	343 Uuq unquadium —	344 Uuq unquadium —	345 Uuq unquadium —	346 Uuq unquadium —	347 Uuq unquadium —	348 Uuq unquadium —	349 Uuq unquadium —	350 Uuq unquadium —	351 Uuq 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unquadium —	502 Uuq unquadium —	503 Uuq unquadium —	504 Uuq unquadium —	505 Uuq unquadium —	506 Uuq unquadium —	507 Uuq unquadium —	508 Uuq unquadium —	509 Uuq unquadium —	510 Uuq unquadium —	511 Uuq unquadium —	512 Uuq unquadium —	513 Uuq unquadium —	514 Uuq unquadium —	515 Uuq unquadium —	516 Uuq unquadium —	517 Uuq unquadium —	518 Uuq unquadium —	519 Uuq unquadium —	520 Uuq unquadium —	521 Uuq unquadium —	522 Uuq unquadium —	523 Uuq unquadium —	524 Uuq unquadium —	525 Uuq unquadium —	526 Uuq unquadium —	527 Uuq unquadium —	528 Uuq unquadium —	529 Uuq unquadium —	530 Uuq unquadium —	531 Uuq unquadium —	532 Uuq unquadium —	533 Uuq unquadium —	534 Uuq unquadium —	535 Uuq unquadium —	536 Uuq unquadium —	537 Uuq unquadium —	538 Uuq unquadium —	539 Uuq unquadium —	540 Uuq unquadium —	541 Uuq unquadium —	542 Uuq unquadium —	543 Uuq unquadium —	544 Uuq unquadium —	545 Uuq unquadium —	546 Uuq unquadium —	547 Uuq unquadium —	548 Uuq unquadium —	549 Uuq unquadium —	550 Uuq unquadium —	551 Uuq 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**Preliminary Examination 2019
Secondary Four Express
Chemistry
Paper 2 (6092/2)**

Date of Examination: 2 September 2019

Duration: 1 hour 45 minutes

*Chua Chu Kang Secondary School Chua Chu Kang Secondary School Chua Chu Kang Secondary School
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Chua Chu Kang Secondary School Chua Chu Kang Secondary School Chua Chu Kang Secondary School*

Name : _____ ()

Class : _____

Instructions to Candidates

Write your name, index number and class in the spaces provided on all 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

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

Section B

Answer all **three** questions, the last question is in the form either/or.
Answer **all** questions in the spaces provided.

At the end of the examination, fasten all your work securely together.
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 18.

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

Section	Marks
A	50
B	30
Total	80

Set by: Mdm Asmahan, Ms Lim CF and Mdm Yasmeen

Vetted by: Mr Benjamin Pooi, Mdm Fiona Tay and Mrs Shaima Anshad

Section A

Answer **all** questions in this section in the spaces provided.
The total mark for this section is 50.

A1 (a) Use the following list of substances to answer the questions.

iodine
magnesium
chlorine
sodium chloride
graphite

(i) Which substance conducts electricity when molten but not in solid?
..... [1]

(ii) Which substance is a solid which sublimes at a low temperature?
..... [1]

(iii) Which **two** substances conduct electricity when in a solid form?
..... [1]

(iv) Which substance is a diatomic gas?
..... [1]

(v) Which substance reacts with acidified silver nitrate to give a white precipitate?
..... [1]

(b) Manganese is a typical transition metal element.
State **three** properties that its oxides will have.
.....
.....
..... [2]

[Total: 7]

A2 Explain why

(a) carelessly discarding plastics can result in **long-term** pollution,

.....
 [1]

(b) not recycling metals can cause problems for **future** generations,

.....
 [1]

(c) the **incomplete** combustion of carbon-containing fuels can be dangerous to people,

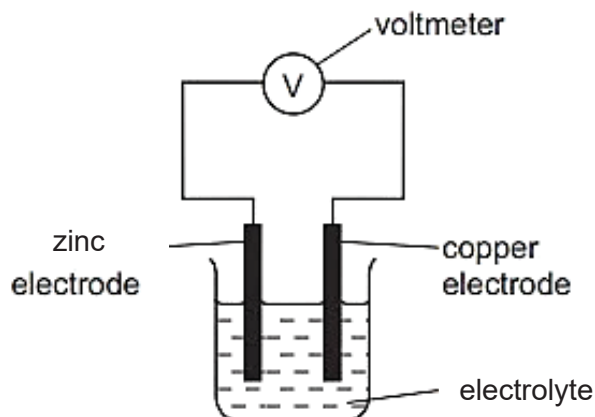
.....
 [1]

(d) the **combustion** of fossil fuels can eventually damage buildings.

