



YUYING SECONDARY SCHOOL

PRELIMINARY EXAMINATION

Secondary 4 Express

NAME

CLASS

REG. NO

CHEMISTRY

6092/1

Paper 1

25 August 2022

1 hour

Setter: Mr Danny Louis

Candidates answer on the Question Paper.

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on this question booklet.

Write in dark blue or black pen on both sides of the paper.

You may use a pencil for any diagrams, graphs, tables or rough working.

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

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.

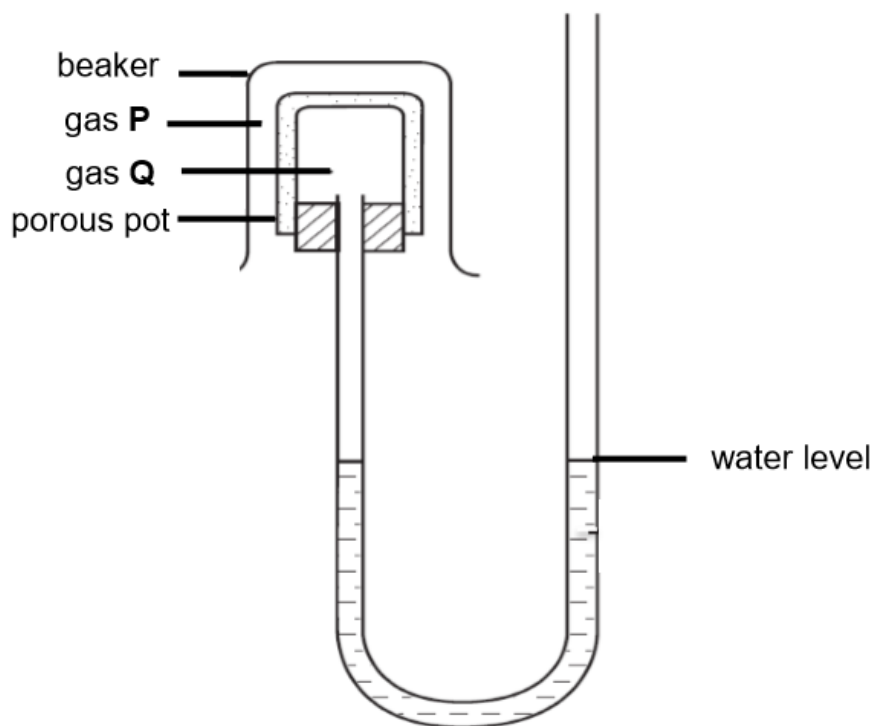
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

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

A copy of the Periodic Table is printed on page 17.

For Examiner's Use	
Total	40

- 1 A beaker of gas **P** is inverted over a porous pot containing gas **Q** as shown.

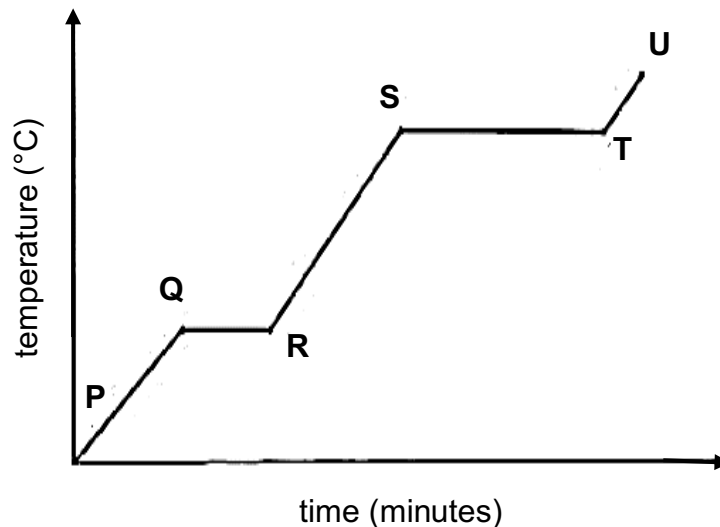


Which pair of gases will result in the water level remaining unchanged?

