MONTFORT SECONDARY SCHOOL CHEMISTRY PRELIMS 2022 P1

Answer **all** questions. Choose the one you consider correct and record your choice with a **soft pencil** on a separate Answer Sheet.

1 Which piece of apparatus could be used to determine the end-point of the reaction between hydrochloric acid and potassium hydroxide?

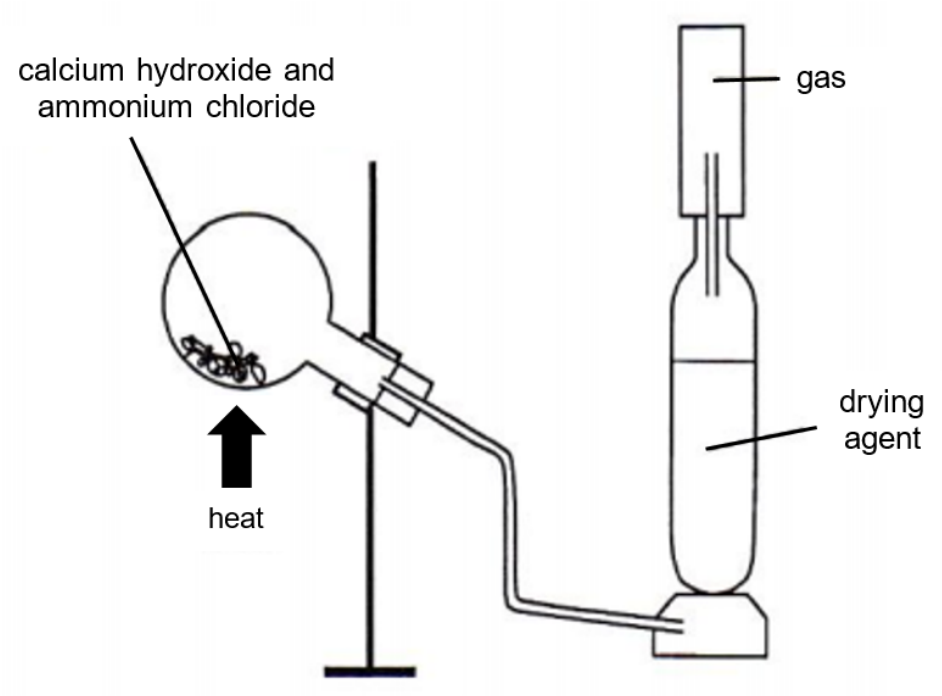
A electronic balance

B gas syringe

C stopwatch

D thermometer

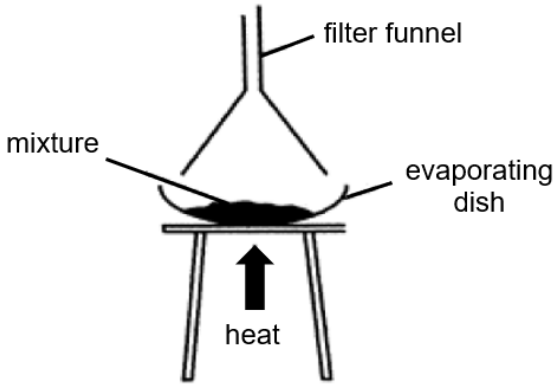
2 A student sets up the following apparatus to collect a gas.



What is the possible identity of the gas and drying agent?

	gas	drying agent
A	ammonia	concentrated sulfuric acid
B	ammonia	calcium oxide
C	hydrogen chloride	calcium oxide
D	hydrogen chloride	concentrated sulfuric acid

3 A student uses the following experimental set-up to separate mixtures.



Which mixture can be separated into its components using this set-up?

A ammonium chloride and iodine

B copper(II) sulfate and sodium chloride

C copper(II) sulfate and sugar

D sodium chloride and ammonium chloride

4 Some properties of substances P, Q, R and S are given in the table.

substance	percentage composition by mass	electrical conductivity when solid	effect of heat
P	fixed	yes	solid burns brightly to form an oxide
Q	fixed	no	solid decomposes to form simpler substances
R	varies	no	liquid burns to form carbon dioxide and water
S	varies	yes	solid melts

Which classification of the substances as an element, a mixture or a compound is correct?

