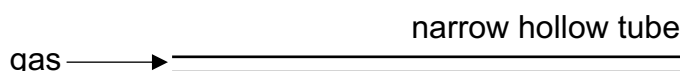


**NGEE ANN SECONDARY SCHOOL
PRELIMINARY EXAMS 2023
CHEMISTRY PAPER 1**

- 1 A student accidentally mixed 50 cm³ of water with 50 cm³ of oil. Which method would allow him to obtain 25 cm³ of the oil most easily?

A evaporation
B filtration
C fractional distillation
D using a separating funnel

- 2 A gas is allowed to diffuse across a narrow hollow tube as shown below.



Which of the following changes will increase the rate of diffusion of the gas through the tube?

- I place the tube vertically
II increase the temperature of the gas from 25 °C to 45 °C
III lowering the pressure from 1 atm to 0.5 atm
IV replacing the nitrogen gas with carbon monoxide gas

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

- 3 Which of the following statement is correct?

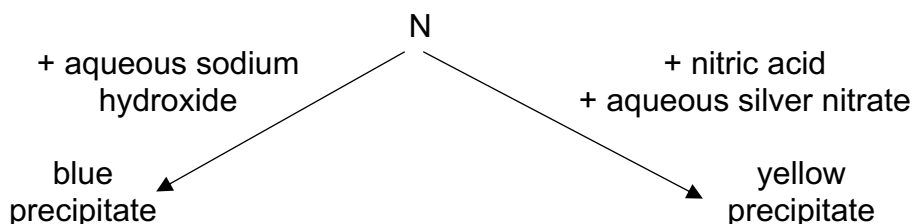
A When a liquid reaches its boiling point, it becomes a gas. This process is called evaporation.
B When a gas condenses, it becomes a liquid and energy is lost to the surroundings.
C When a solid changes directly to a gas, the process is called deposition.
D When a solid melts, the particles get further apart and have less energy.

- 4 An aqueous solution contains the same amount of Al³⁺(aq) and of Cu²⁺(aq). Aqueous ammonia is added until in excess. After shaking, the mixture is filtered.

What would be left on the filter paper?

A a white solid and a blue solid
B a white solid
C a blue solid
D no solid residue

- 5 An aqueous solution of a compound, N, undergoes the following reactions.



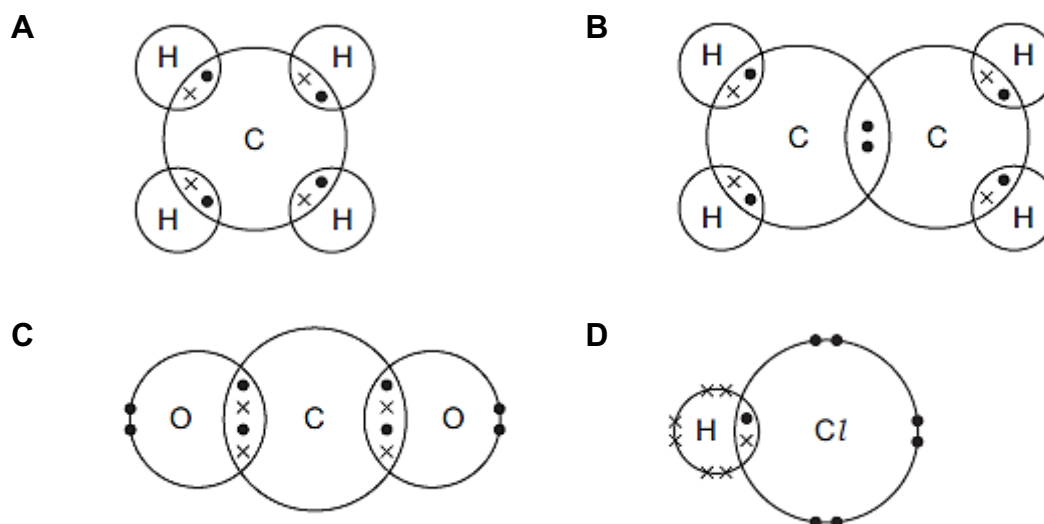
What is N?

