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NORTHLAND SECONDARY SCHOOL

PRELIMINARY EXAMINATION

Secondary Four Express

CHEMISTRY

6092/01

Paper 1 Multiple Choice

31 August 2022

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS

Write in soft pencil.

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

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

There are **forty** questions in this section. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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 19.

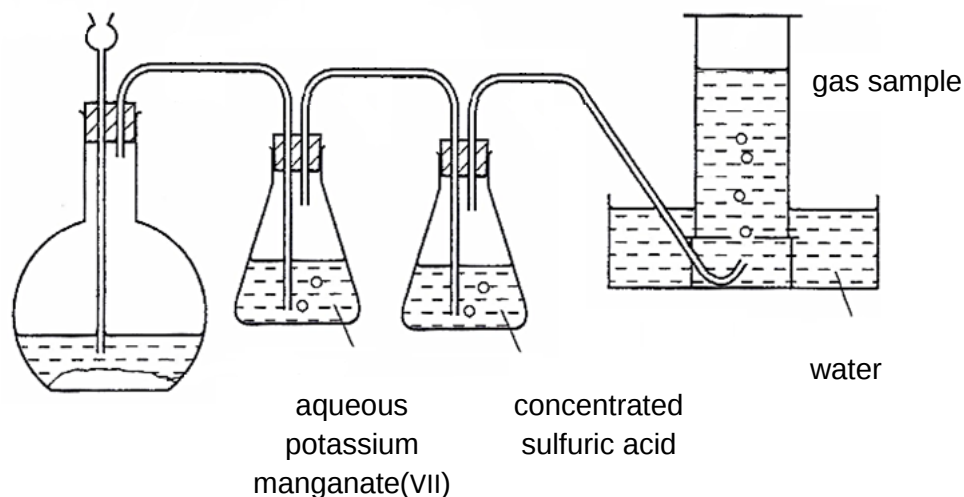
The use of an approved scientific calculator is expected, where appropriate.

SECTION	FOR EXAMINER'S USE
TOTAL	40

Setter: Mdm Kumari

Vetter: Mdm Nilasari

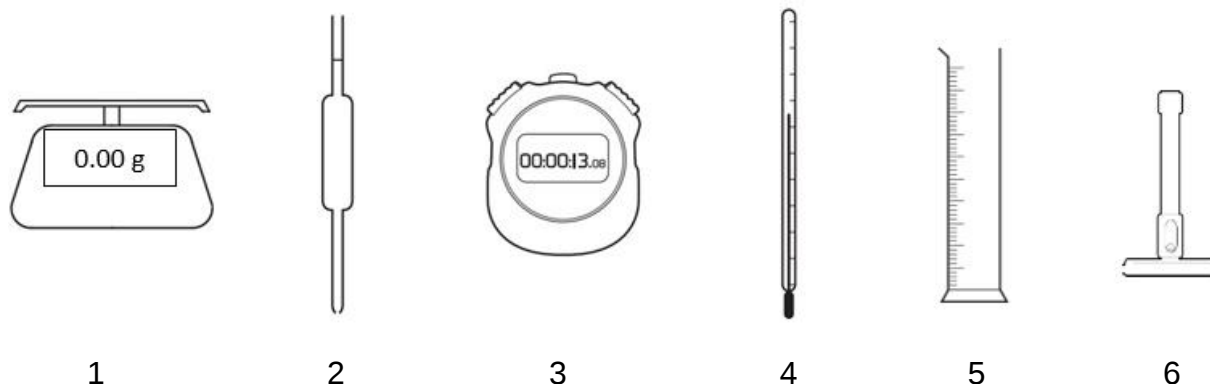
- 1 The diagram shows apparatus used to obtain a gas sample from a mixture of nitrogen, carbon monoxide, carbon dioxide and ammonia.



Which gases would be present in the gas sample?

- A carbon monoxide and ammonia only
 - B carbon monoxide and carbon dioxide only
 - C nitrogen and ammonia only
 - D nitrogen and carbon dioxide only
- 2 A student is given 750 cm^3 of a saturated solution containing a sodium salt S and 550 cm^3 of a saturated solution containing a potassium salt P. Both salts do not decompose on heating.

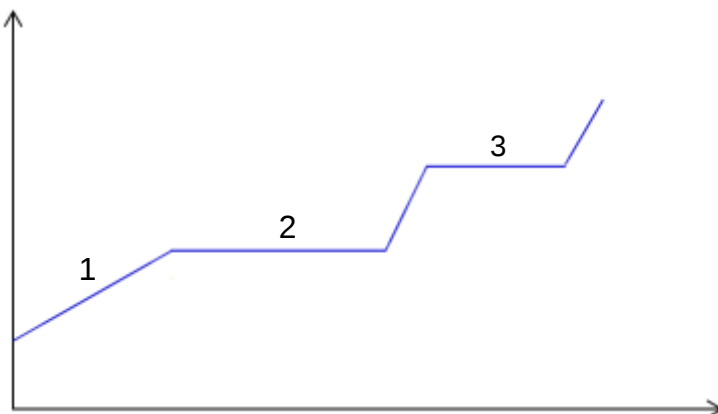
Which apparatus must she use to enable her to determine which salt is more soluble?