	element	mixture	compound
A	P	R	Q, S
B	S	Q, R	P
C	R	S	Q, P
D	P	R, S	Q

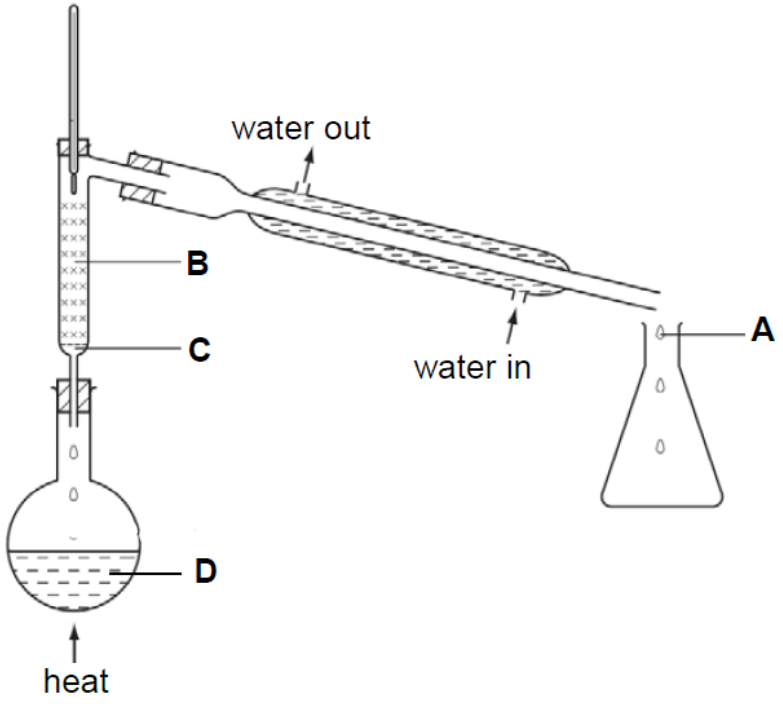
5 An unknown substance melts at -210 °C and boils at -196 °C.

Which row correctly describes the arrangement and movement of the particles of this substance at -204 °C?

	arrangement	movement
A	closely packed in a disorderly manner	sliding past one another
B	closely packed in a disorderly manner	vibrating about fixed positions
C	closely packed in an orderly manner	sliding past one another
D	closely packed in an orderly manner	vibrating about fixed positions

6 A mixture containing an equal volume of two miscible liquids is heated as shown.

When the mixture starts boiling and the thermometer first registers a steady reading, at which position, **A**, **B**, **C**, or **D**, will there be the highest proportion of liquid with the higher boiling point?



7 Paper chromatography is carried out on three different mixtures of dyes, using the same solvent. Each mixture contains at least one of the dyes W, X, Y and Z.

The R_f values of the dyes in the three mixtures are shown.

dye	R_f values from mixture 1	R_f values from mixture 2	R_f values from mixture 3
W	0.14	0.14	0.14
X	0.00	0.00	0.00
Y	0.50	0.50	0.50
Z	0.82	0.82	0.00

Which conclusion is correct?

A Dye W is nearest to the solvent front and is present only in mixture 1 and mixture 3.

B Dye X has travelled furthest up the chromatography paper.

C Dye Y is the only dye present in all three mixtures.

D Dye Z is nearest the solvent front and is found in only two of the mixtures.

8 The table shows information about two particles, L and M.

particle	number of protons	number of neutrons	electronic structure
L	11	12	2.8
M	19	20	2.8.8

Which statement about L and M is correct?

A Both are atoms of noble gases.

B Both are isotopes of the same element.

C Both are negative ions.

D Both are positive ions.

9 When testing for a chloride ion using silver nitrate, the solution must be acidified with dilute nitric acid.

What is the purpose of the nitric acid?

A to act as a catalyst

B to oxidise the chloride ion

C to prevent decomposition of any silver chloride formed

D to prevent precipitation of silver carbonate

10 Rubidium has a relative atomic mass of 85.5. It consists of only two isotopes with different percentage abundance.

isotope	percentage abundance
rubidium-85	?
rubidium-87	

What is the percentage abundance of rubidium-85 that occurs naturally?

A 25 %

B 45 %

C 50 %

D 75 %

11 An oxide compound contains 18.5 % by mass of calcium and 51.9 % by mass of iron.

What is its empirical formula?