	P	Q
A	CH ₄	N ₂
B	C ₂ H ₄	CO
C	C ₂ H ₆	CO ₂
D	C ₃ H ₈	O ₂

- 2 Which of the following occurs when iodine sublimes?
- A** distance between iodine particles increases
 - B** forces of attraction between iodine particles become stronger
 - C** iodine particles become lighter
 - D** iodine particles begin to be arranged in a more orderly manner

- 3 The following shows the heating curve of ice.



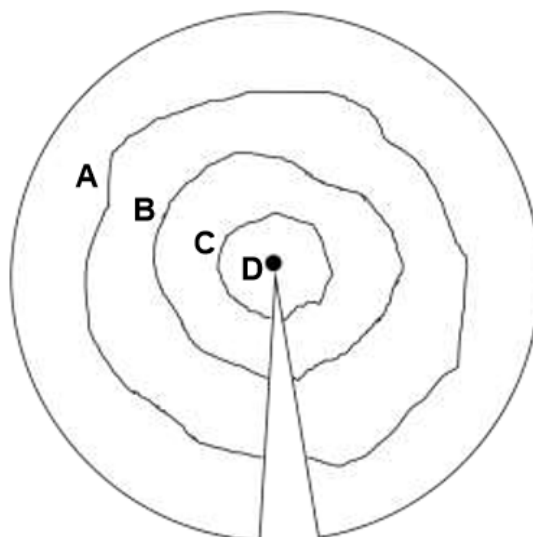
Which description in the table below **best** explains the respective section of the graph?

	section	description
A	P to Q	all ice molecules are in fixed positions
B	Q to R	the average kinetic energy of the particles remains constant
C	R to S	the volume of steam is increasing
D	T to U	water is boiling

- 4 Propyl ethanoate and water are two liquids, which are immiscible.
Which method is **best** to separate a mixture of propyl ethanoate and water?
- A** filtration
 - B** fractional distillation
 - C** use a separating funnel
 - D** evaporation to dryness
- 5 Which piece of apparatus is **not** required to obtain water from a can of green tea?
- A** white tile
 - B** condenser
 - C** distillation flask
 - D** fractionating column

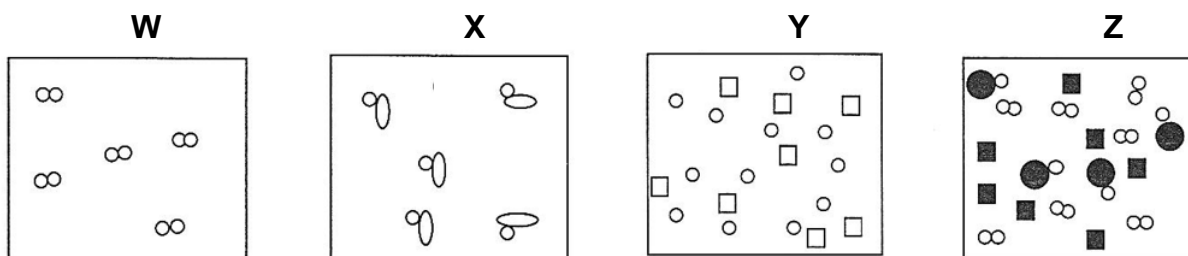
- 6 Paper chromatography was used to separate an ink which is comprised of several dyes. In the experiment, a few drops of solvent was added to the centre of the filter paper and allowed to spread out.

The diagram below shows the chromatogram obtained from the experiment. Which dye has the greatest solubility in the solvent used?



- 7 The diagrams below can be used to illustrate the following.

- I pure element
- II mixture of elements
- III pure compound
- IV mixture of elements and a compound



Which row in the table below is **correct**?

	I	II	III	IV
A	W	X	Y	Z
B	Z	W	X	Y
C	W	Y	X	Z
D	X	Z	W	Y

- 8 The table shows details of the particles present in the ions of potassium and sulfur.

formula	proton number	nucleon number	number of neutrons	number of electrons
K^+	19	39	X	Y
S^{2-}	Z	32	16	18

What are the values of **X**, **Y** and **Z**?

	X	Y	Z
A	20	19	20
B	21	19	16
C	21	18	20
D	20	18	16

- 9 Which element would be expected to form an ion with the largest ionic radius?