- A 1, 4 and 6
- B 1, 5 and 6
- C 1, 2, 3 and 4
- D 2, 4, 5 and 6

- 3 The graph shows the changes in temperature when a mixture containing equal volumes of X (boiling point 78 °C) and Y (boiling point 108 °C) is heated and separated by fractional distillation.

temperature / °C



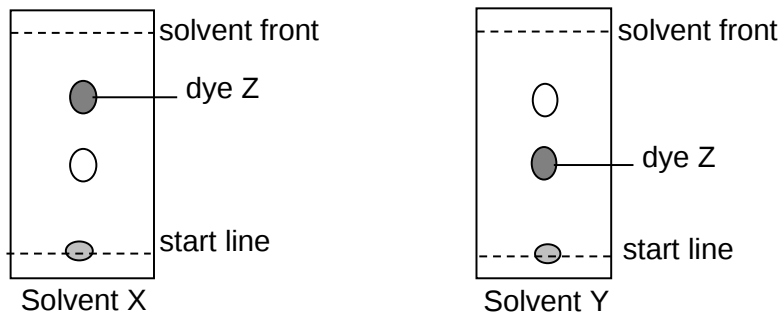
time / min

Which section(s) describe(s) the concentration of vapours X and Y correctly?

section	concentration of vapours
1	equal X and Y in the distilling flask
2	more X than Y in the condenser
3	more X than Y in the condenser

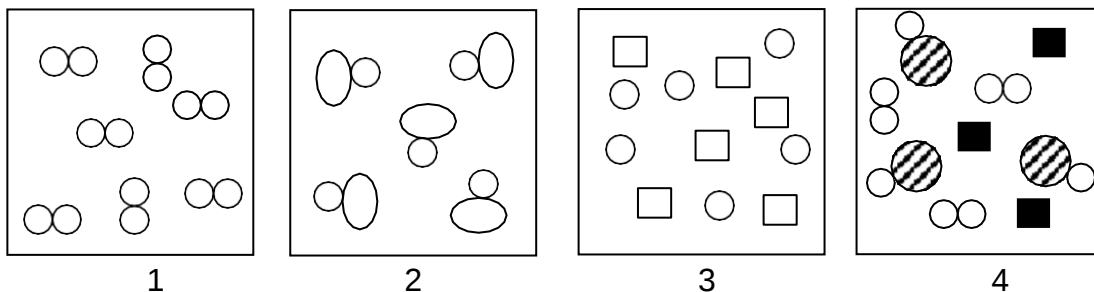
- A** 2 only
B 1 and 2 only
C 2 and 3 only
D 1, 2 and 3

- 4 In a paper chromatography experiment involving some food colouring, two different solvents X and Y were used on separate samples of the colouring. The two chromatograms are shown.



Which statement can be deduced from the results?

- A** Dye Z is equally soluble in solvent X and solvent Y.
B Dye Z is more soluble in solvent Y than solvent X.
C The distance dye Z travels depends on the amount of colouring used.
D The distance dye Z travels depends on the solvent used.
- 5 Four substances 1 to 4 can be represented by the diagrams.



A student described them as follows:

Substance	Description
1	Mixture of elements
2	Molecules of a compound
3	Molecules of an element
4	Mixture of elements and compounds

Which substance(s) has/have been correctly described by the student?

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

- 6 Element J exists mostly as the isotope ^{51}J , which makes up 77.8% of a sample of the element. The other known isotope is ^{54}J .

What is the relative atomic mass of element J?

- A 51.7
B 51.9
C 52.5
D 53.4

- 7 The structural diagrams of two molecules, X_2Y and ZY_2 , are shown.

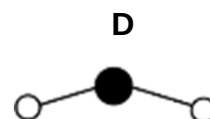
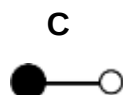
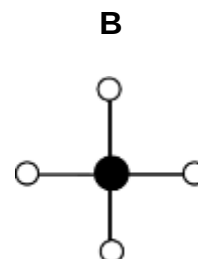
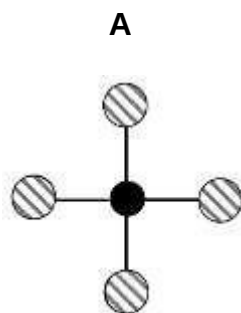


X_2Y



ZY_2

Which diagram represents a molecule of a compound formed between X and Z?



