O

ANDERSON SECONDARY SCHOOL
Preliminary Examination
Secondary Four Express

CANDIDATE NAME:

CLASS: / INDEX NUMBER:

CHEMISTRY **6092/01**

Paper 1 Multiple Choice **23 August 2024**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number 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.

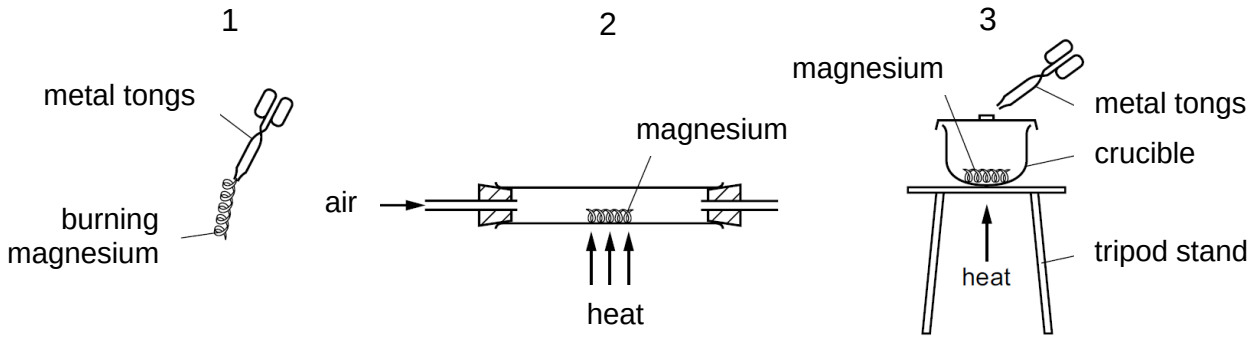
There are **forty** questions on this paper.
Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in pencil on the separate Answer Sheet.

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 18.
The use of an approved scientific calculator is expected, where appropriate.

1 When heated, magnesium undergoes combustion to form magnesium oxide, a white powder.

A student investigates the change in mass that occurs during this reaction. The student is given a balance and three sets of apparatus as shown.



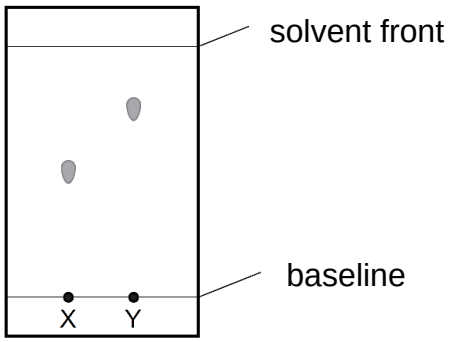
Which sets of apparatus are suitable for this investigation?

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

2 The results of a paper chromatography experiment are shown, which is **not** drawn to scale.

X is an aqueous solution of a salt of a Group 1 element.

Y is an aqueous solution of a salt of a transition element.



Which row is correct?

	larger R_f value	requires a locating agent
A	X	X
B	X	Y
C	Y	X
D	Y	Y

3 A laboratory has a powdered mixture of solid iodine and solid carbon.

Iodine is very soluble in hexane and slightly soluble in water. Carbon is insoluble in both solvents.

One sample of the mixture is shaken with hexane. This is P.

Another sample of the mixture is shaken with water. This is Q.

Which procedure is used to prepare a pure sample of iodine?

A P is distilled and the distillate is evaporated to dryness.
B P is filtered and the filtrate is allowed to evaporate to dryness.
C P is filtered and the residue is allowed to evaporate to dryness.
D Q is distilled and the distillate is evaporated to dryness.