- A** copper(II) carbonate
B copper(II) chloride
C copper(II) iodide
D copper(II) nitrate
- 6 The element X and Y form an ionic compound XY_3 . Given that X has 56 particles in the nucleus, which row shows the correct composition of an **ion** of X?

	number of protons	number of neutrons	number of electrons
A	26	30	23
B	26	30	26
C	30	26	30
D	30	26	33

- 7 The 'dot-and-cross' diagrams for four compounds are shown. Only outer shell electrons are shown.

Which diagram is correct?

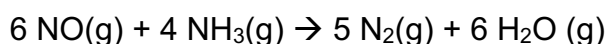


- 8 An oxide of element Z has the following properties.

- ☐ conducts electricity in molten but not in solid
- ☐ insoluble in water
- ☐ used as a refractory material

Which electronic configuration is likely to be Z?

- A** 2, 8, 1
B 2, 8, 2
C 2, 8, 4
D 2, 8, 7
- 9 Nitrogen monoxide gas from motor vehicles exhausts can be removed by injecting a stream of ammonia gas into the exhaust vapour. The reaction is shown below.

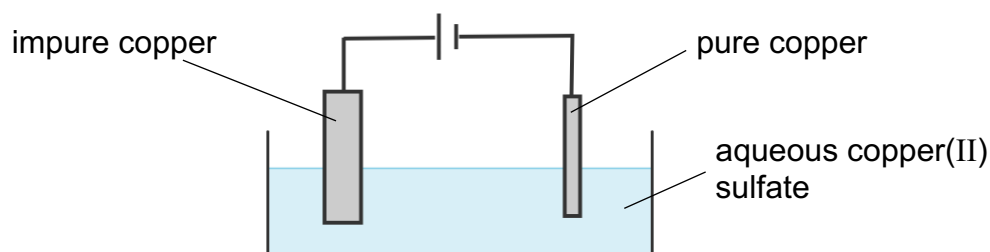


What volume of ammonia gas is needed to completely react with 3600 cm³ of nitrogen monoxide?

- A** 600 cm³
B 1200 cm³
C 2400 cm³
D 5400 cm³
- 10 0.2 mol/dm³ of dilute sulfuric acid is titrated with 0.3 mol/dm³ aqueous potassium hydroxide. What is the volume of aqueous potassium hydroxide required to react completely with V dm³ of dilute sulfuric acid?
- A** $\frac{1}{3}$ V dm³
B $\frac{2}{3}$ V dm³
C $\frac{3}{2}$ V dm³
D $\frac{4}{3}$ V dm³
- 11 Which of the following involves the largest number of electrons for complete discharge during electrolysis?
- A** 3 mol of P³⁻ ions
B 4 mol of Al³⁺ ions
C 5 mol of O²⁻ ions
D 8 mol of Na⁺ ions

- 12 Which statement best describes the mechanism of a hydrogen-oxygen fuel cell?
- A Electricity is used to provide heat energy.
 - B Electricity is used to generate hydrogen and oxygen.
 - C Hydrogen ions react with hydroxide ions to generate electricity.
 - D Hydrogen and oxygen undergo redox reactions to generate electricity.

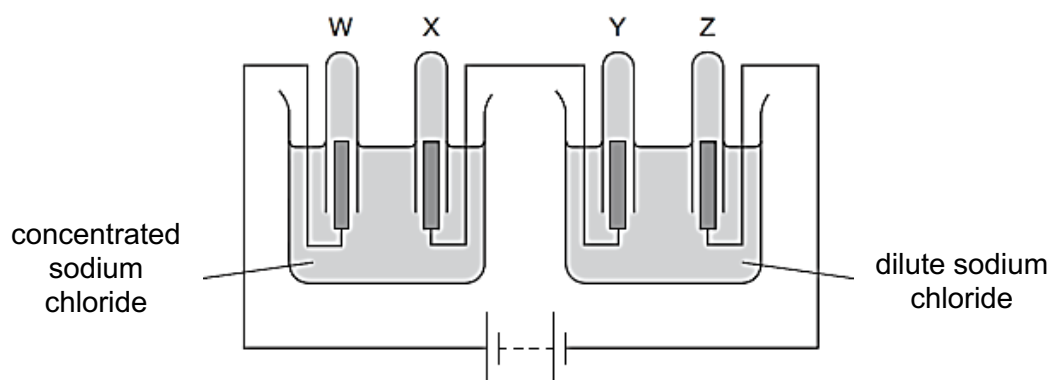
- 13 The diagram shows the apparatus used for refining a sample of impure copper.



