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ST. ANTHONY'S CANOSSIAN SECONDARY SCHOOL
Preliminary Examination 2022
Secondary 4 Express

CHEMISTRY

6092/01

Paper 1
 Setter: MRS ESTHER BOO

15 September 2022

1 hour



Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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 in the spaces provided unless this has been done for you.

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

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

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark.

A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

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

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

40

Parent's
signature:

This document consists of **20** printed pages

[Turn over

- 1 A student plans two experiments.

Experiment 1: find the concentration of a solution of sodium hydroxide by titration with dilute hydrochloric acid.

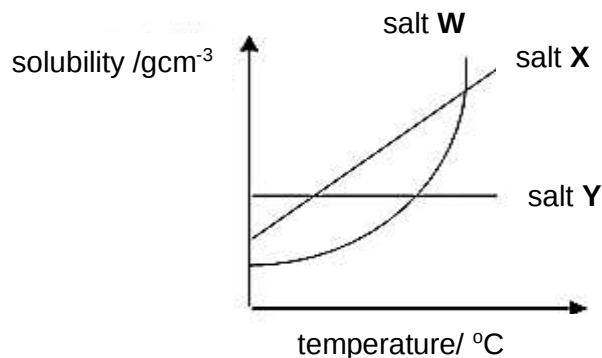
Experiment 2: find the rate of the reaction between pieces of calcium carbonate and dilute hydrochloric acid by measuring the volume of gas given off every minute.

What apparatus is needed for both experiments?

	experiment 1	experiment 2
A	electronic balance, measuring cylinder, thermometer	gas syringe, stopwatch
B	burette, pipette	electronic balance, measuring cylinder, thermometer
C	burette, pipette	gas syringe, stopwatch
D	gas syringe, stopwatch	burette, pipette

- 2 The solubility curves of three salts are shown.

Which salt(s) **cannot** be prepared by crystallisation?

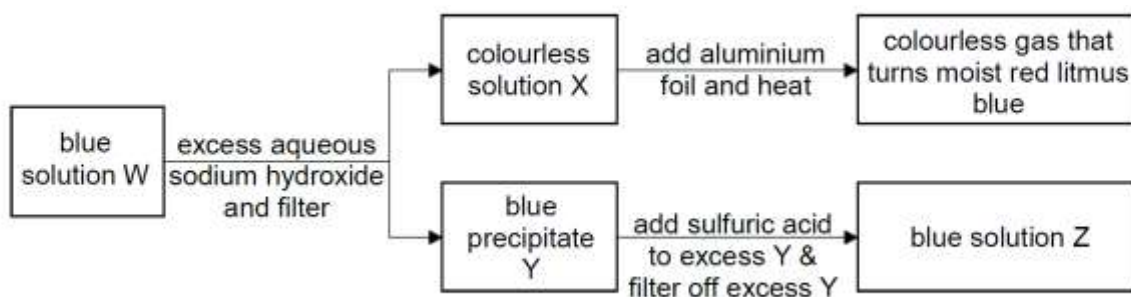


- A W only
 B Y only
 C W and X
 D X and Y

3 Which test is used to show that a sample of water is pure?

- A evaporate the water to see if there is any solid left behind
- B heat the water to check its boiling point
- C test with anhydrous cobalt(II) chloride
- D use universal indicator paper to check its pH

4 The flow chart below shows some reactions that blue solution W undergoes.



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

	W	X	Y	Z
A	$\text{Cu}(\text{NO}_3)_2$	NaNO_3	$\text{Cu}(\text{OH})_2$	CuSO_4
B	CuSO_4	Na_2SO_4	$\text{Cu}(\text{OH})_2$	CuSO_4
C	$\text{Fe}(\text{NO}_3)_2$	NaNO_3	$\text{Fe}(\text{OH})_2$	FeSO_4
D	$(\text{NH}_4)_2\text{SO}_4$	$\text{NH}_3(\text{aq})$	$\text{Cu}(\text{OH})_2$	CuSO_4