.....
 [1]

[Total: 4]

A3 The diagram shows a simple cell set up.



The table shows information about zinc–copper simple cells.

Complete the table by filling in the missing information.

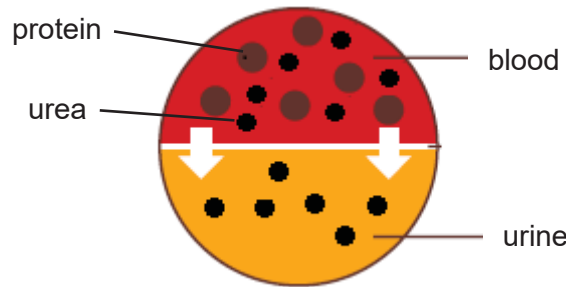
electrolyte	electrodes used	product of reaction at positive electrode	product of reaction at negative electrode
dilute hydrochloric acid	copper and zinc		
	copper and zinc	copper	

[3]

[Total: 3]

A4 Glomerular Filtration Rate (GFR) is a test to check how well the kidneys are working. It estimates the rate at which blood passes through the kidney and urea is removed. In a healthy individual with a fully functioning kidney, the average rate of GFR is 120 ml/min.

The diagram below shows the movement of particles from blood to urine in the kidney.



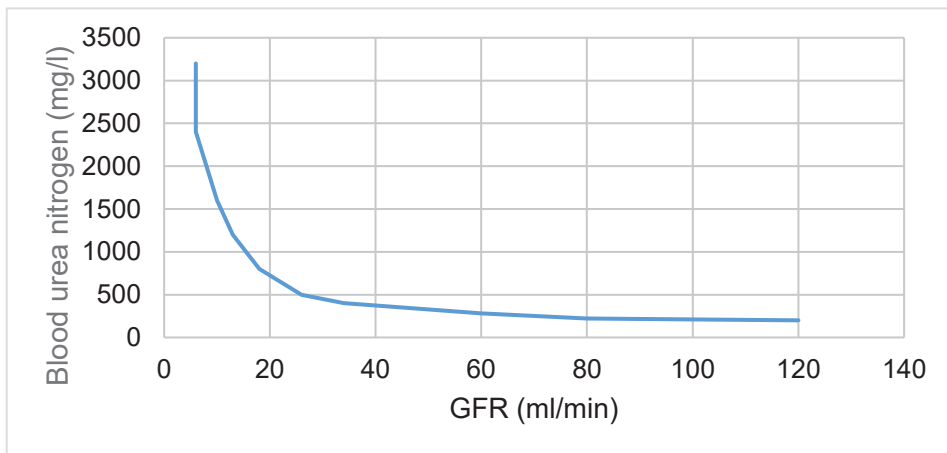
(a) How does the kidney remove urea from the blood?

.....
 [2]

(b) Blood sample of elderly patients tend to contain traces of protein. Suggest a reason.

..... [1]

(c) The following graph shows the relationship between blood urea nitrogen levels and GFR.



(i) With reference to the graph above, state how the glomerular filtration rate (GFR) affects the blood urea nitrogen levels.