The loss in mass of the positive electrode was 50 g and the gain in mass of the negative electrode was 45 g. What was the percentage purity of this sample of copper?

- A 5.0 %
 - B 10.0 %
 - C 90.0 %
 - D 95.0 %
- 14 The diagram shows the electrolysis of concentrated and dilute aqueous sodium chloride using inert electrodes.

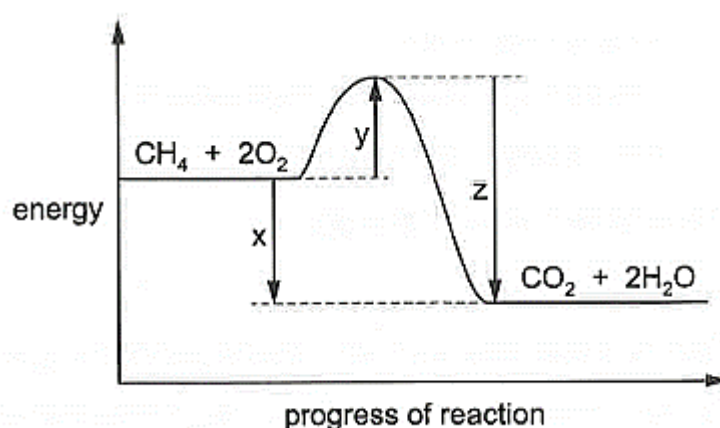
Gases are produced and collected in each of the test-tubes W, X, Y and Z.



Which statement is correct?

- A Approximately equal volumes of gas are produced and collected in test-tubes Y and Z.
- B Oxygen gas is collected in test-tube W.
- C Three different gases are produced in the experiment.
- D Two different gases are produced in the experiment.

- 15 Methane burns in oxygen to form carbon dioxide and water. The energy profile diagram is shown.



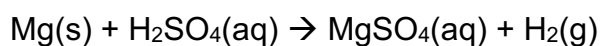
Which statement about bond breaking and forming is correct?

- A The energy released in forming bonds is labelled x.
 - B The energy released in breaking bonds is equal to z.
 - C The energy released in breaking bonds is less than the energy absorbed in forming bonds.
 - D The energy released in forming bonds is more than the energy absorbed in breaking bonds.
- 16 The formation of liquid water from hydrogen and oxygen may occur in three stages.
- 1 $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 4\text{H}(\text{g}) + 2\text{O}(\text{g})$
 - 2 $4\text{H}(\text{g}) + 2\text{O}(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
 - 3 $2\text{H}_2\text{O}(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$

Which stage(s) are endothermic?

- A 1, 2 and 3
 - B 1 only
 - C 2 only
 - D 3 only
- 17 In which reaction is substance P reduced?
- A Acidified potassium manganate(VII) is decolourised on addition to an aqueous solution of P.
 - B Adding aqueous potassium iodide to an aqueous solution of P gives a brown colour.
 - C $\text{P} \rightarrow \text{P}^{2+} + 2\text{e}^-$
 - D $\text{PO}^- + \text{O}_2 \rightarrow \text{PO}_3^-$

- 18** Dilute sulfuric acid was reacted with 24.0 g of powdered magnesium at room temperature in two experiments, experiment 1 and experiment 2.



In experiment 1, 100 cm³ of 1.0 mol/dm³ sulfuric acid was used.