A $CaFe_2O_4$

B $CaFe_2O$

C Ca_2FeO_2

D $Ca_2Fe_4O_8$

12 Which statement **best** explains why graphite is a suitable material to make pencil leads?

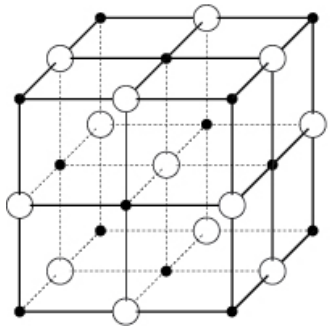
A The atoms can slide past one another easily.

B The delocalised electrons are free and mobile.

C The intermolecular forces of attraction between hexagonal layers of carbon atoms are easy to overcome.

D The strong covalent bonds between carbon atoms are difficult to overcome.

13 The diagram shows the arrangement of the ions in an ionic crystal.



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

A calcium chloride, $CaCl_2$

B copper(II) sulfate, $CuSO_4$

C lithium fluoride, LiF

D magnesium oxide, MgO

14 Aqueous sodium hydroxide reacts with the solution of a metal chloride, GCl_n, to form a precipitate of the metal hydroxide.

$$GCl_n + nNaOH \rightarrow G(OH)_n + nNaCl$$

15 cm^3 of 0.500 mol/dm^3 sodium hydroxide required 20 cm^3 of 0.125 mol/dm^3 GCl_n solution for the reaction to complete.

What is the formula of the metal chloride?

A GCl

B GCl_2

C GCl_3

D GCl_4

15 200 cm^3 of ammonia burns in 120 cm^3 of oxygen according to the following equation.

$$4NH_3(g) + 3O_2(g) \rightarrow 2N_2(g) + 6H_2O(g)$$

What volume of nitrogen will be obtained, at room temperature and pressure?

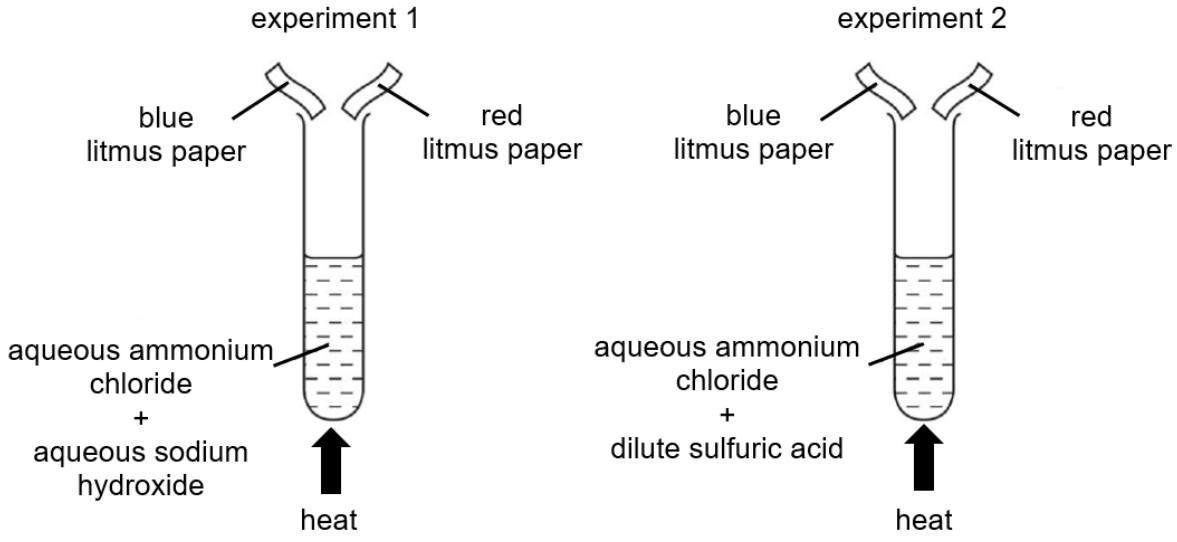
A 80 cm^3

B 100 cm^3

C 240 cm^3

D 320 cm^3

16 The diagram shows two experiments.



What will happen to the pieces of litmus paper?

	experiment 1	experiment 2
A	blue → red	both pieces bleach
B	blue → red	no change
C	red → blue	both pieces bleach
D	red → blue	no change

17 A sample of magnesium hydroxide, $Mg(OH)_2$, is made by adding an excess of aqueous sodium hydroxide to an aqueous solution containing 1.20 g magnesium sulfate, $MgSO_4$.

The mass of magnesium hydroxide formed is 0.26 g.

What is the percentage yield of magnesium hydroxide?