- A** chlorine
- B** fluorine
- C** magnesium
- D** oxygen

- 10 Element **J** is found in Group II of the Periodic Table. It has an atomic number b , and a nucleon number a .

Which entry shows the correct information on the ion formed by isotope atom **J**?

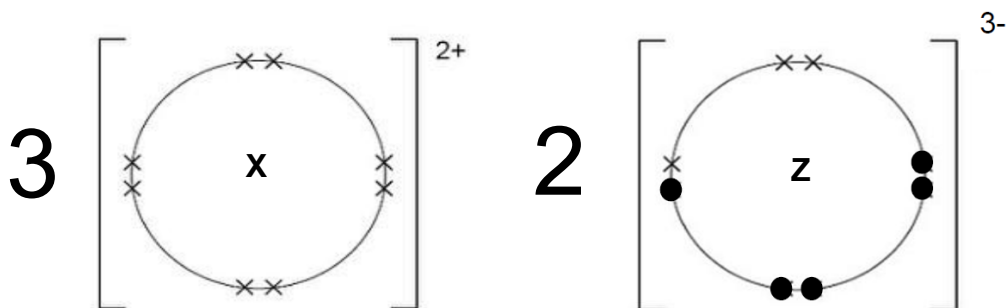
	number of protons	number of neutrons	number of electrons
A	a	$a - b + 1$	$b + 2$
B	a	b	$b - 2$
C	b	$a - b$	$b - 2$
D	b	$b - a$	$b - 2$

- 11 An element **S** has 2 isotopes of mass numbers 16 and 18. Its average relative atomic mass is 16.4.

What is the proportion of each isotopes in element **S**?

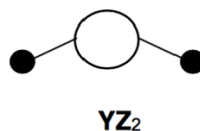
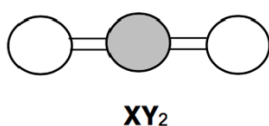
- A** 50% of S-16 and 50% of S-18
- B** 60% of S-16 and 40% of S-18
- C** 70% of S-16 and 30% of S-18
- D** 80% of S-16 and 20% of S-18

- 12 The dot-and-cross diagram (with only the outer electrons) of the compound formed between element **X** and **Z** is shown below.

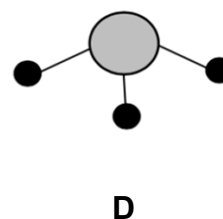
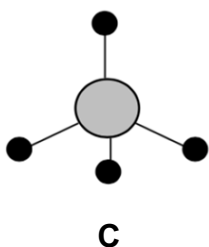
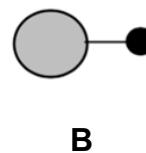
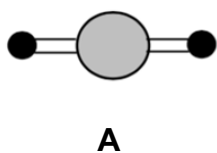


Which of the following is the correct set of formula of the chloride of **X** and **Z**?

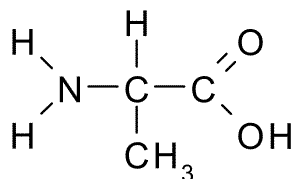
- A XCl , Z_3Cl
 B XCl , ZCl_3
 C XCl_2 , Z_3Cl
 D XCl_2 , ZCl_3
- 13 The models shown below represent two molecules.



Which model **correctly** represents the molecule formed between **X** and **Z**?



- 14 An amino acid, alanine, has the following structure.



How many pairs of valence electrons are **not** involved in bonding in the alanine molecule?