- 8 Which substance could be graphite?

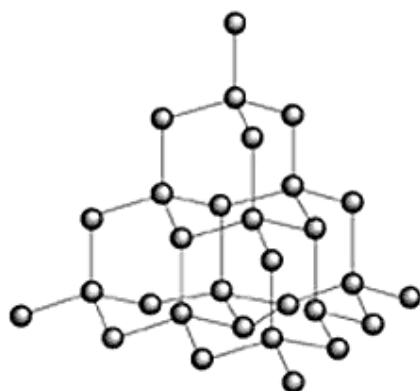
	melting point / $^{\circ}\text{C}$	boiling point / $^{\circ}\text{C}$	Electrical conductivity when solid
A	-52	-2	poor
B	98	883	good
C	648	1294	poor
D	3652	4827	good

- 9 The table gives the proton and nucleon numbers of atoms P, Q, R and S.

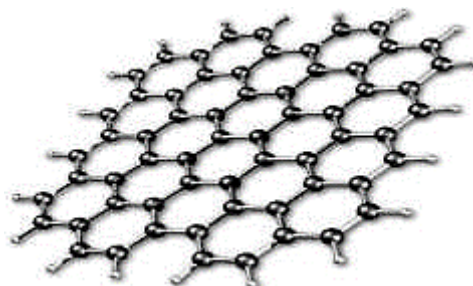
atom	proton number	nucleon number
P	6	14
Q	7	14
R	16	32
S	20	40

Which statement is true?

- A** Atom P and atom Q are isotopes of the same element.
B Atom P and atom R will combine to form a covalent compound.
C Atom Q and atom S will form an ionic compound with the formula S_2Q_3 .
D Atom S can form a diatomic molecule.
- 10 The diagrams show the structures of diamond and graphene, made up of carbon atoms in different arrangements



diamond



graphene

Which row shows the correct properties of diamond and graphene?

	diamond	graphene
A	good electrical conductor	poor electrical conductor
B	poor electrical conductor	poor electrical conductor
C	high melting point	high melting point
D	low melting point	high melting point

- 11 Chlorobutane, C_4H_9Cl , can be made from butanol using the reaction shown.



In an experiment, 20 g of butanol produced 24 g of chlorobutane.

What is the percentage yield of chlorobutane?

[M_r of C_4H_9OH : 74; M_r of C_4H_9Cl : 92.5]

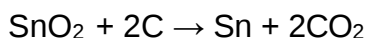
- A** 19.5 %
B 48.0 %
C 55.3 %
D 96.0 %

- 12** $x \text{ cm}^3$ of gaseous hydrogen chloride, measured at room temperature and pressure, was dissolved in water to make 200 cm^3 of hydrochloric acid. 20.0 cm^3 of the hydrochloric acid prepared required 30.0 cm^3 of 0.1 mol/dm^3 sodium hydroxide for complete neutralisation.

What is the value of x ?

- A** 0.110 cm^3
- B** 1.10 cm^3
- C** 72.0 cm^3
- D** 720 cm^3

- 13** Tin is extracted from its ore, SnO_2 , by reducing it with carbon in a furnace. The equation for the reaction is shown.

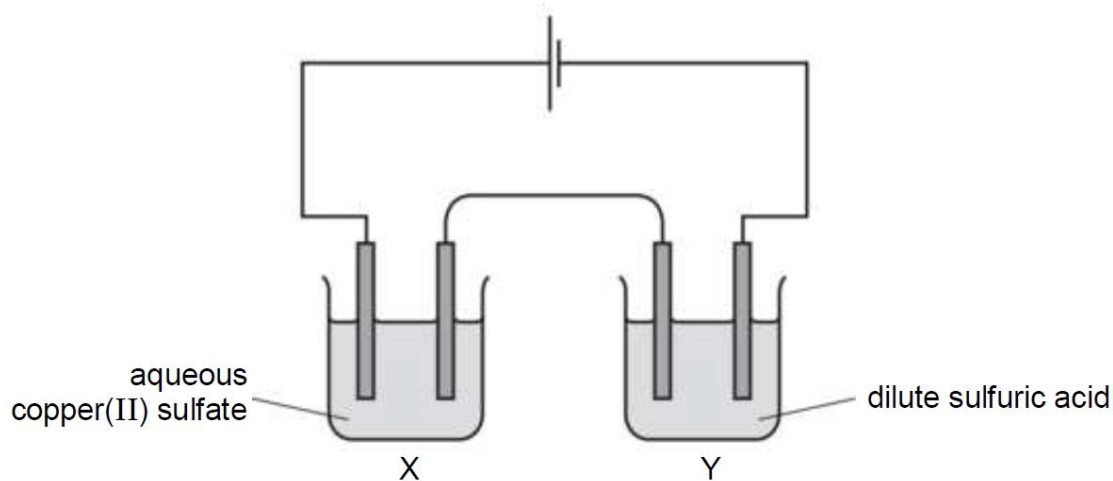


What is the percentage purity of tin ore if 600 g of the tin ore is reduced to produce 82 g of tin?