A 10.5 %

B 21.7 %

C 44.8 %

D 61.9 %

18 Which substance reacts with water to form a soluble compound and an insoluble gas?

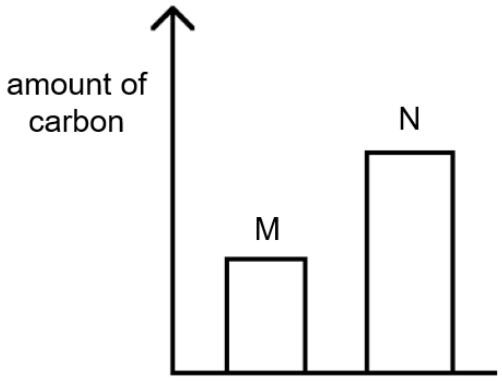
A ammonium sulfate

B caesium

C copper

D magnesium carbonate

19 Two steel bars from different manufacturers, M and N, has different amount of carbon.



Which statement shows the correct comparison of hardness and brittleness between the steel bars?

A M is harder and more brittle than N.

B M is harder than N, but N is more brittle than M.

C N is harder than M, but M is more brittle than N.

D N is harder and more brittle than M.

20 Elements H, J, L are in the same period in the Periodic Table.

The oxide of H dissolves in water to form a solution with a pH 12.5. The oxide of J forms a solution with a pH less than 4.5. The oxide of L is soluble in both aqueous potassium hydroxide and dilute nitric acid.

Which option shows the position of the elements in order of increasing atomic number?

A H, J, L

B H, L, J

C J, L, H

D L, J, H

21 Which element is most likely to be a transition metal?

element	melting point °C	density in g/cm^3	number of chlorides formed
A	-7	3.10	2
B	113	2.07	1
C	1521	1.12	1
D	1083	8.92	2

22 Which process does **not** involve either oxidation or reduction?

A formation of ammonium sulfate from ammonia and sulfuric acid

B formation of nitrogen monoxide from ammonia

C formation of sulfuric acid from sulfur

D formation of zinc from zinc blende, ZnS

23 Which reagent can be used to convert MnO_4^- ions to Mn^{2+} ions?

A acidified potassium manganate(VII)

B acidified potassium dichromate(VI)

C aqueous potassium iodide

D chlorine gas

24 W, X, Y and Z are metals. When the metals are heated with an oxide of another metal, the following results are obtained.

oxide of Z + W → oxide of W + Z

oxide of X + W → no reaction

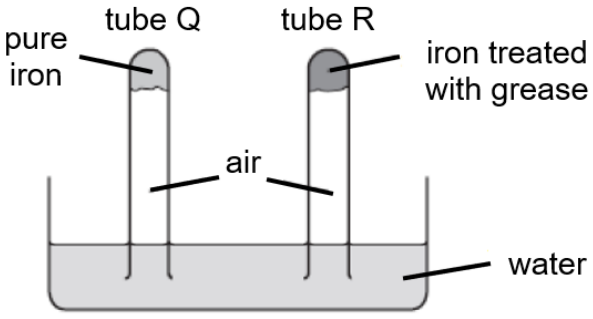
oxide of Z + Y → oxide of Y + Z

oxide of W + Y → no reaction

What is the correct arrangement of metals W, X, Y and Z in order of decreasing reactivity?

	most reactive	→		least reactive
A	X	W	Y	Z
B	Y	X	W	Z
C	W	X	Y	Z
D	Z	Y	W	X

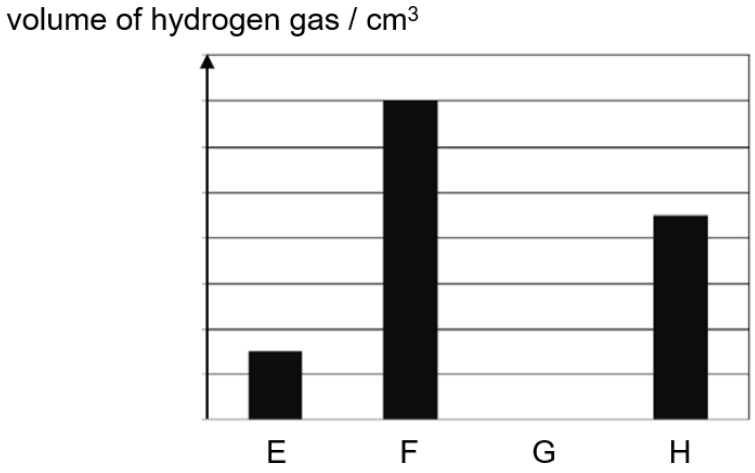
25 An experiment to investigate the effect of treating iron with grease is shown.