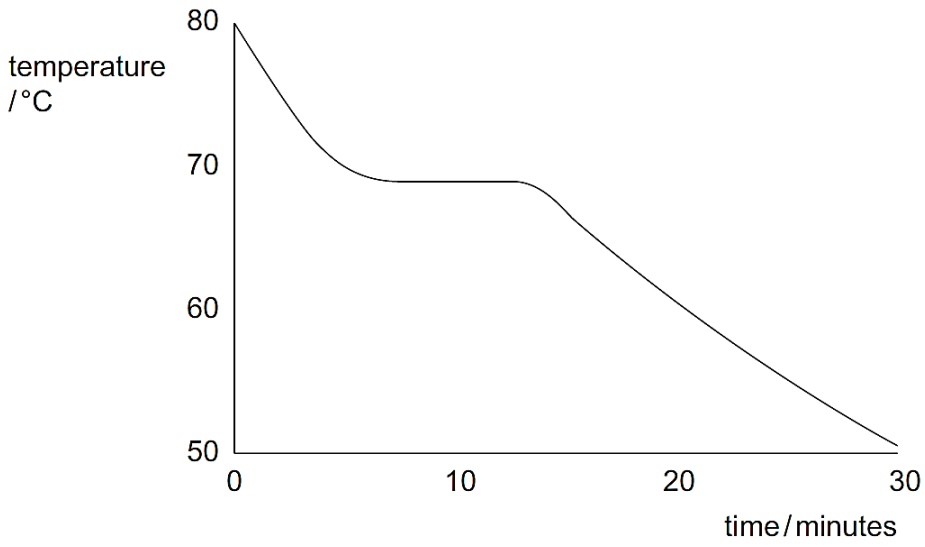
4 Mineral wool soaked in aqueous ammonia is placed in the apparatus shown.

After 5 minutes, the damp red litmus paper turns blue.

Which process led to this change?

A condensation
B crystallisation
C diffusion
D fractional distillation

5 Stearic acid has a melting point of 69°C.
A heated sample of pure stearic acid is cooled, and the temperature is recorded every minute for 30 minutes. A graph of the results is shown.



Which process occurs between 8 and 12 minutes?

A boiling
B condensing
C freezing
D melting

6 The number of electrons, protons and neutrons in four different particles are shown.

particle	electrons	protons	neutrons
1	19	19	20
2	18	19	20
3	20	20	20
4	19	19	22

Which particles are isotopes of the same element?

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

7 Element E and element G react together to form a compound.

The electronic configurations of E and G are 2,8,3 and 2,6 respectively.

Which row is correct?

	element E	element G	type of compound
A	2 atoms each loses 3 electrons	3 atoms each gains 2 electrons	covalent
B	2 atoms each loses 3 electrons	3 atoms each gains 2 electrons	ionic
C	2 atoms each gains 3 electrons	3 atoms each loses 2 electrons	covalent
D	2 atoms each gains 3 electrons	3 atoms each gains 2 electrons	ionic

8 Which substance has a giant covalent structure and contains atoms of more than one element?

A ammonia
B diamond
C graphite
D silicon dioxide

9 Three statements about the properties of metals are shown.

1 All metals conduct electricity.
2 All metals have 2 electrons in their innermost shell.
3 All metals have high melting points.

Which statements are correct?

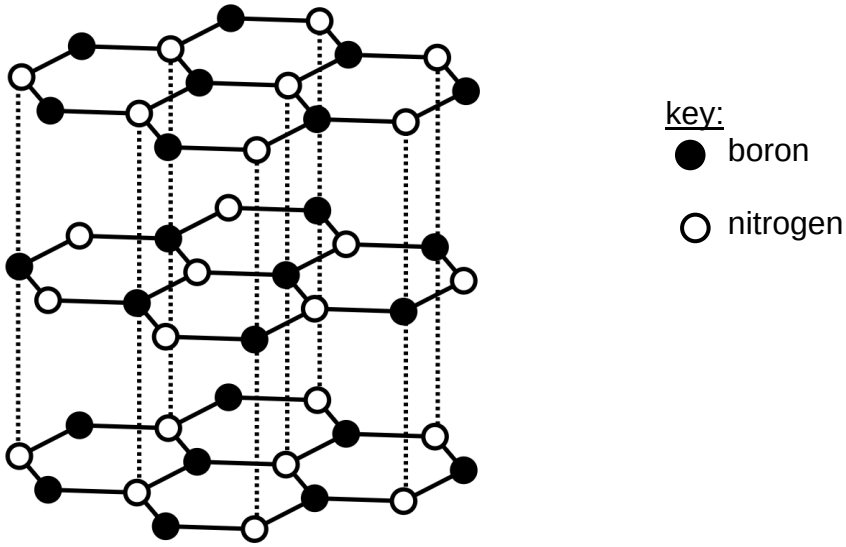
A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 1, 2 and 3