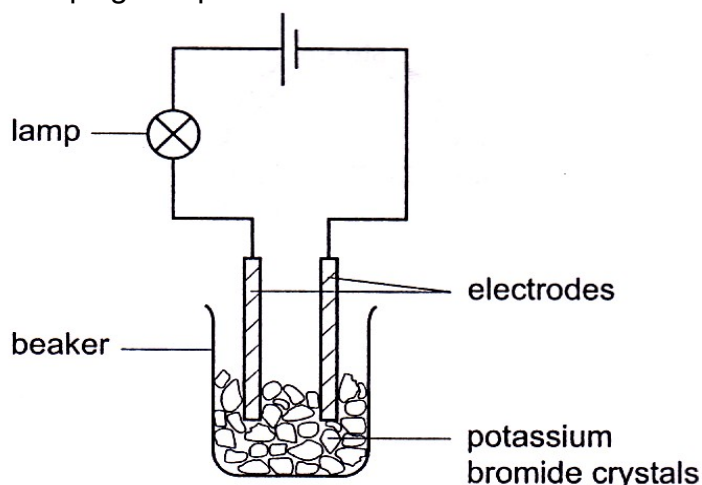
- A** 4
B 5
C 9
D 10
- 15 The relative molecular mass of a compound with the formula $\text{K}_3\text{Co}(\text{CN})_x$ is 332. What is the value of **x**?
- A** 3
B 4
C 5
D 6
- 16 The formula of an oxide of element **R** is **R₂O**.
 6.2 g of **R₂O** contains 4.6 g of **R**.
 How many moles of **R** ions does 6.2 g of **R₂O** contain?
- A** $\frac{1.6}{16} \div 2$
B $\frac{1.6}{16} \times 2$
C $\frac{6.2}{16 \times 2}$
D $\frac{6.2}{16} \times 2$
- 17 When the metal bismuth (Bi) is added to copper(II) nitrate, bismuth(III) nitrate and copper are formed.
 What is the ionic equation of this reaction?
- A** $\text{Bi(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Bi}^{3+}(\text{aq}) + \text{Cu(s)}$
B $2\text{Bi(s)} + 3\text{Cu}^{2+}(\text{aq}) \rightarrow 2\text{Bi}^{3+}(\text{aq}) + 3\text{Cu(s)}$
C $\text{Bi(s)} + \text{Cu}(\text{NO}_3)_2(\text{aq}) \rightarrow \text{Bi}(\text{NO}_3)_3(\text{aq}) + \text{Cu(s)}$
D $\text{Bi}^{3+}(\text{aq}) + 3\text{NO}_3^-(\text{aq}) \rightarrow \text{Bi}(\text{NO}_3)_3(\text{aq})$

- 18 68 g of impure hydrogen peroxide, H_2O_2 ($M_r = 34$) decomposes in the presence of manganese(IV) oxide, to produce 2.4 dm^3 of oxygen gas at room temperature and pressure as shown in the equation below.



What is the purity of the hydrogen peroxide?

- A 2.5 %
 B 5.0 %
 C 10.0 %
 D 15.0 %
- 19 In the set-up shown below, the lamp does not light. Distilled water is then added to the beaker and the lamp lights up.



Which statement explains these results?

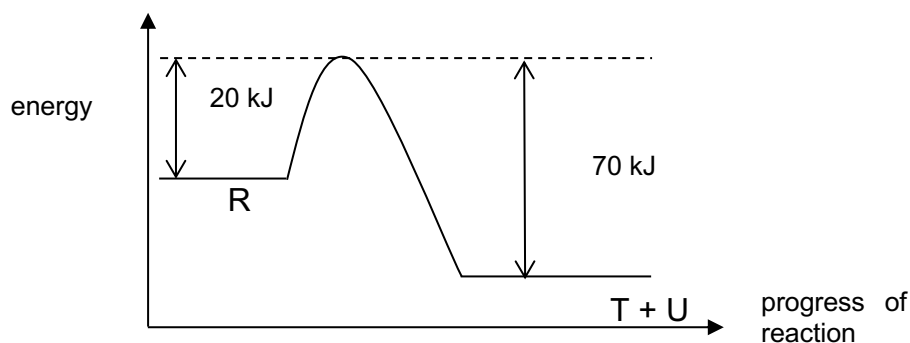
- A Electrons are free to move in the solution when potassium bromide dissolves.
 B Metal ions are free to move when potassium bromide melts.
 C Metal ions are free to move when potassium reacts with water.
 D Oppositely charged ions are free to move in the solution when potassium bromide dissolves.
- 20 A concentrated aqueous solution containing each of the following ions : Cl^- , SO_4^{2-} , Na^+ , Cu^{2+} , is electrolysed using platinum electrodes.
 Which row shows the ions that are discharged **first** at the two electrodes?

	at anode	at cathode
A	Cl^-	Cu^{2+}
B	Cl^-	Na^+
C	SO_4^{2-}	Cu^{2+}
D	SO_4^{2-}	Na^+

21 Which statement describes what happens in a hydrogen-oxygen fuel cell?

- A Electricity is generated.
- B Electricity is used to produce water.
- C Hydrogen is burned to produce steam.
- D Hydrogen reacts to form fuel.