In experiment 2, 50 cm³ of 2.0 mol/dm³ sulfuric acid was used.

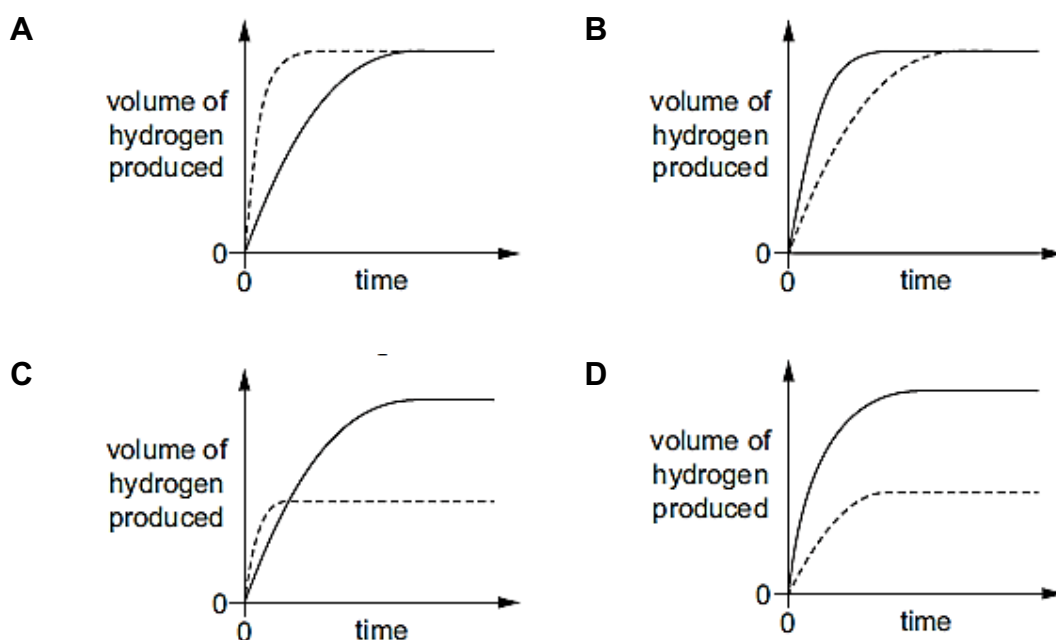
During each experiment the volume of hydrogen produced is measured. The results are plotted on a graph.

Which graph is correct? Refer to the key for the graphs.

key

— experiment 1

- - - experiment 2



- 19** Which row shows the pH values for 0.1 mol/dm³ solutions of ammonia, hydrochloric acid, sodium chloride and sodium hydroxide?

	pH values			
	NH ₃	HCl	NaCl	NaOH
A	1	7	13	11
B	7	1	11	13
C	11	1	7	13
D	13	11	7	1

- 20 Three separate mixtures of a solution and a solid are made. The mixtures are warmed.

In which mixture does a gas form?

	NaOH(aq) and NH ₄ Cl(s)	H ₂ SO ₄ (aq) and NH ₄ Cl(s)	H ₂ SO ₄ (aq) and Mg(s)
A	✓	✓	x
B	✓	x	✓
C	x	✓	x
D	x	x	✓

- 21 Given a supply of lead(II) carbonate, copper(II) carbonate, dilute nitric acid and aqueous sodium hydroxide, how many different salt(s) could be prepared?

A 1 B 2 C 3 D 4

- 22 Which statement about oxides is correct?

A A basic oxide is an oxide of a non-metal.
 B Acidic oxides contain ionic bonds.
 C Amphoteric oxides contain a metal.
 D Basic oxides are always gases.

- 23 The elements in Group I of the Periodic Table show trends in both their reactivities and their melting points. Rubidium is in Group I.

Which statement about rubidium is correct?

A It has a higher melting point than potassium.
 B It reacts with water to produce an acidic solution.
 C It reacts with water to produce oxygen gas.
 D It is more reactive than potassium.