10 Element J forms a positive ion when it reacts with oxygen.

Using the Periodic Table, how many protons are in atom J?

A 6 **B** 10 **C** 16 **D** 20

11 The diagram shows the structure of boron nitride.



Which statement about boron nitride is correct?

A It has a low melting point.
B It has an ionic lattice.
C It has the same structure as diamond.
D It can be used as a lubricant.

12 Three compounds are listed.

- calcium carbonate
- potassium sulfate
- zinc nitrate

Which row shows the element present in the greatest percentage by mass in each compound?

	element present in the greatest percentage by mass in calcium carbonate	element present in the greatest percentage by mass in potassium sulfate	element present in the greatest percentage by mass in zinc nitrate
A	calcium	oxygen	oxygen
B	calcium	oxygen	zinc
C	oxygen	potassium	zinc
D	oxygen	potassium	oxygen

13 Samples of two hydrated compounds are weighed and then dehydrated by heating.

The anhydrous compounds are weighed and the results are shown.

3.97g $FeSO_4.xH_2O$ gives 2.17g anhydrous $FeSO_4$.

2.88g $CaSO_4.yH_2O$ gives 2.27g anhydrous $CaSO_4$.

What are the values of x and y?
[M_r: $FeSO_4$, 152; $CaSO_4$, 136; H_2O, 18]

	x	*y*
A	5	2
B	5	5
C	7	5
D	7	2

14 50.0 cm^3 of 0.100 mol/dm^3 silver nitrate, $AgNO_3$, is added to 150.0 cm^3 of 0.0500 mol/dm^3 sodium iodide, NaI, in a beaker.

After the reaction, solid silver iodide is present in the beaker.

What else is present?

A aqueous silver nitrate and aqueous sodium nitrate
B aqueous sodium iodide and aqueous sodium nitrate
C aqueous sodium iodide only
D aqueous sodium nitrate only

15 Aqueous hydrogen peroxide, H_2O_2, decomposes slowly at 25°C.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

The decomposition reaction takes place faster when a catalyst is added.

A student adds a small amount of catalyst to 10 cm^3 of 1.00 mol/dm^3 of aqueous hydrogen peroxide and collects the gas that is produced. The volume of gas collected is 90 cm^3. All measurements are made at room temperature and pressure.

What is the percentage yield of oxygen?

A 28.1% **B** 37.5% **C** 56.3% **D** 75.0%

16 What is a chemical product of a hydrogen-oxygen fuel cell?

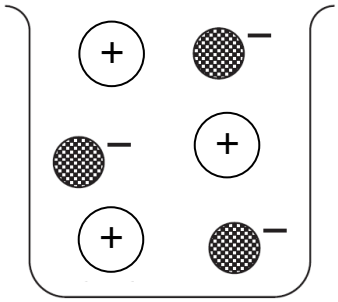
A electricity
B hydrogen
C oxygen
D water

17 Which method of preparation of magnesium sulfate is an example of redox reaction?

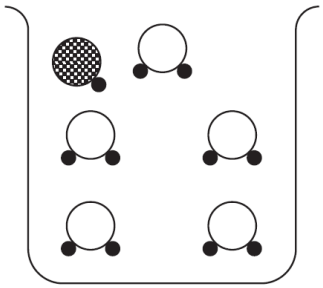
A $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$
B $MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$
C $Mg(OH)_2 + H_2SO_4 \rightarrow MgSO_4 + 2H_2O$
D $MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$