5 Which of the following solutions when mixed, would **not** produce a precipitate?

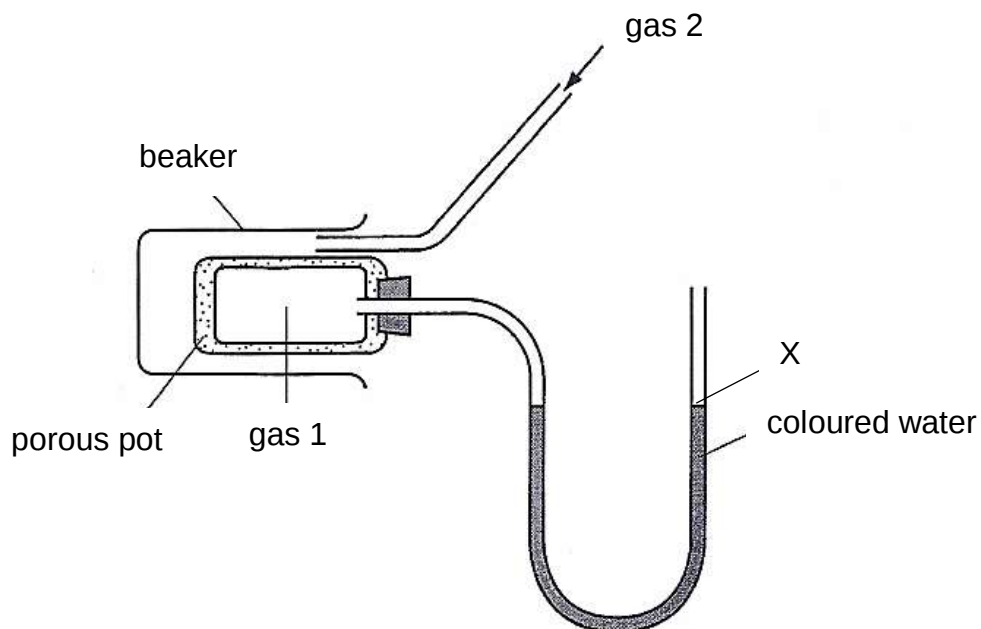
- A aqueous ammonia with aqueous sodium chloride
- B aqueous copper(II) sulfate with lithium carbonate solution
- C aqueous zinc nitrate with aqueous ammonia
- D aqueous silver nitrate solution with aqueous potassium iodide

- 6 A student tested a solution by adding aqueous sodium hydroxide. A precipitate was not seen because the reagent was added too quickly.

What could **not** have been present in the solution?

- A Al^{3+}
- B Ca^{2+}
- C Pb^{2+}
- D Zn^{2+}

- 7 The apparatus is used to show the diffusion of gases.

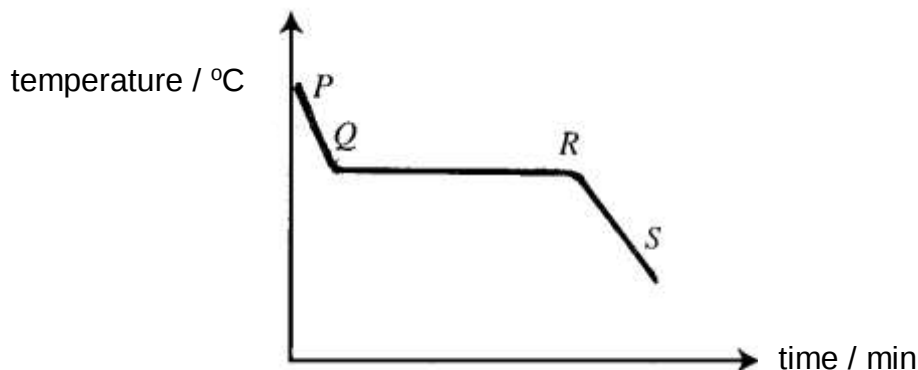


Which pair of gases 1 and 2 would cause the level of coloured water to rise at X?

	gas 1	gas 2
A	H_2	C_2H_6
B	CH_4	CO_2
C	C_2H_4	CO
D	NO_2	N_2

- 8 A sample of solid X is heated until it is completely melted.

The graph shows how its temperature varies with time as molten X is cooled.



Which of the following statements are true about the particles in X?

1. They are closer to each other at stage RS than at stage PQ.
2. The forces of attraction are stronger at stage P than at stage S.
3. The arrangement is more orderly at stage RS than at stage PQ.
4. Their total energy content at stage QR is lower than at stage RS.

- A** 1 and 2 are correct
B 1 and 3 are correct
C 2 and 3 are correct
D 2 and 4 are correct

- 9 Carbon-12 and carbon-14 are two isotopes of carbon. Measuring the amount of carbon-14 in a sample from a dead plant or animal can be used to calculate the age of the animal or plant.