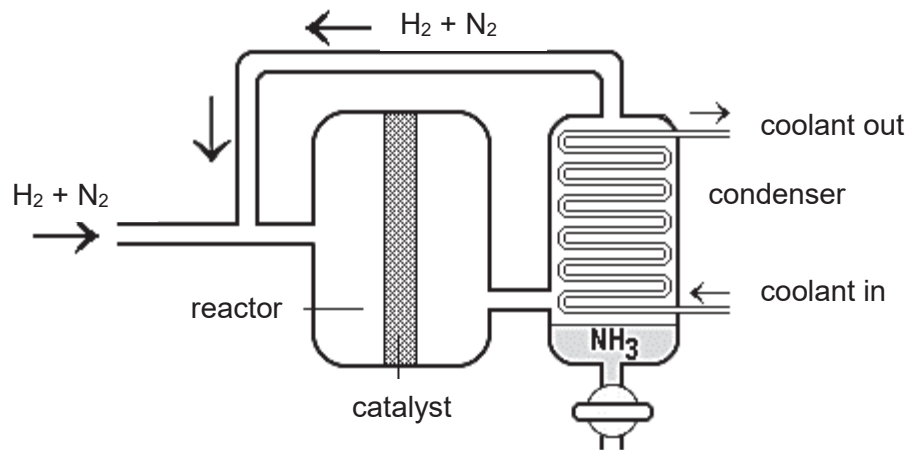
.....

 [2]

(ii) Deduce, from the graph, the normal blood urea levels in a healthy individual.

..... [1]
 [Total: 6]

A5 The diagram shows some information about the Haber process for making ammonia.



(a) Write a balanced chemical equation for the process.

..... [1]

(b) Name the catalyst used.

..... [1]

(c) When the mixture of hydrogen, nitrogen and ammonia enters the condenser, the ammonia turns to a liquid but the other gases do not.

What does this tell you about the boiling point of ammonia?

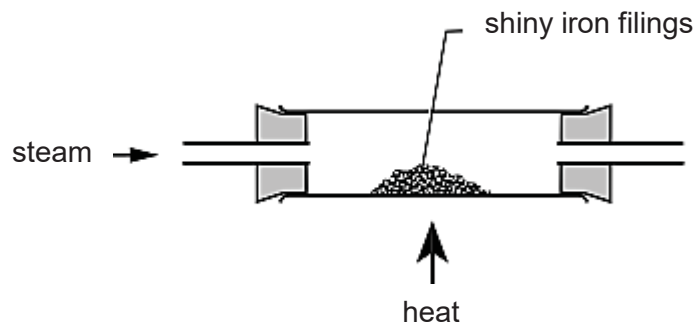
..... [1]

(d) Give an advantage, other than cost, of recycling unreacted nitrogen and hydrogen.

..... [1]

[Total: 4]

- A6** The diagram below shows an experiment in which steam is passed over hot iron filings. The iron filings glow, turns black and then forms a red brown iron oxide solid and a gas which burns with a blue flame.



- (a) Describe how the observations would be different if the experiment was repeated using each of the following two metals in place of the iron filings.

(i) magnesium

.....
 [2]

(ii) copper

..... [1]

- (b) Iron is manufactured from haematite, an oxide of iron.

Describe the manufacture of iron from haematite.

.....

 [3]

[Total: 6]

A7 **P** is a mixture of iron(II) sulfate and ammonium sulfate.

The tests on **P** and some of the observations are recorded in the following table.

Complete the table by filling in the missing information.

tests		observations
(a)	Appearance of solution P [1]
(b)	Aqueous barium nitrate was added to a portion of solution P followed by dilute nitric acid. [2]
(c)	(i) Excess aqueous sodium hydroxide was added to a portion of solution P [2]
	(ii) The mixture from (c)(i) was filtered and the filtrate heated. The gas given off was tested with damp litmus paper. [1]

(d) When equal volumes of potassium manganate(VII) solution and solution **P** are mixed, potassium manganate(VII) decolourises.

(i) State another observation when both solutions are mixed.