[A_r of Sn: 119, M_r of SnO_2 : 151]

- A** $\frac{82}{119} \times \frac{151}{600} \times 100$
- B** $\frac{82}{119} \times \frac{600}{151} \times 100$
- C** $\frac{119}{82} \times \frac{151}{600} \times 100$
- D** $\frac{119}{82} \times \frac{600}{151} \times 100$

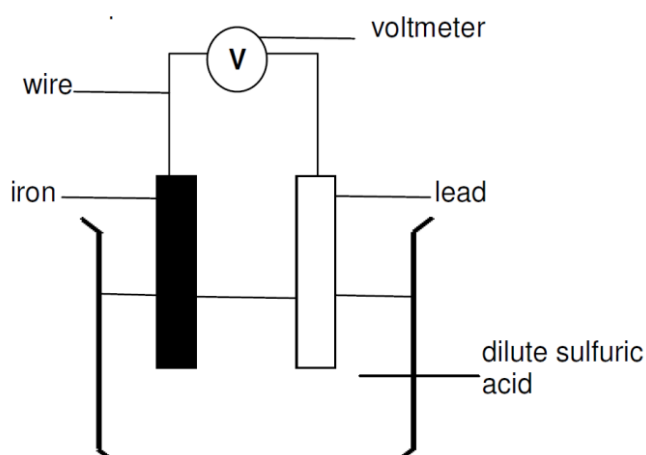
14 The diagram shows an electrolysis experiment using inert electrodes.



Which row indicates the concentration of the electrolytes in X and Y after some time?

	X	Y
A	changes	changes
B	changes	unchanged
C	unchanged	changes
D	unchanged	unchanged

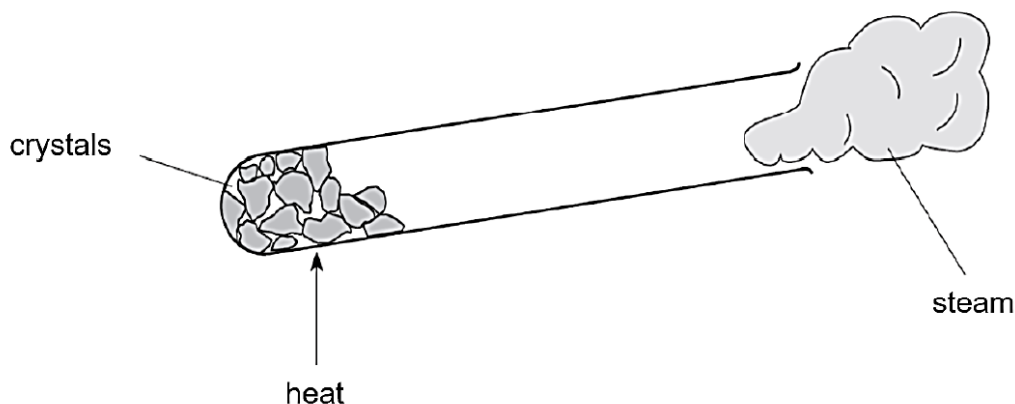
15 The diagram shows a simple cell.



Which half-equations best represent the reactions occurring at the positive and the negative electrode?

	negative electrode	positive electrode
A	$\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$	$\text{Pb}^{2+} + 2\text{e}^- \rightarrow \text{Pb}$
B	$\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
C	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$
D	$\text{Pb}^{2+} + 2\text{e}^- \rightarrow \text{Pb}$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$

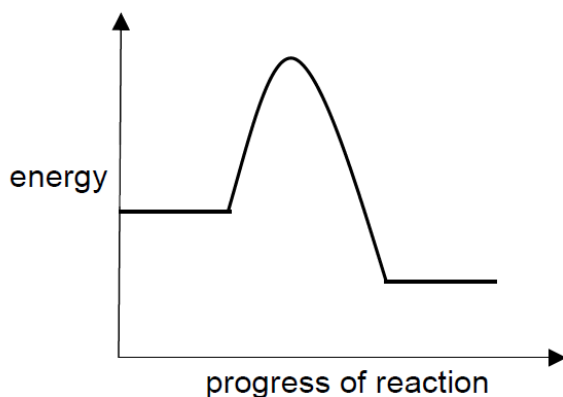
- 16 The diagram shows crystals of copper(II) sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, being heated.