After seven days, what would happen to the water levels in tubes Q and R?

	tube Q	tube R
A	falls	no change
B	no change	rises
C	rises	no change
D	rises	rises

26 The bar chart below shows the volume of hydrogen gas collected in 1 min when equal masses of metals E, F, G and H are added to excess dilute nitric acid.



The carbonates of these metals were then heated.

Which row correctly shows the temperature required to decompose the carbonates of these metals in increasing order?

	increasing temperature →			
A	F	E	H	G
B	F	H	E	G
C	G	E	F	H
D	G	E	H	F

27 Ammonia is produced by the Haber process.

$$N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_3\,(g) \qquad \Delta H = -92\ kJ/mol$$

Which statement about the Haber process is **not** correct?

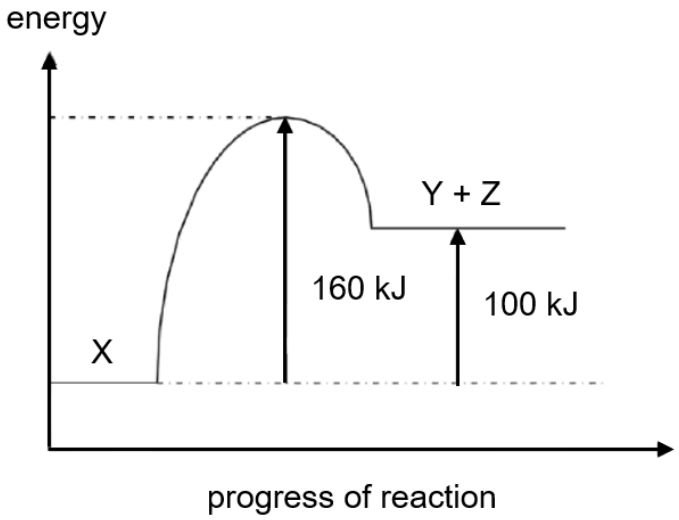
A An iron catalyst is used.

B Decreasing the temperature leads to an increase in the yield of ammonia.

C The hydrogen used is obtained from the fractional distillation of air.

D The yield of the reaction is always lower than 100 % as the reaction is reversible.

28 The diagram shows the energy profile for the decomposition of X to form products Y and Z.



What will be the activation energy for the reverse reaction?

A -160 kJ

B -60 kJ

C 60 kJ

D 160 kJ

29 The reaction between hydrogen and chlorine is represented by the equation shown.

$$H_2 + Cl_2 \rightleftharpoons 2HCl \qquad \Delta H = -184 \text{ kJ/mol}$$

The H–H bond energy is 436 kJ/mol and the C*l*–C*l* bond energy is 242 kJ/mol.

What is the H–Cl bond energy?

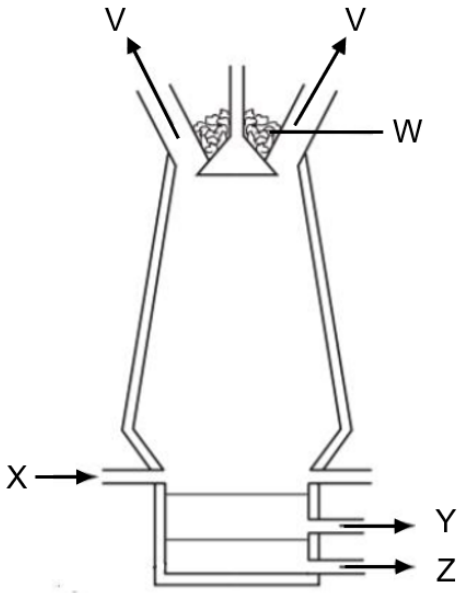
A 247 kJ/mol

B 431 kJ/mol

C 494 kJ/mol

D 862 kJ/mol

30 The diagram shows a blast furnace used in the extraction of iron.



Some statements about the extraction of iron are given.

I Air enters from X and waste gases escape from V.
II Haematite, limestone and coke are added to the furnace at W.
III Molten iron and slag is collected at Y and Z respectively.
IV Nitrogen is one of the main waste gases in the blast furnace.

Which statements about the extraction of iron in the blast furnace are correct?