- 24 Aqueous bromine is added to aqueous sodium chloride.

Which statement is correct?

A Bromine is oxidised and chloride ions are reduced.
 B Bromine is reduced and chloride ions are oxidised.
 C Neither oxidation nor reduction takes place.
 D Sodium ions are oxidised.

- 25 Which property of aluminium suggests it is **not** a transition metal?

A conducts electricity
 B high melting point
 C low density
 D malleable

- The sulfates of P and R are colourless; the sulfate of Q is blue.

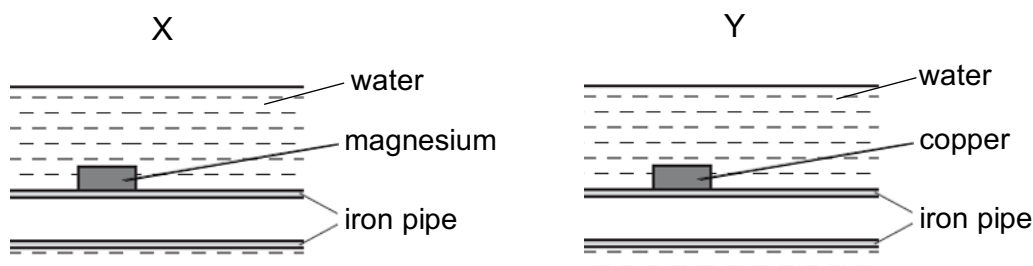
	metal added	metal sulfate solution	colour change
A	P	Q	blue → colourless
B	Q	P	colourless → blue
C	Q	R	blue → colourless
D	R	Q	blue → colourless

- 1 Has to be stored under oil
- 2 Catalyst in the production of margarine
- 3 Constituent of stainless steel
- 4 Burns in oxygen forming a white powder that turns yellow when hot.
- 5 Found in catalytic converters

	Cr	K	Ni	Pt	Zn
A	3	1	2	5	4
B	3	4	5	2	1
C	4	5	2	3	1
D	5	1	4	2	3

- A** Carbon dioxide, carbon monoxide and nitrogen gas escape as waste gases.
- B** Haematite, containing mainly iron(II) oxide is reduced.
- C** Molten slag is collected below molten iron.
- D** Slag is formed due to neutralisation between a silicon dioxide and a neutral oxide.

- 30 The diagrams X and Y show two underwater iron pipes attached with magnesium and copper respectively.

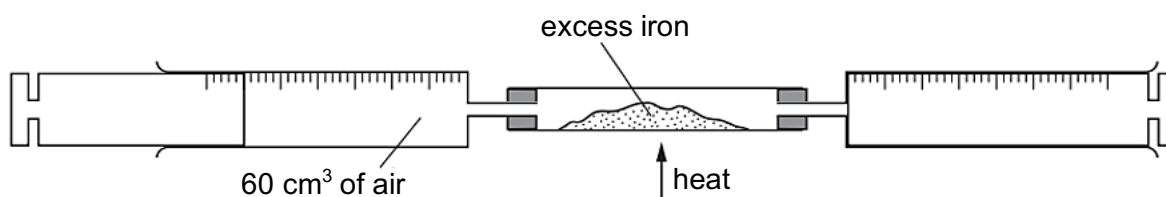


Which statement is correct?

- A The iron pipe in X will rust.
 - B The magnesium in X will be oxidised.
 - C The iron pipe in Y will not rust.
 - D The water surrounding the iron pipe in Y will turn pale blue.
- 31 Which row shows the correct source and effect of the named pollutant?

	pollutant	source	effect
A	methane	photochemical reactions	breathing difficulties
B	nitrogen dioxide	burning of fossil fuel	photochemical smog
C	ozone	decaying vegetable matter	global warming
D	sulfur dioxide	volcanic eruptions	acid rain