18 Which diagram represents the ionisation of a weak acid?

A



B



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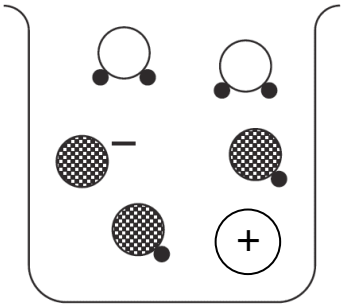
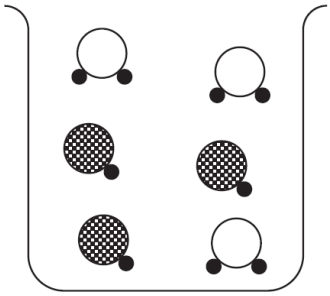


D



key:

 water molecule

 molecule of weak acid

 H^+ ion

 negative ion

19 A salt, H, dissolved in water to give a green solution. On adding chlorine, the green solution turned yellow. On addition of aqueous ammonia, the green solution gave a green precipitate and the yellow solution gave a red-brown precipitate. On addition of dilute nitric acid followed by aqueous barium nitrate, the green solution gave a white precipitate.

What is the formula of H?

A $CuCl_2$ **B** $CuSO_4$ **C** $FeCl_2$ **D** $FeSO_4$

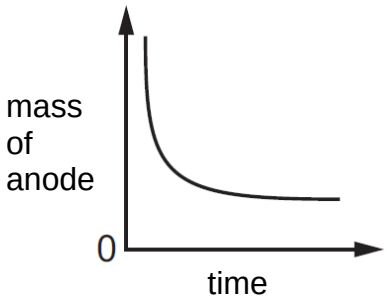
20 Which reaction shows the most suitable reaction for making silver chloride?

A $2Ag + 2HCl \rightarrow 2AgCl + H_2$
B $Ag_2CO_3 + 2HCl \rightarrow 2AgCl + CO_2 + H_2O$
C $AgNO_3 + HCl \rightarrow AgCl + HNO_3$
D $Ag_2O + 2HCl \rightarrow 2AgCl + H_2O$

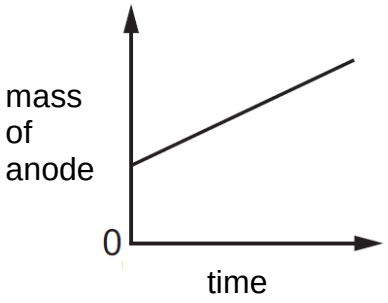
21 Aqueous copper(II) sulfate is electrolysed using copper electrodes. The current is constant and the anode is weighed at regular time intervals.

Which graph is obtained when the mass of the anode is plotted against time?

A



B



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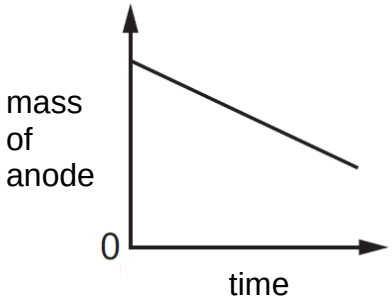

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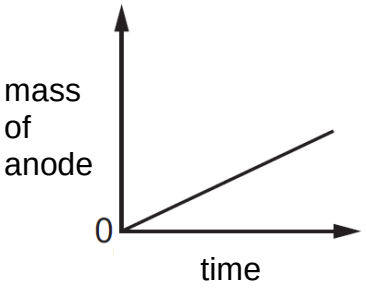