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

31 Magnesium reacts with dilute hydrochloric acid at a constant temperature of 25 °C.

Which statement about the rate of this reaction is correct?

A It decreases as the reaction proceeds.
B It decreases then increases as the reaction proceeds.
C It increases as the reaction proceeds.
D It remains the same as the reaction proceeds.

32 A metal fork is to be electroplated with nickel.

Which row correctly describes the set-up for this process?

	anode	cathode	electrolyte
A	metal fork	nickel	nickel(II) nitrate
B	metal fork	nickel	sulfuric acid
C	nickel	metal fork	nickel(II) nitrate
D	nickel	metal fork	sulfuric acid

33 Which pairs of statements correctly describe the differences between the conduction of electricity during electrolysis and the conduction of electricity by metals?

	conduction during electrolysis	conduction by metals
1	current is due to the movement of both positive and negative ions	current is due to the movement of electrons
2	charged particles move towards both electrodes	charged particles move in one direction only
3	results in a chemical change	does not result in a chemical change

A 1, 2 and 3 are correct

B 1 and 2 only are correct

C 2 and 3 only are correct

D 1 only is correct

34 Which atmospheric pollutants, emitted by internal combustion of engines, are reacted together to convert them to less harmful products?

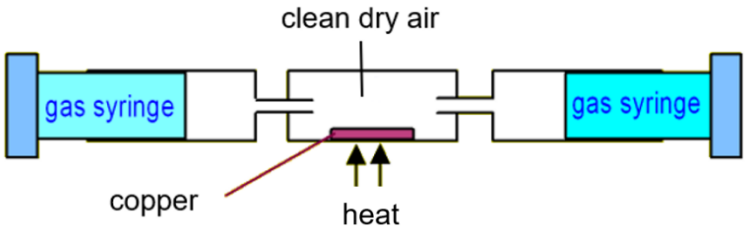
A carbon monoxide and nitrogen dioxide

B carbon monoxide and unburned hydrocarbons

C nitrogen dioxide and sulfur dioxide

D sulfur dioxide and unburned hydrocarbons

35 A sample of clean, dry air is passed over hot copper until all the oxygen in the air reacts with the copper. The volume of air decreases by 60 cm^3.



What is the approximate initial volume of the sample of air?

A 75 cm^3

B 120 cm^3

C 300 cm^3

D 600 cm^3

36 In an electrolysis experiment, the same amount of electrons deposited 3.90 g of zinc and 2.36 g of cobalt. The charge on the zinc ion was 2+.

[A_r: Co, 59; Zn, 65]

What is the charge of cobalt ion?

A 1+

B 2+

C 3+

D 4+

37 Which of the following could **not** be produced when methane reacts with fluorine in the presence of ultraviolet light?

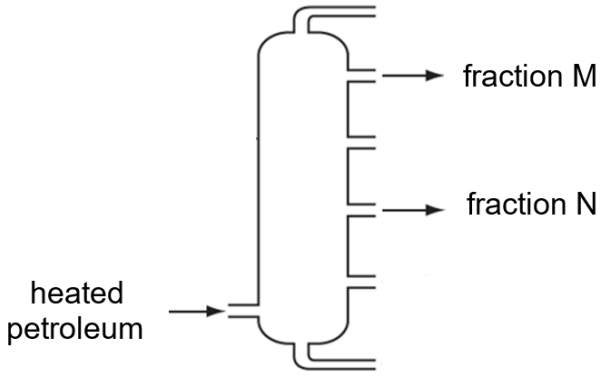
A fluoromethane

B hydrogen

C hydrogen fluoride

D tetrafluoromethane

38 The diagram shows the fractional distillation of petroleum.



Which row about fraction M and N is correct?

	M burns more easily than N	M has a higher boiling point than N	M is more viscous than N
A	true	false	false
B	true	true	false
C	false	true	true
D	false	false	true

39 Which statement about vegetable oil and the margarine made from it is correct?

A Both are liquids at room temperature and pressure.

B Both occur naturally.

C Margarine has a higher melting point.

D Vegetable oil has fewer carbon-carbon double bonds than margarine.

40 If one mole of each alcohol is burnt in excess oxygen, which alcohol will provide CO_2 and H_2O in a mole ratio of 3:4?

A CH_3OH

B C_2H_5OH

C C_3H_7OH

D C_4H_9OH

End of Paper 1

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key proton (atomic) number atomic symbol name relative atomic mass									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 –		

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

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