22 The diagram below represents the energy profile diagram for the following reaction:



What is the enthalpy change for this reaction?

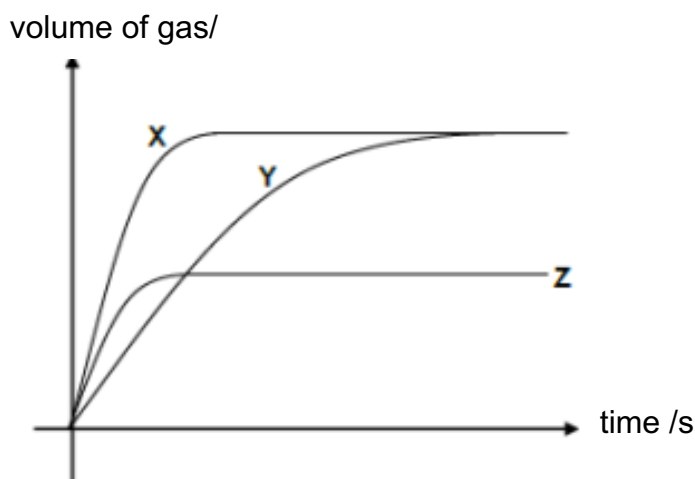
- A + 50 kJ
- B - 50 kJ
- C - 70 kJ
- D + 90 kJ

23 In which reaction is pressure **least** likely to affect the rate of reaction?

- A $C(s) + CO_2(g) \rightarrow 2CO(g)$
- B $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
- C $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$
- D $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

- 24 A student performed three experiments to produce carbon dioxide gas using excess magnesium carbonate and dilute nitric acid at 30°C.

experiment	magnesium carbonate	dilute nitric acid	
	particle size	volume (cm ³)	concentration (mol/dm ³)
1	powdered	20	1.00
2	lumps	10	1.00
3	lumps	40	0.50

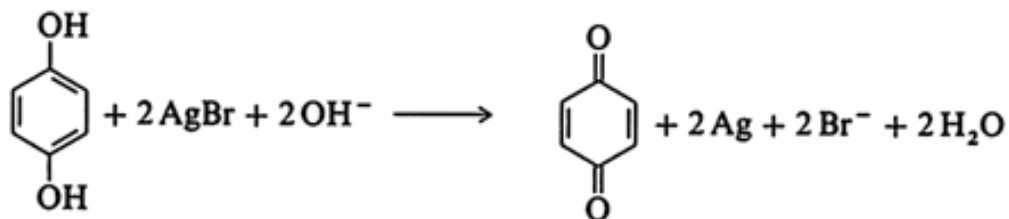


Which graph **best** represents each of the three experiments?

	experiment 1	experiment 2	experiment 3
A	X	Y	Z
B	Y	X	Z
C	X	Z	Y
D	Z	X	Y

- 25 Colour changes are often observed when redox reactions occur. Which colour change is due to the reduction of the named agent?
- A** Black solid copper(II) oxide changes to blue aqueous copper(II) sulfate.
 - B** Colourless aqueous potassium iodide changes to become a brown solution.
 - C** Green aqueous iron(II) chloride changes to yellow/brown aqueous iron(III) chloride.
 - D** Purple acidified potassium manganate(VII) changes to become colourless.

- 26 When exposed film from a camera is developed, one step involves reacting the light-activated silver bromide crystals with aqueous alkaline hydroquinone.



Which of the following **best** describes the role of hydroquinone?