22 Which reagent and observation describes the test for a reducing agent?

	reagent	colour change
A	acidified aqueous potassium manganate(VII)	colourless to purple
B	acidified aqueous potassium manganate(VII)	purple to colourless
C	aqueous potassium iodide	colourless to purple
D	aqueous potassium iodide	purple to colourless

23 Electrolysis is used to plate a metal coin with silver.
The coin is used as an electrode in a suitable electrolyte.

Which row is correct?

	coin	electrolyte
A	anode	AgC*l*(aq)
B	anode	$AgNO_3$(aq)
C	cathode	AgC*l*(aq)
D	cathode	$AgNO_3$(aq)

24 Winkler method is used to determine the amount of dissolved oxygen in a water sample.
The procedure involves the following sequence of reactions.

Step 1 $2Mn^{2+}(aq) + O_2(g) + 4OH^-(aq) \rightarrow 2MnO(OH)_2(s)$

Step 2 $MnO(OH)_2(s) + 2I^-(aq) + 4H^+(aq) \rightarrow I_2(aq) + Mn^{2+}(aq) + 3H_2O(aq)$

Step 3 $I_2(aq) + 2S_2O_3^{2-}(aq) \rightarrow 2I^-(aq) + S_4O_6^{2-}(aq)$

When a 5.00 dm^3 sample of water was analysed using the Winkler method, a total of 4.00×10^{-3} mol of thiosulfate ($S_2O_3^{2-}$) was required in Step 3.

What concentration of oxygen was present in the original sample?

A 3.20 mg/dm^3
B 6.40 mg/dm^3
C 12.8 mg/dm^3
D 32.0 mg/dm^3

25 Five statements about different elements are given.

1 proton number = 24
2 cuts easily with a knife
3 constituent of brass
4 burns in oxygen with a dazzling white light
5 catalyst in the Haber process

Which statement is correct for each element?

	K	Zn	Fe	Cr	Mg
A	2	3	4	5	1
B	2	3	5	1	4
C	3	2	5	1	4
D	4	5	2	3	1

26 The addition of calcium hydroxide to soil reduces its acidity but also reduces the efficiency of fertilisers.

Which **two** equations explain this?

1 $Ca(OH)_2(s) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$
2 $Ca(OH)_2(s) + 2H^+(aq) \rightarrow Ca^{2+}(aq) + 2H_2O(l)$
3 $Ca(OH)_2(s) + 2NH_4NO_3(aq) \rightarrow Ca(NO_3)_2(aq) + 2NH_3(g) + 2H_2O(l)$
4 $Ca(OH)_2(s) + Cu^{2+}(aq) \rightarrow Cu(OH)_2(s) + Ca^{2+}(aq)$

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

27 Which statement is correct?

A Group 1 elements are less reactive than the Group 2 element in the same period because they only need to lose one electron to have complete shells.

B Group 1 elements are stored under oil to avoid reaction with oxygen and water in the air.

C Group 1 elements become more reactive as the group is descended because the number of outer shell electrons increases.

D The melting point of Group 1 elements decreases as the group is descended because there is more attraction between positive ions and the 'sea' of delocalised electrons.

28 Copper(II) carbonate, calcium carbonate and zinc carbonate decompose when heated.

What is the correct increasing order for their decomposition?

	lowest temperature ⟶ highest temperature		
A	calcium carbonate	zinc carbonate	copper(II) carbonate
B	copper(II) carbonate	calcium carbonate	zinc carbonate
C	copper(II) carbonate	zinc carbonate	calcium carbonate
D	zinc carbonate	copper(II) carbonate	calcium carbonate

29 Zinc is used to galvanise iron, which prevents the iron from rusting.

Which statements are correct?