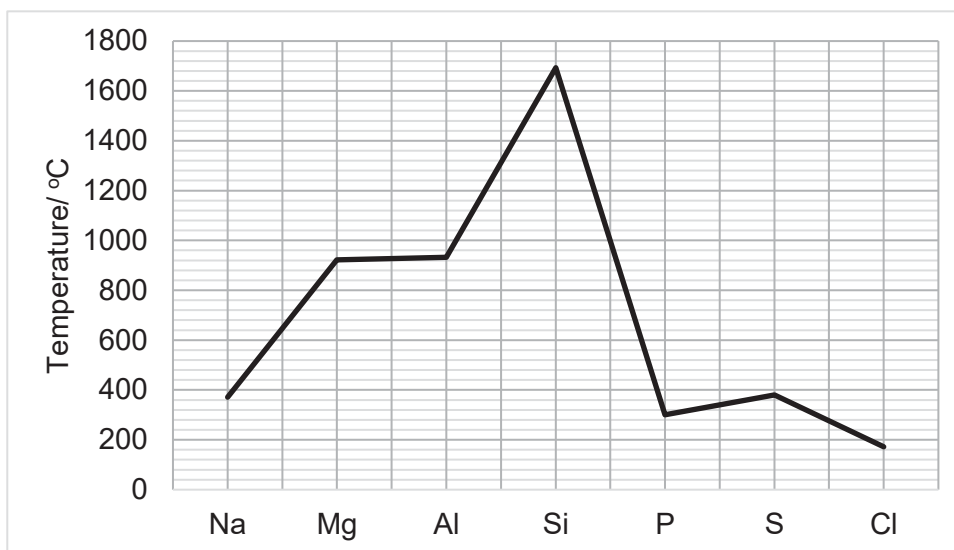
.....
..... [1]

(ii) Explain, in terms of electron transfer, your answer in (d)(i).

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

[Total: 8]

A8 The following graph shows the melting points of elements in Period 3 of the Periodic Table.



(a) Describe the general trend in the melting points of the elements in Period 3.

.....

.....

..... [2]

(b) Explain the reasons, in terms of bonding, for the trend in the melting points of the elements.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (c) Chlorine forms various oxides. The formulas and boiling points of two such oxides are given below.

name	formula	boiling point / °C
dichlorine monoxide	Cl ₂ O	2
dichlorine hexoxide	Cl ₂ O ₆	200

- (i) Draw a 'dot-and-cross' diagram for dichlorine monoxide.

[2]

- (ii) Suggest a reason for the difference in the boiling points of the two compounds.

.....

 [2]

- (d) Predict and explain the difference in electrical conductivities of molten magnesium oxide and liquid dichlorine monoxide, in terms of structure and bonding.

.....

 [2]

[Total: 12]

Section B

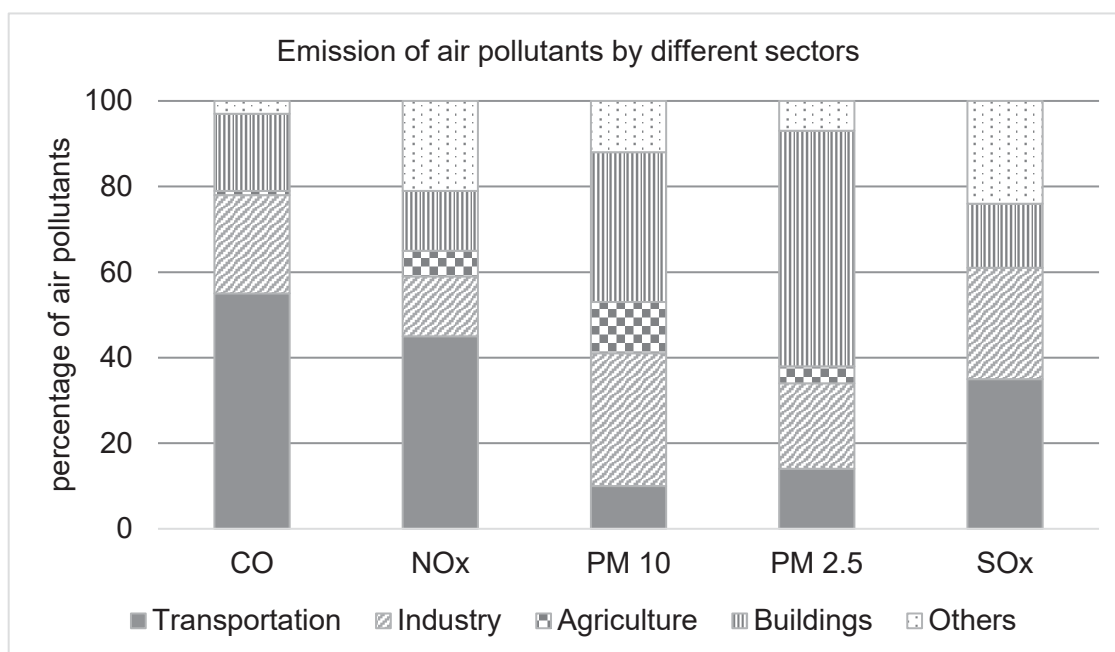
Answer all **three** questions in this section.