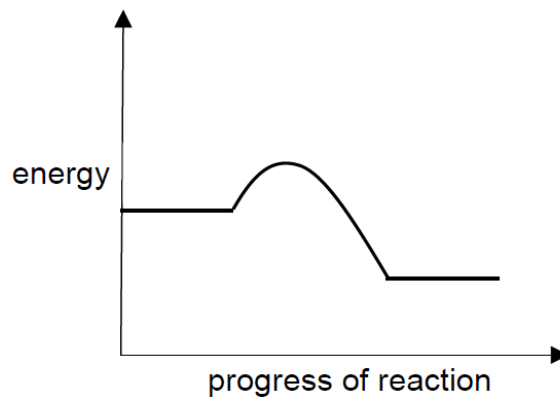
The copper(II) sulfate crystals were noted to have changed colour during the heating.

Which two terms best describe the changes observed in the above diagram?

- A endothermic and dehydration
 - B endothermic and hydration
 - C exothermic and dehydration
 - D exothermic and hydration
- 17 The diagrams show the energy profile diagrams of the same chemical reaction carried out under 2 different conditions.



Reaction 1

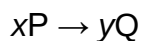


Reaction 2

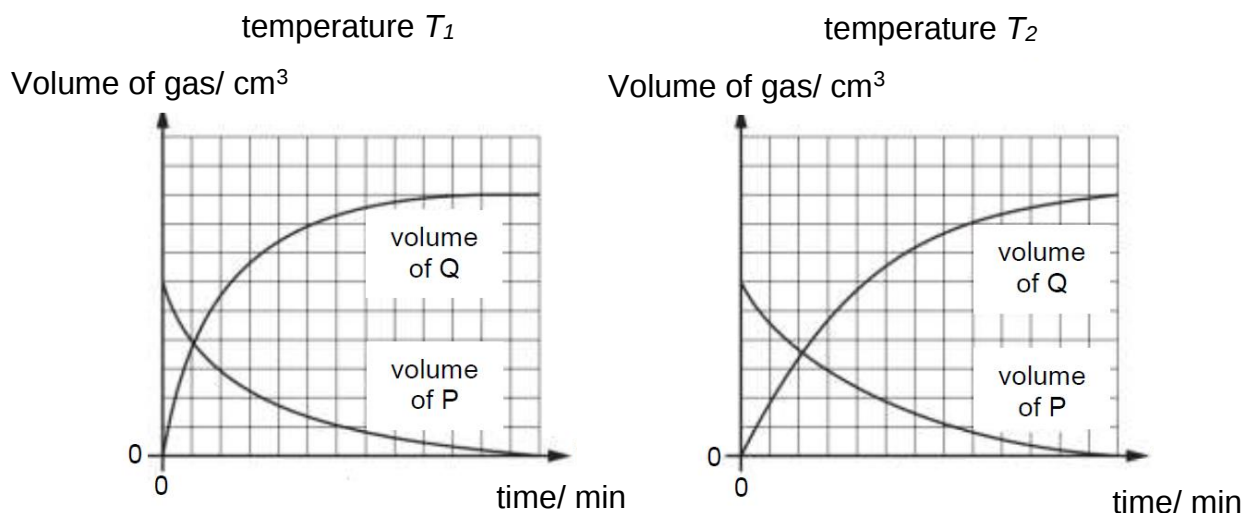
Which statement is true?

- A Reaction 1 is exothermic and took place at a slower rate.
- B Reaction 1 is exothermic while reaction in Reaction 2 is endothermic.
- C Reaction 1 took place at a higher temperature and a faster rate than Reaction 2
- D Reaction 2 is endothermic and the concentrations of the reactants were lower.

18 Gas P decomposes to form gas Q as shown in the equation.



Two experiments are conducted to investigate how different temperatures affect the rate of decomposition of gas P. The results of the experiments are shown.



Which of the following is correct?

	x	y	temperature
A	2	3	T_1 is higher than T_2
B	2	3	T_2 is higher than T_1
C	3	2	T_1 is higher than T_2
D	3	2	T_2 is higher than T_1

19 The thermometer shows the temperature at the start of the reaction in each beaker.

Which beaker shows the fastest rate of reaction?

A

1 g of marble powder
in 200 cm³ of
3 mol/dm³ HCl

B

1 g of marble chips
in 200 cm³ of
2 mol/dm³ HCl

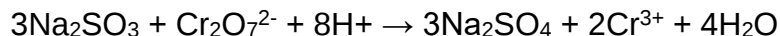
C

1 g of marble chips
in 200 cm³ of
2 mol/dm³ HCl

D

1 g of marble powder
in 200 cm³ of
1 mol/dm³ HCl

- 20 A reaction can be represented by the following equation.