- A** an acid
 - B** an oxidizing agent
 - C** an acid and reducing agent
 - D** a base and oxidizing agent
- 27 The table below gives some statements about acids and alkalis and explanations for these statements.
Which row shows both a correct statement and a correct explanation for the statement?

	statement	explanation
A	ammonia can be made by heating ammonium sulfate with calcium hydroxide	the hydroxide ion acts as a base and removes H^+ from the ammonium ion
B	the pH of a weak acid is higher than the pH of a strong acid of the same concentration	pH shows the extent of ionisation—the more ionised the acid is, the higher the pH
C	calcium hydroxide can be used to control pH in soils	metal hydroxides are acidic and can reduce excess alkalinity
D	when an acid reacts with a metal, the metal is reduced	reduction is gain of electrons

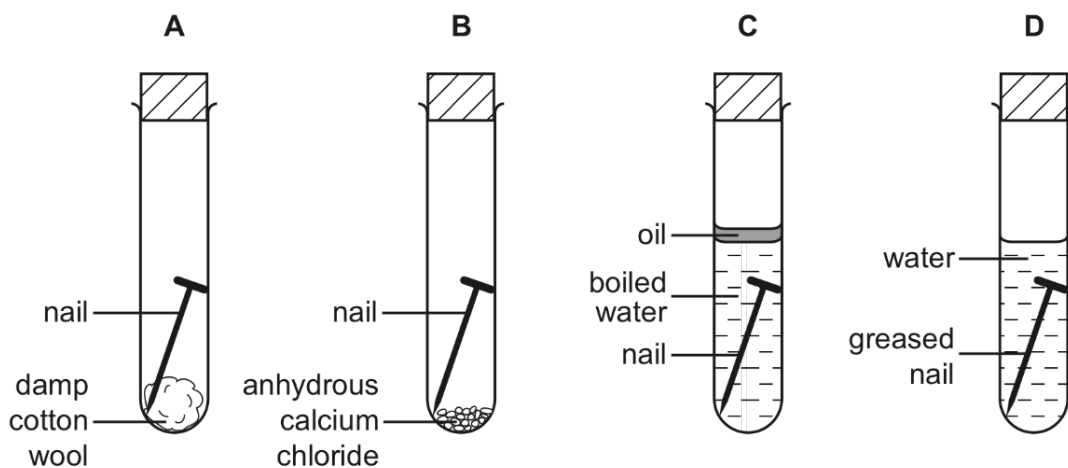
- 28 Given a supply of lead(II) carbonate, copper(II) carbonate, dilute nitric acid and aqueous sodium hydroxide, how many different salts could be prepared?
- A** 1
 - B** 2
 - C** 3
 - D** 4

- 29 An aqueous solution containing a mixture of copper(II), lead(II) and zinc ions was treated with an excess of aqueous ammonia. What was the precipitate left behind at the end of the reaction?
- A** copper(II) hydroxide and lead(II) hydroxide
B copper(II) hydroxide and zinc hydroxide
C lead(II) hydroxide only
D zinc hydroxide only
- 30 The positions of five elements **P**, **Q**, **R**, **S** and **T** are shown in the part of the Periodic Table.

Period	I	II	III	IV	V	VI	VII	0
1st								
2nd				Q				S
3rd					T		R	
4th	P							

Which statement about the elements shown is **not correct**?

- A** Element **S** exists as a monoatomic gas.
B Element **P** is the most reactive metal shown in the table above.
C Element **T** has 5 valence electrons in its outermost shell.
D Elements **Q** and **R** form an ionic compound which has the formulae of **QR₄**.
- 31 Which alloy of iron is used in surgical instruments?
- A** high carbon steel
B low carbon steel
C mild steel
D stainless steel
- 32 In which test-tube is the iron nail **most** likely to rust?



33 Some facts about three metals are as follows.

metal	fact
rhodium	found naturally as an alloy with other metals
thallium	extracted by electrolysis of its molten chloride
cobalt	extracted by heating its oxide with coke

What is the likely order of reactivity of the metals?

	least reactive	—————→	most reactive
A	rhodium	thallium	cobalt
B	thallium	cobalt	rhodium
C	rhodium	cobalt	thallium
D	cobalt	rhodium	thallium