Which statement about the isotopes is correct?

- A** Carbon-14 has gained two electrons to form carbon-12.
B Carbon-14 has lost two electrons to form carbon-12.
C Carbon-14 has two more neutrons than carbon-12.
D Carbon-14 has two more protons than carbon-12.

10 Which statement correctly describes both chlorine atoms and chloride ions?

- A** They are chemically identical.
- B** They have the same melting and boiling point.
- C** They have the same number of electrons in the valence shell.
- D** They have the same number of protons.

11 Which row correctly describe the properties of a mixture of iron and sulfur, and the compound iron(II) sulfide, FeS?

	mixture of iron and sulfur	compound iron(II) sulfide
1	iron and sulfur mix without chemically reacting	iron and sulfur combine in a chemical reaction to form iron(II) sulfide
2	the ratio of iron to sulfur in mixtures can vary	the ratio of iron to sulfur in iron(II) sulfide is always the same
3	the mixtures do not have the properties of iron or sulfur	iron(II) sulfide has the properties of iron and sulfur

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

12 The table shows four elements W, X, Y and Z with their atomic numbers.

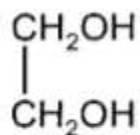
element	W	X	Y	Z
atomic number	6	8	11	17

Which row shows the formulae of the compounds formed from the four elements?

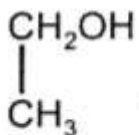
	formula of ionic compound formed	formula of covalent compound formed
A	WX	YZ
B	YW	WZ ₄
C	YZ	ZW
D	Y ₂ X	WX ₂

- 13 Which compound contains only eight covalent bonds?

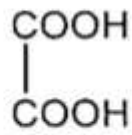
A



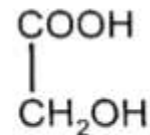
B



C



D



- 14 The complex ion $[\text{Ag}(\text{NH}_3)_x]^+$ consists of 76% of silver by mass.

What is the value of x ?

A 1

B 2

C 3

D 4

- 15 The formula of a nitride of element X is X_3N_2 .
23.8 g of X_3N_2 contains 4.5 g of X .

How many moles are there in 4.5 g of X ?

A $\frac{19.3}{14} \times \frac{2}{3}$

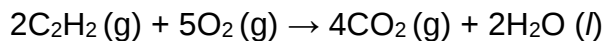
B $\frac{19.3}{14} \times \frac{3}{2}$

C $\frac{23.8}{14} \times \frac{2}{3}$

D $\frac{23.8}{14} \times \frac{3}{2}$

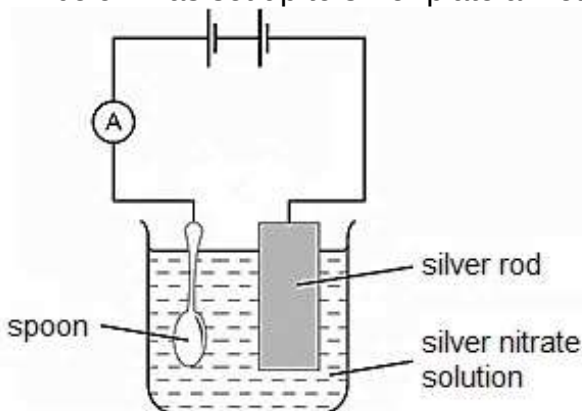
- 16 20.0 cm³ of ethyne, C₂H₂, is reacted with 60.0 cm³ of oxygen.

The equation for the reaction is



What is the total volume of gas remaining at the end of the reaction? (all volumes are measured at room temperature and pressure)

- A 40.0 cm³
B 50.0 cm³
C 60.0 cm³
D 70.0 cm³
- 17 The apparatus shown below was set up to silver plate a metal spoon.



The experiment did **not** work.

What was the mistake in the set-up?

- A The spoon should be at the negative electrode.
B Silver nitrate solution is not a suitable electrolyte.
C The silver rod should be completely immersed in the solution.
D The spoon must be made into an electrode by applying graphite paste.

- 18** In an experiment, a quantity of electricity plated 0.12 mole of copper metal onto a paper clip, from Cu^{2+} . The same quantity of electricity plated 0.08 mole of gold onto a ring.