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

- B9** Country **X** has been addressing the emission of air pollutants from various sectors. They have placed many regulations in place to enhance air quality. In many cases, these changes have led to a general decline in the total emissions of air pollutants. Over recent years, there has also been a modernisation of road vehicles, including the introduction of more vehicles with improved emission control.

Though many efforts have been put in place, natural causes of air pollution are still prevalent. Additionally, global shipping has been identified as one of the growing sector that releases high volumes of air pollutants. There has also been an increase in the awareness of the contribution made by national and international shipping traffic to SO_x emissions and NO_x emissions.

The stacked chart below shows the emission of air pollutants by various sectors in country **X**.



- (a) Referring to the information and chart above, suggest the main source of air pollution in Country **X**. Give reason for your choice.

.....

.....

.....

[2]

- (b) A student made the following comment after studying the chart.

“The chart shows that transportation vehicles produce a greater volume of carbon dioxide than oxides of nitrogen. Carbon monoxide, which is colourless, dissolves in rainwater to form acid rain.”

Identify **two** mistakes in the student’s comments. Explain why.

.....

 [2]

- (c) State a method used to convert carbon monoxide and nitrogen monoxide into less harmful substances in vehicles. Write a chemical equation to show the reaction.

.....

 [2]

- (d) Apart from the solutions suggested in (c), describe **two** methods to reduce the emission of air pollutants.

.....

 [2]

- (e) PM10 refers to particulate matter which is 10 micrometre and smaller in size – about one-seventh the diameter of a strand of human hair. This is also found in high percentage in haze brought about by forest fires.

Suggest a possible chemical that is classified as PM10. Explain why this chemical is present in the haze.

.....

 [2]

[Total: 10]

- B10** A student carried out an experiment to investigate the reaction between bromide ions and chlorine gas.

She bubbled chlorine gas through dilute aqueous potassium bromide for 6 minutes. She took samples of the reactive mixture every 30s and measured the colour intensity of each sample using a colorimeter.

A colorimeter measures the intensity of light that is absorbed by a coloured solution. The darker the colour of the solution, the more light is absorbed and the higher the reading on the colorimeter.

- (a) Write an ionic equation, with state symbols, for the reaction between chlorine gas and bromide ions.

..... [2]

- (b) Describe and explain how the absorbance reading change as the reaction takes place.

.....

 [3]

- (c) The student carried out three more experiments to determine the time taken for each reaction to finish. She used the same volume of potassium bromide solution each time. She recorded the time taken and the absorbance reading at the end of each reaction in a table.

experiment	time taken for reaction to finish/ min	absorbance reading at the end of reaction
1	5.00	0.8
2	6.00	0.4
3	2.50	0.8
4	2.50	0.9

- (i) Which experiment uses potassium bromide of a lower concentration than in experiment 1?

..... [1]

- (ii) Which two experiments show the same concentration of reactants being used but at different temperatures?

..... [1]

- (d) Chlorine, bromine and iodine are elements from Group VII of the Periodic Table and they are known as halogens.

The student decided to repeat the experiment using different halide solutions. State and explain how the absorbance reading will be higher, lower or no change compared to experiment 1.

- (i) chlorine and potassium iodide

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

- (ii) bromine and potassium chloride

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

[Total: 10]

EITHER

- B11** Magnesium and calcium occur naturally in the anhydrous mineral dolomite, $\text{MgCO}_3 \cdot \text{CaCO}_3$, a mixture of insoluble carbonates. Useful products such as calcium sulfate can be obtained by first adding excess hydrochloric acid to form mixture **A** and then sulfuric acid to form mixture **B**.