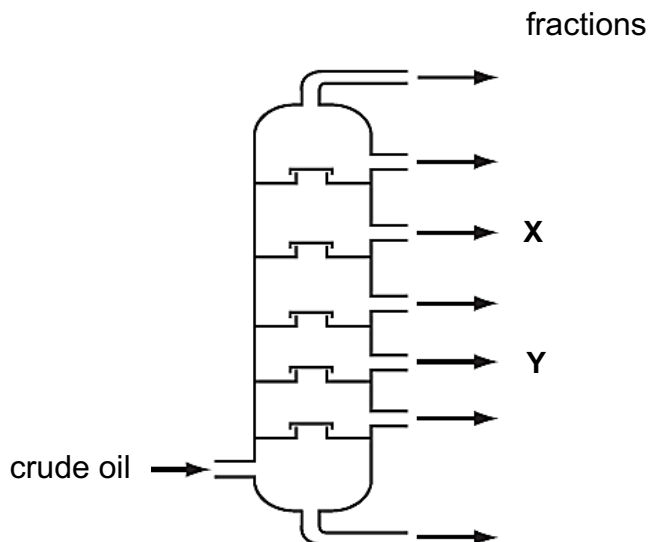
34 Which pair of pollutants cause damage to buildings?

- A** CFCs and carbon monoxide
- B** methane and carbon dioxide
- C** unburnt hydrocarbon and nitrogen monoxide
- D** nitrogen dioxide and sulfur dioxide

35 Nitrogen and hydrogen gases react to form ammonia gas in the Haber process. A higher yield of ammonia is favoured by a lower temperature but in industry, a high temperature of 450°C is used. Why is this so?

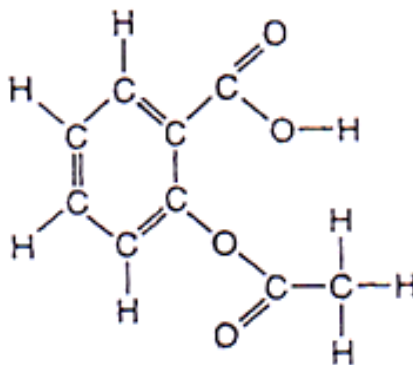
- A** At high temperatures, gases expand and less volumes are needed.
- B** At high temperatures, the catalyst is more effective.
- C** At low temperatures, liquid ammonia is collected instead.
- D** At low temperatures, the rate of reaction is too slow.

- 36 The diagram below shows the different fractions after crude oil has undergone fractional distillation.



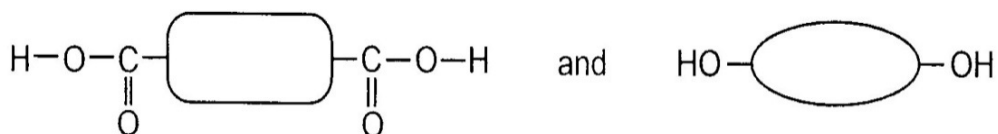
- Which statement is **correct**?
- A X and Y are both used as fuels.
 - B X has a higher boiling point than Y.
 - C X has a lower relative molecular mass than Y.
 - D X has more carbon atoms than Y.
- 37 One mole of a hydrocarbon **Q** reacted completely with 1 mole of hydrogen gas in the presence of a heated catalyst.
What could be the formula of **Q**?
- A C_2H_6
 - B C_3H_8
 - C C_5H_{10}
 - D C_7H_{16}
- 38 A food chemist wants to create a flavor from pineapples for a product. An ester with this flavor has the formula $C_3H_7CO_2C_2H_5$.
Which pair of organic compounds will react to form this ester?
- A $C_2H_5CO_2H$ and C_2H_5OH
 - B $C_2H_5CO_2H$ and C_3H_7OH
 - C $C_3H_7CO_2H$ and C_2H_5OH
 - D $C_3H_7CO_2H$ and C_3H_7OH

- 39 Aspirin is a drug which is used as a general painkiller. The structural formula of aspirin is shown below.



Which of the following statements about aspirin is **incorrect**?

- A** It decolourises aqueous bromine.
 - B** It turns acidified potassium manganate(VII) colourless.
 - C** It is formed from an alcohol and a carboxylic acid.
 - D** Its aqueous solution reacts with solid sodium carbonate.
- 40 A synthetic polymer is made by the condensation polymerisation of the two monomers shown below.



Which of the following shows the correct changes in the properties of the polymer formed?

	melting point	percentage composition of carbon by mass
A	increases	increases
B	increases	no change
C	decreases	decreases
D	no change	no change

END OF PAPER