1 The layer of zinc forms a barrier between the iron and the oxygen and water in the atmosphere.

2 Zinc will oxidise before the iron does, even if the layer of zinc is scratched.

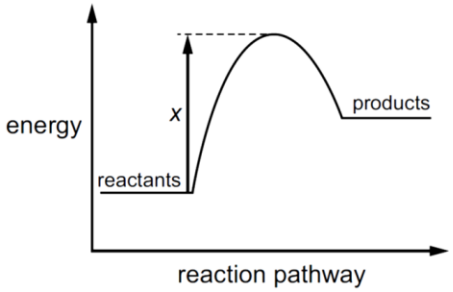
3 When iron rusts, atoms of iron gain electrons to form ions.

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

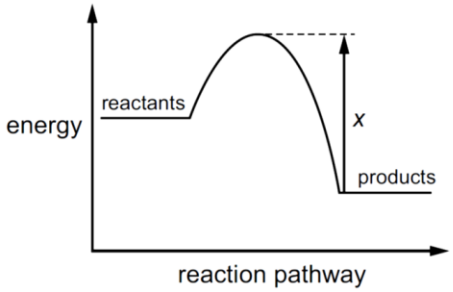
30 An endothermic reaction has an activation energy of *x*.

Which energy profile diagram is correct for this reaction?

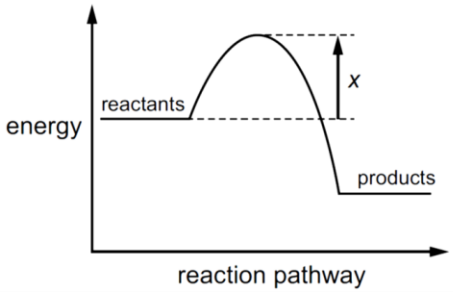
A



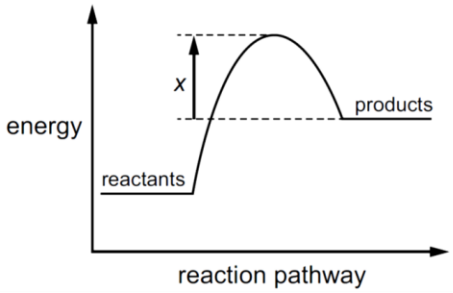
B



C



D



31 Two gases react inside a sealed vessel.

Which change in conditions would decrease the rate of reaction?

1 decreasing the pressure inside the vessel

2 decreasing the temperature inside the vessel

3 decreasing the volume of the vessel

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

32 The volume of gas produced by the reaction of 100 cm^3 of hydrochloric acid with an excess of calcium carbonate is measured in two experiments.

The volumes of gas are measured at room temperature and pressure, and the results are shown.

time / s	0	30	60	90	120	150	180	300
volume of gas in experiment 1 / cm^3	0	20	30	38	44	48	50	50
volume of gas in experiment 2 / cm^3	0	30	42	55	65	70	75	75

Which **one** change in conditions to experiment 1 gives the results for experiment 2? Assume all other conditions are unchanged.

A A greater mass of calcium carbonate is added.

B A higher concentration of acid is used.

C Smaller pieces of calcium carbonate are used.

D The temperature of the acid is higher.

33 Which statement about global warming is correct?

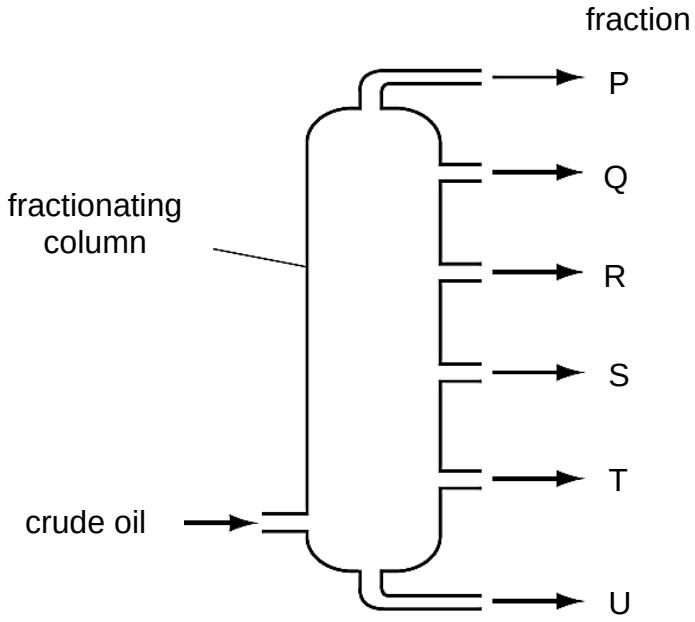
A Methane produced by digestion in animals has no effect on the rate of global warming.