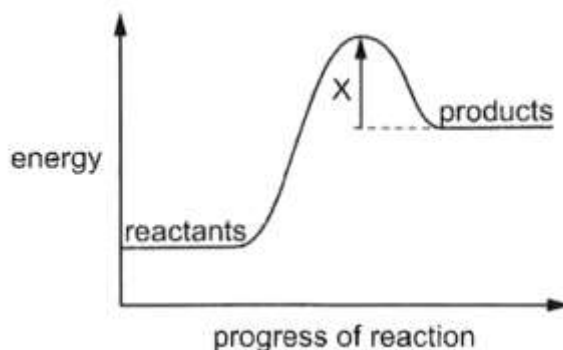
What is the charge of the gold ions?

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

- 19** Which statement is true for both electrochemical cells and electrolytic cells?

	electrochemical cell	electrolytic cell
A	It converts electrical energy into chemical energy.	It converts chemical energy into electrical energy.
B	Oxidation occurs at positive electrode.	Oxidation occurs at negative electrode.
C	Forced flow of electrons from anode to cathode by an external generator.	Spontaneous flow of electrons from anode to cathode.
D	Anode gets used up.	Electrodes may not undergo any changes.

- 20 The energy profile diagram shows the energy changes that occur as a reaction takes place.



From the diagram, which statement about this reaction is correct?

- A The energy change when breaking bonds is greater than the energy change when making bonds.
- B The equation for this reaction could be $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$.
- C The reaction has a negative ΔH value.
- D X is the activation energy for the reaction.

- 21 Ammonium chloride dissolves in water according to the equation below.



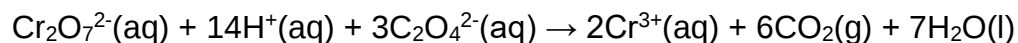
When 0.2 moles of ammonium chloride dissolves in 50.0 cm³ of water,

1. the concentration of the solution is 4.0 mol/dm³.
2. the energy level of NH₄Cl increases.
3. the heat liberated is 3.0 kJ.
4. the temperature of water falls.

Which of the above statements are correct?

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

- 22** A student is exploring the various ways to measure the rate of the following reaction by measuring the changes in different variables of the reaction:

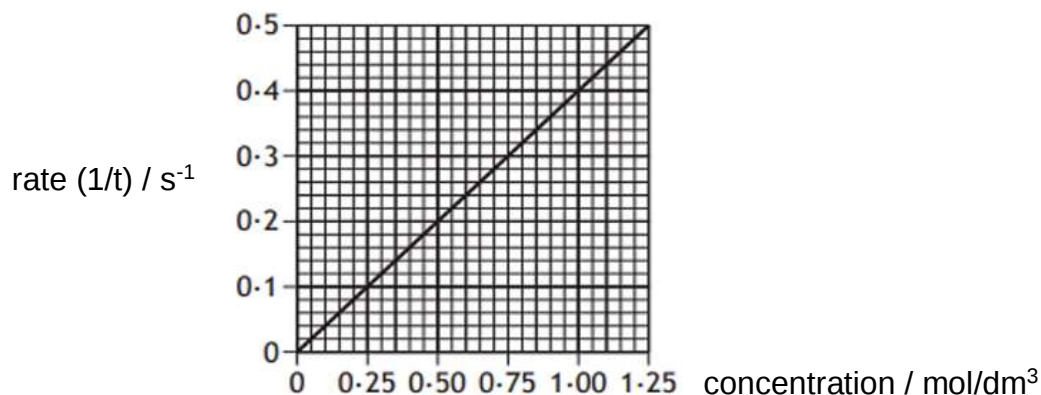


Which of the following methods of monitoring the rate of reaction are suitable?

1. volume of gas produced
2. pH of the reaction mixture
3. mass of the reaction mixture
4. amount of precipitate formed
5. intensity of the orange colour of the reaction mixture

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

- 23** The graph shows how the rate of a reaction varies with the concentration of one of the reactants.



What is the reaction time, in seconds, when the concentration of the reactant was 0.50 mol/dm³?

- A** 0.2 s
B 0.5 s
C 2.0 s
D 5.0 s

24 In which reaction is vanadium reduced?

- A V to V_2O_5
- B V^{3+} to VO^{2+}
- C VO_3^- to VO^{2+}
- D VO^{2+} to VO_2^+

25 X, Y and Z represent different halogens.

The table shows the results of nine experiments in which aqueous solutions of X_2 , Y_2 and Z_2 were separately added to separate aqueous solutions containing X^- , Y^- and Z^- ions.