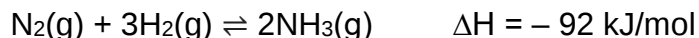
Which statement about the reaction is **incorrect**?

- A Na_2SO_3 is acting as a reducing agent.
- B The oxidation state of chromium is increased from -2 to +3.
- C The oxidation state of sulfur is increased from +4 to +6.
- D The reaction takes place in an acidic medium.

- 21 Which equation shows the greatest change in oxidation number for nitrogen?

- A $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$
- B $3\text{NO}_2 + \text{H}_2\text{O} \rightarrow 2\text{HNO}_3 + \text{NO}$
- C $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$
- D $4\text{NH}_3 + 6\text{NO} \rightarrow 5\text{N}_2 + 6\text{H}_2\text{O}$

- 22 Industrial ammonia is obtained by the Haber process.



Which statement about the process is **incorrect**?

- A High pressure favours the production of ammonia but is difficult to maintain.
- B The hydrogen needed is obtained mainly by cracking of petroleum oil.
- C The industrial catalyst used is finely divided iron.
- D The reaction is endothermic, hence a temperature of 450 °C is used.

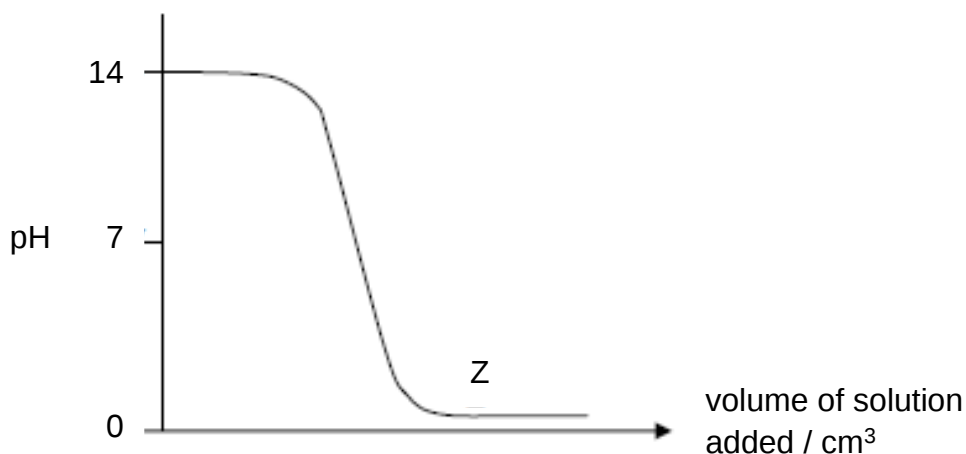
- 23 When performing an experiment, a student made the following observations.

- 1 The solution changes colour.
- 2 No bubbles of gas are formed.
- 3 No precipitate is formed.

Which pair of chemicals could the student have added together to obtain the above observations?

- A aqueous calcium nitrate and aqueous ammonia
- B aqueous lead(II) nitrate and aqueous magnesium chloride
- C dilute nitric acid and barium carbonate
- D dilute nitric acid and copper(II) oxide

24 The graph shows how the pH changes in a reaction between an acid and an alkali.

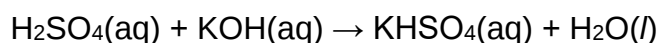


Which statements could be deduced from the graph?

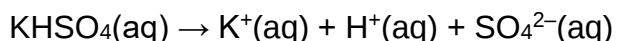
- 1 An acid is added to a fixed volume of an alkali.
- 2 Only salt and water are present at part Z of the graph.
- 3 Neutralisation occurs at about pH 7.

- A** 1 and 2
B 1 and 3
C 2 and 3
D all of the above

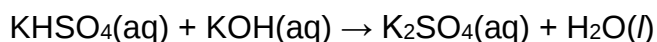
25 When dilute sulfuric acid and potassium hydroxide react, potassium hydrogen sulfate, KHSO_4 , is formed first.



Aqueous potassium hydrogen sulfate dissociates into ions.



If more potassium hydroxide is added, potassium sulfate can be formed.



Which results for these two salts, when tested with blue litmus paper and lead(II) nitrate solution are correct?

	salt	effect on blue litmus	addition of lead(II) nitrate solution
A	KHSO_4 K_2SO_4	no effect no effect	no precipitate no precipitate
B	KHSO_4 K_2SO_4	turns red no effect	white precipitate white precipitate
C	KHSO_4 K_2SO_4	no effect turns red	no precipitate no precipitate
D	KHSO_4 K_2SO_4	turns red turns red	white precipitate white precipitate

- A** Add dilute sulfuric acid to barium carbonate and then filter.
- B** Add excess aqueous sodium sulfate to barium carbonate and then filter.
- C** Add excess nitric acid to barium carbonate followed by dilute sulfuric acid and filter.
- D** Heat barium carbonate and then react the barium oxide with dilute sulfuric acid, then filter.