B The products of burning fossil fuels have no effect on the rate of global warming.

C The products of decomposition of vegetation have no effect on the rate of global warming.

D The products of photosynthesis have no effect on the rate of global warming.

34 The diagram shows a fractionating column used in the separation of petroleum.



Which row explains why fraction R is collected above fraction S?

	boiling point of R	average molecular mass of R
A	greater than S	greater than S
B	greater than S	smaller than S
C	smaller than S	greater than S
D	smaller than S	smaller than S

35 Which statements about the cracking of hydrocarbons are correct?

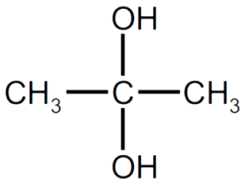
1 Cracking involves breaking down hydrocarbon molecules.

2 One of the products of cracking is always unsaturated.

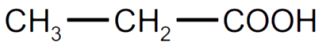
3 Cracking is essential because of the demand for fractions containing smaller molecules.

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

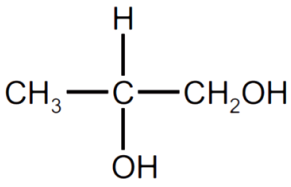
36 The structures of three compounds, W, X and Y, are shown.



W



X



Y

Which statements about these three compounds are correct?

1 W and Y are both alcohols and X is a carboxylic acid.
2 W, X and Y have the same molecular formula.
3 W and Y are structural isomers of each other.

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

37 Which equation shows the reaction of ethane with chlorine in the presence of ultraviolet light?

A $C_2H_6 + Cl_2 \longrightarrow C_2H_6Cl_2$
B $C_2H_6 + Cl_2 \longrightarrow C_2H_4Cl_2 + H_2$
C $C_2H_6 + Cl_2 \longrightarrow C_2H_5Cl + HCl$
D $C_2H_6 + Cl_2 \longrightarrow 2CH_3Cl$

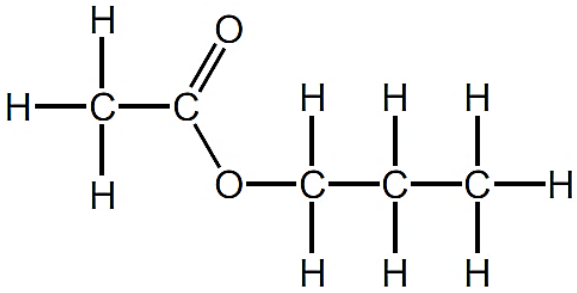
38 Isoprene is an alkene which is commonly found in plants.

Which properties does isoprene have?

1 It burns in air.
2 It can form condensation polymers.
3 It decolourises aqueous bromine.

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

39 The structure of an organic compound is shown.



Which **two** reactants form the organic compound?

A butanol and methanoic acid
B ethanol and propanoic acid
C propanol and ethanoic acid
D propanol and methanoic acid

40 Which compound, without the addition of any other reagent, polymerises to produce a polyamide similar to nylon?

A $C_2H_5CO_2H$
B $C_2H_5NH_2$
C $H_2N(CH_2)_4NH_2$
D $H_2N(CH_2)_4CO_2H$

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The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							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	3	4	5	6	7	8	9	10	11	12	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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

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.).
The Avogadro constant, $L = 6.02 \times 10^{23}\ mol^{-1}$.