	$X^-(aq)$	$Y^-(aq)$	$Z^-(aq)$
$X_2(aq)$	no reaction	no reaction	no reaction
$Y_2(aq)$	X_2 formed	no reaction	Z_2 formed
$Z_2(aq)$	X_2 formed	no reaction	no reaction

Which row contains the halogens X_2 , Y_2 and Z_2 in order of their decreasing strength as oxidising agents?

	strongest	→	weakest
A	X_2	Y_2	Z_2
B	Y_2	X_2	Z_2
C	Y_2	Z_2	X_2
D	Z_2	Y_2	X_2

26 Which oxide is insoluble in aqueous ammonia?

- A FeO
- B NO_2
- C P_4O_{10}
- D ZnO

27 Some statements about acids are given.

1. A 1 mol/dm^3 solution of a strong acid will have a higher pH than a 1 mol/dm^3 solution of a weak acid.
2. pH gives a measure of the H^+ concentration in a solution.
3. Universal indicator turns blue when placed in a solution of pH 5.
4. When acids react with metals, hydrogen ions gain electrons.

Which statements about acids are correct?

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

28 A sample of potassium oxide, K_2O is dissolved in 250 cm^3 of distilled water. 25.0 cm^3 of the solution is neutralised by 15.0 cm^3 of 2.00 mol/dm^3 of dilute sulfuric acid.

What is the mass of potassium oxide dissolved in 250 cm^3 of distilled water?

- A 2.82 g
- B 5.64 g
- C 28.2 g
- D 56.4 g

29 Which of the following pairs of elements react most vigorously together?

- A copper and oxygen
- B magnesium and chlorine
- C potassium and fluorine
- D sodium and bromine

- 30** Rubidium, Rb, is an element in the same group of the Periodic Table as lithium, sodium and potassium.

1. It reacts explosively with cold water.
2. It forms a soluble carbonate salt.
3. It forms a carbonate with a formula of RbCO_3 .
4. It can be extracted *via* electrolysis of concentrated aqueous RbCl .

Which statements about rubidium are likely to be **wrong**?

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

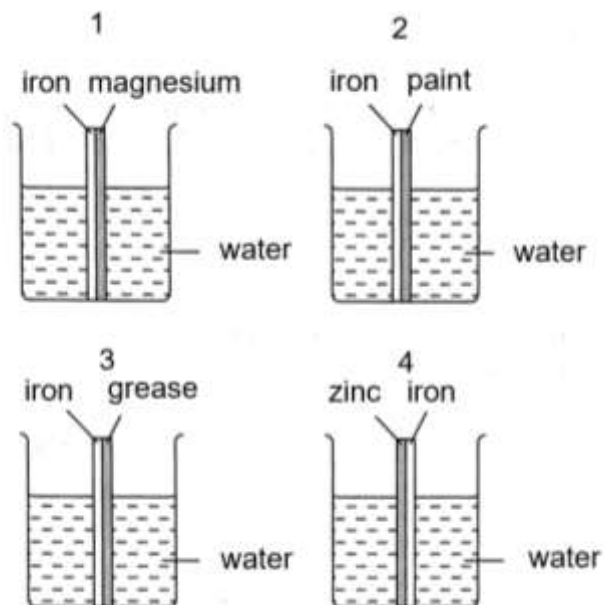
- 31** A student carried out an experiment to find the order of reactivity of five metals. They were tested with cold water, hot water and steam. The results were recorded in the following table.

metal	cold water	hot water	steam
V	no reaction	reacts slowly	vigorous reaction
W	no reaction	no reaction	slow reaction
X	reacts slowly	vigorous reaction	not attempted
Y	no reaction	no reaction	no reaction
Z	vigorous reaction	explosive reaction	not attempted

What is the order of reactivity of these metals?

	more reactive → less reactive				
A	V	W	Y	X	Z
B	W	X	Z	V	Y
C	Z	X	V	W	Y
D	Z	X	Y	W	V

32 The following experiments were set up.



In which beaker(s) would the iron be less likely to rust after two days?

- A 1 and 3 only
- B 1 and 4 only
- C 2 and 3 only
- D all of the above

- 33** The table below shows the results obtained when solid carbonates of three metals, **W**, **X** and **Y**, are warmed.