														R			
S														T	U		
V																	

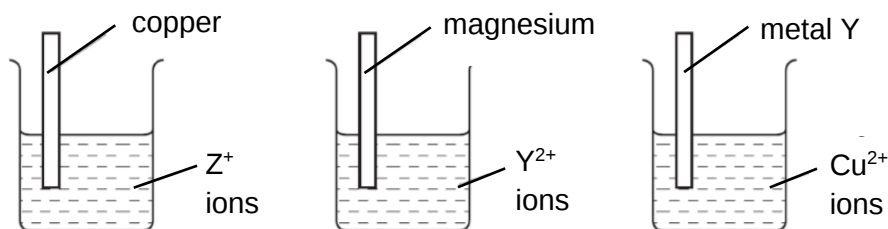
A T forms an ionic compound with U.
B The metallic character of Period 2 elements increases from S to U.
C The valence shell of an atom of R has an octet structure.
D V is a stronger reducing agent than S.

A Their melting points decrease on descending the group
B Their reactivities decrease on descending the group.
C They form covalent bonds with Group VII elements.
D They form oxides on reacting with water.

Which descriptions of X are correct?

	number of valence electron(s) in atoms of X	structure of gas X
A	2	single atoms
B	2	diatomic molecules
C	8	single atoms
D	8	diatomic molecules

- 30** A student conducted three experiments to compare the reactivities of four different metals: copper, magnesium, metal Y and metal Z.

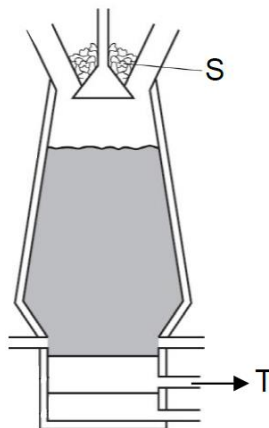


A deposit was observed on the metal strip for each experiment.

How many metal(s) that are investigated will be able to react with aqueous hydrochloric acid?

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

- 31** The diagram shows a blast furnace used to extract iron from haematite.



Which statement about the method of extraction is correct?

- A** Acidic impurities like sand are removed as slag which floats at T.
- B** Haematite, coke, hot air and limestone are added into the furnace through S.
- C** Haematite is oxidised to iron by the carbon monoxide which forms inside the furnace.
- D** Limestone reduces haematite to iron and carbon dioxide.

32 The diagram shows a boat made from iron.

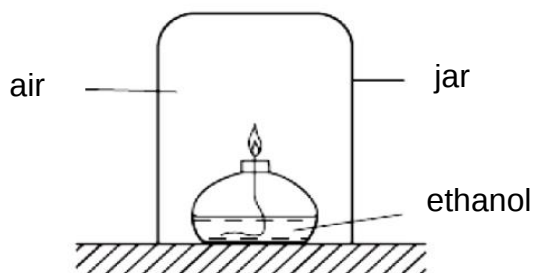
Some magnesium blocks are attached to the iron below the water line.



How does the magnesium stop the iron boat from rusting?

- A** Magnesium corrodes in preference to the iron.
- B** Magnesium forms an alloy with the iron.
- C** Magnesium prevents oxygen in the water from reacting with iron.
- D** Magnesium reacts to form a protective coating of magnesium oxide on the iron.

33 The diagram shows ethanol burning in a sealed jar.



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

Which gas is it?

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

34 The following are statements about air pollutants.

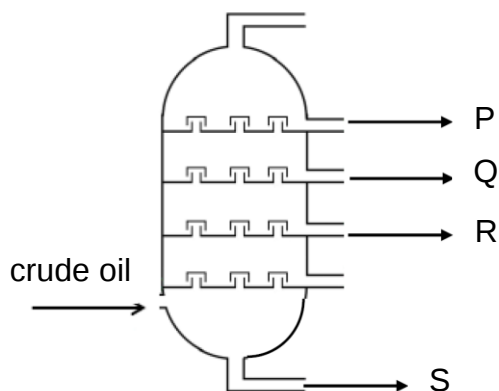
- 1 Carbon monoxide is responsible for the production of acid rain.
- 2 Oxides of nitrogen are present in car exhausts.
- 3 Sulfur dioxide can be produced by the combustion of fossil fuels.
- 4 Methane causes global warming.

Which statements are correct?

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

Refer to the diagram to answer Questions 35 and 36.