- (a) Write one chemical equation that represents one possible chemical reaction that occurs in the scheme shown, include state symbols.

..... [2]

- (b) State the compounds present in mixture **A**.

.....
 [2]

- (c) In order to produce calcium sulfate from dolomite, it is important to add excess hydrochloric acid before sulfuric acid. Explain why.

.....

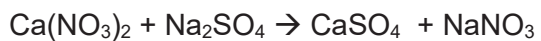
 [2]

- (d) Describe the steps to obtain dry calcium sulfate powder after the addition of sulfuric acid to mixture **A**.

.....

 [2]

- (e) Calcium sulfate could also be produced by the following reaction.



Discuss why this method is more environmentally friendly compared to the method in (d).

.....

.....

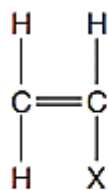
.....

..... [2]

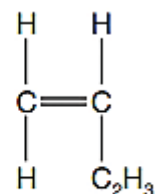
[Total: 10]

OR

B11 Styrene-butadiene rubber is a synthetic rubber. It is made by polymerising a mixture of the monomers butadiene and styrene.



styrene



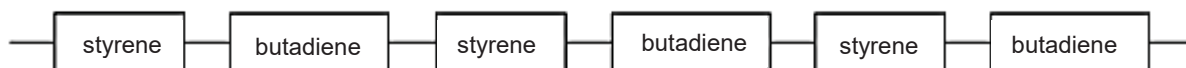
butadiene

- (a) What type of polymerisation will take place when the monomers polymerise? Explain your reasoning.

.....

 [2]

- (b) One possible structure for the polymer is shown below.



- (i) Give the structural formula for the repeating unit in this polymer structure.

[2]

- (ii) When the mixture of styrene and butadiene polymerises, the polymer is unlikely to contain only this regular, repeating pattern. Suggest a reason.

.....
 [1]

- (c) Butadiene can be made by cracking butane in a cracking tower.
- (i) Butane cracks to form butadiene and one other product.
Write an equation to show this reaction.
..... [1]
- (ii) Give a use of the other product in this reaction.
..... [1]
- (d) 2.90 kg of butane entered the cracking tower. After the reaction, 2.16 kg of butadiene was made.

Calculate the percentage yield of butadiene.

[3]

[Total: 10]

END OF PAPER 2

The Periodic Table of Elements

		Group																							
I	II	III	IV	V	VI	VII	0																		
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	19 K potassium 39	20 Ca calcium 40	37 Rb rubidium 85	38 Sr strontium 88	55 Cs caesium 133	87 Fr francium —	1 H hydrogen 1	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20	2 He helium 4								
<p style="text-align: center;">Key</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>proton (atomic) number</td> <td>1</td> </tr> <tr> <td>atomic symbol</td> <td>H</td> </tr> <tr> <td>name</td> <td>hydrogen</td> </tr> <tr> <td>relative atomic mass</td> <td>1</td> </tr> </table>																		proton (atomic) number	1	atomic symbol	H	name	hydrogen	relative atomic mass	1
proton (atomic) number	1																								
atomic symbol	H																								
name	hydrogen																								
relative atomic mass	1																								
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	39 Y yttrium 89	40 Zr zirconium 91								
39 Zr zirconium 91	40 Nb niobium 93	41 Mo molybdenum 96	42 Tc technetium —	43 Ru ruthenium 101	44 Rh rhodium 103	45 Pd palladium 106	46 Ag silver 108	47 Cd cadmium 112	48 In indium 115	49 Sn tin 119	50 Sb antimony 122	51 Te tellurium 128	52 I iodine 127	53 Xe xenon 131	54 Ba barium 137	55 La lanthanoids —	56 Ce cerium 140								
57 La lanthanium 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	88 Ra radium —	89 Ac actinoids —	90 Th thorium 232								
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 —	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —								
103 Lr lawrencium —	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 —	113 Nh nihonium —	114 Fl flerovium —	115 Lv livermorium —	116 Ts tennessine —	117 Og oganesson —	118 Uu ununoctium —	119 Uue unbinilium —	120 Uub unbihexium —								

lanthanoids

actinoids

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