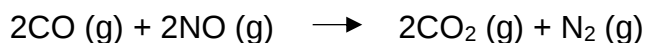
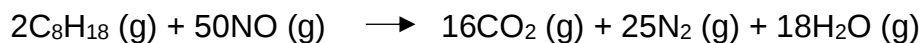
	result
carbonate of W	A gas is given off. Solid changes colour from green to black
carbonate of X	A gas is given off. Solid does not change in colour.
carbonate of Y	A gas is not given off. Solid does not change in colour.

Which statements are correct?

- 1 Metal **Y** is loses electrons more readily than metal **X**.
- 2 Metal **W** is a transition metal.
- 3 If dilute nitric acid is added to all three carbonates, carbon dioxide is given off only for the carbonates of **W** and **X** but not for the carbonate of **Y**.

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

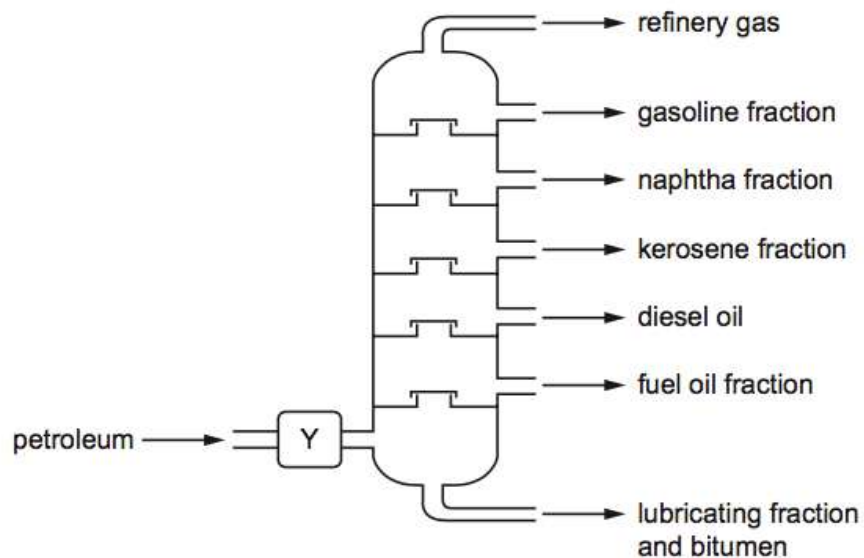
- 34** The equations below are for two of the reactions which occur in catalytic converters.



Which statement is correct for both reactions?

- A** Carbon dioxide is formed by the reduction of a carbon containing compound.
B Nitrogen is produced by the oxidation of nitrogen monoxide.
C Nitrogen monoxide is a reducing agent.
D The reactions are redox reactions.

- 35 The fractional distillation of petroleum is shown.



Which process happens at Y?

- A burning
- B condensation
- C cracking
- D vapourisation

- 36 In which process(es) will carbon dioxide be produced?

- 1 respiration by animals
- 2 formation of ethanoic acid from ethanol
- 3 photosynthesis by plants
- 4 combustion of methane

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

- 37** The compound C_6H_{10} is a member of a hydrocarbon homologous series. Which one of the following is the first member of this series?

A C_2H_2
B C_2H_3
C C_2H_4
D C_2H_6

- 38** Three chemical reactions are shown.

- 1 catalytic addition of steam to ethene
- 2 combustion of ethanol
- 3 fermentation of glucose

In which of the reactions does the relative molecular mass of the carbon-containing compound decrease?

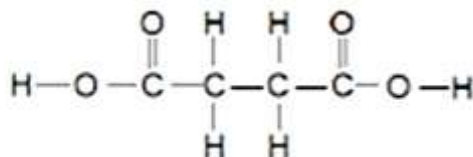
A 1 and 2
B 1 only
C 2 and 3
D 3 only

- 39** A liquid can react separately with sodium carbonate, potassium hydroxide and propanol.

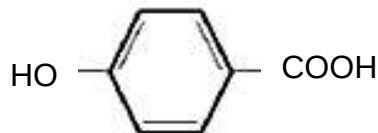
What is the liquid?

A aqueous ammonia
B dilute hydrochloric acid
C ethanoic acid
D ethyl ethanoate

40 Which statement about the two compounds is **not** true?



X



Y

- A X and Y react together to form a polyester.
- B Both X and Y can react with magnesium metal.
- C Y undergoes condensation polymerisation by reacting with itself.
- D Y turns aqueous acidified potassium manganate(VII) from purple to colourless.

END OF PAPER