35 The diagram shows a fractionating column used for the refining of crude oil.



Which statements about the fractions P, Q, R and S are correct?

- 1 Fraction P has the lowest viscosity.
- 2 Fraction P is more flammable than fraction Q.
- 3 Fraction S has a smaller range of boiling points than fraction R.
- 4 All four fractions contain a mixture of hydrocarbons.

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

36 Which fraction is used for paving roads?

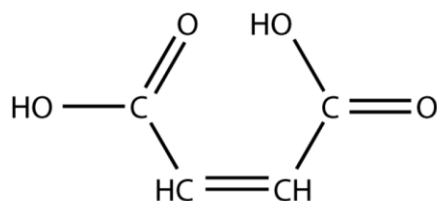
- A** Fraction P
B Fraction Q
C Fraction R
D Fraction S

37 0.4 mol of a polyunsaturated hydrocarbon was reacted with excess iodine until there was no further reaction. It was found that the product had an increase of 305 g.

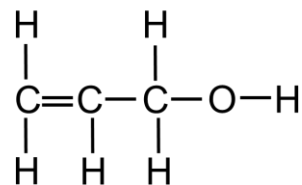
How many carbon-carbon double bonds did the hydrocarbon contain?

- A** 2
B 3
C 4
D 5

38 The structures of butenedioic acid and propenol are shown.



butenedioic acid



propenol

How many substance(s) can be used to distinguish between the two compounds?

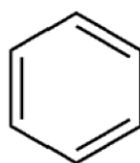
- aqueous bromine
- copper(II) carbonate
- acidified potassium manganate(VII) solution

- A 0
B 1
C 2
D 3

39 The diagram shows the structural formula of pentene together with a simplified version that most chemists use.

structural formula of pentene	simplified version

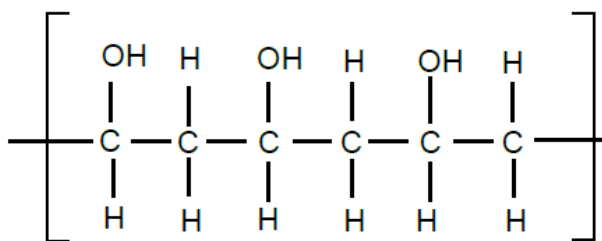
Benzene is a colourless and highly flammable hydrocarbon that is responsible for the aroma around petrol stations due to a sweet smell the liquid gives out. The simplified version of the structure of benzene is shown.



What is the empirical formula of benzene?

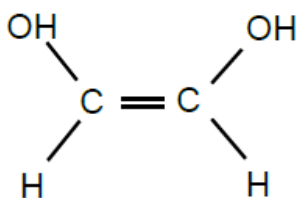
- A CH
B CH₂
C C₂H
D C₂H₃

- 40** Polyethenol is a new plastic, which is water soluble. This plastic is useful in hospitals for keeping soiled laundry and thereby preventing infection. The dirty laundry is then placed in the wash and the bag dissolves letting the washing out. The structure of polyethenol is shown.

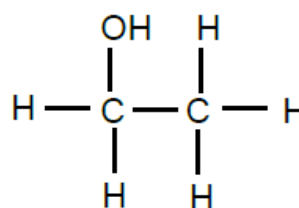


What is the monomer unit for this polymer?

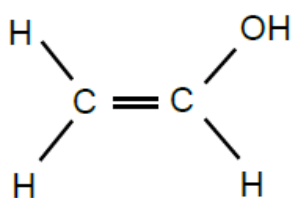
A



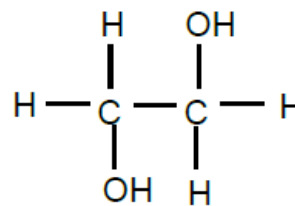
B



C



D



The Periodic Table of Elements

Group																		
I	II	Key										III	IV	V	VI	VII	0	
		proton (atomic) number atomic symbol name relative atomic mass																
		1 H hydrogen 1																
3 Li lithium 7	4 Be beryllium 9											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	
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84	
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131	
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium -	85 At astatine -	86 Rn radon -	
87 Fr francium -	88 Ra radium -	89 – 103 actinoids	104 Rf Rutherfordium -	105 Db dubnium -	106 Sg seaborgium -	107 Bh bohrium -	108 Hs hassium -	109 Mt meitnerium -	110 Ds darmstadtium -	111 Rg roentgenium -	112 Cn copernicium -	114 Fl flerovium -	116 Lv livermorium -	117 Ts tennessine -	118 Og oganeson -	119 Uue unbinilium -	120 Uuh ununilium -	

lanthanoids															71 Lu lutetium 175
57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium -	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175	
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 -	
actinoids															103 Lr lawrencium -

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