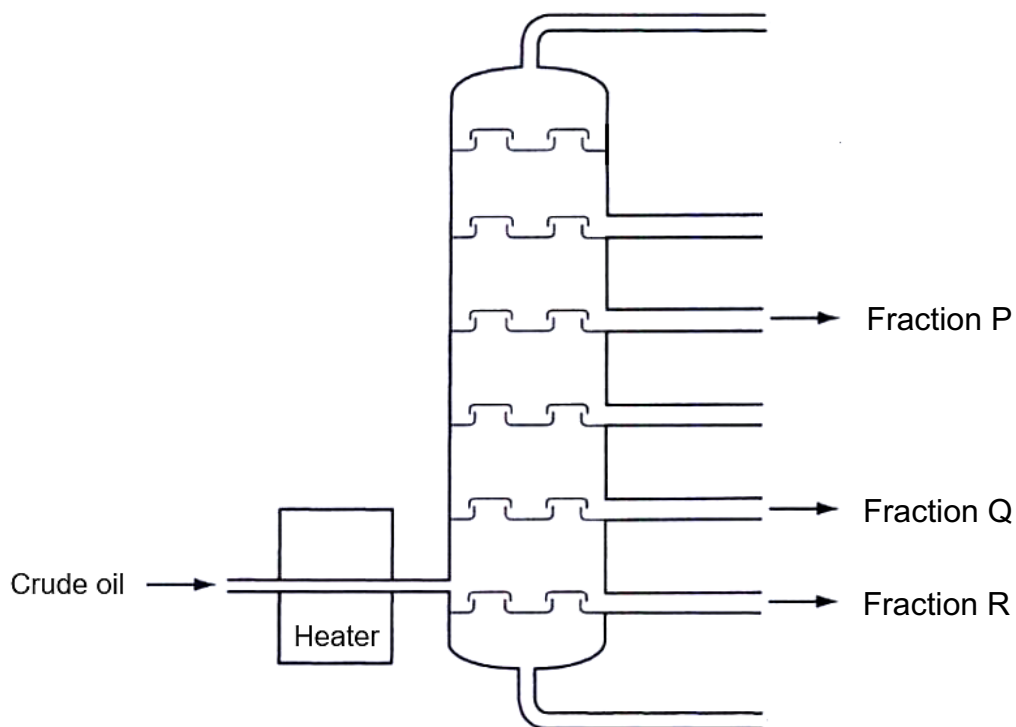
- 32 A 60 cm³ sample of air is trapped in a syringe. The air is slowly passed over heated iron in a tube until there is no further decrease in volume.



When cooled to room temperature, what volume of gas will remain?

- A 36 cm³
- B 48 cm³
- C 60 cm³
- D 80 cm³

33 The diagram below shows a set-up used in the fractional distillation of crude oil.



Which of the following correctly identifies the use of fractions P, Q and R?

	fraction P	fraction Q	fraction R
A	fuel for car engines	fuel for cooking using oil stoves	paving of road surfaces
B	fuel for car engines	fuel for diesel engines	making of waxes
C	making of plastics	fuel for cooking using oil stoves	paving of road surfaces
D	making of plastics	fuel for diesel engines	making of waxes

34 Which of the following statements about fractional distillation of petroleum is correct?

- A** Fractions collected at the top of the fractionating column have higher boiling points.
- B** Fractions collected at the top of the fractionating column are less flammable.
- C** Fractions collected at the bottom of the fractionating column have greater viscosity.
- D** Fractions collected at the bottom of the fractionating column have lower density.

- 35** Two different hydrocarbons each contain the same percentage by mass of hydrogen.

Which of the following should be similar between both hydrocarbons?

- A** density
- B** empirical formula
- C** number of isomers
- D** relative molecular mass

- 36** In an experiment, 10 cm³ of a gaseous hydrocarbon, X, required 75 cm³ of oxygen for complete combustion to give 60 cm³ of carbon dioxide. All gas volumes were measured at room temperature and pressure.

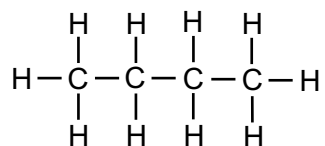
What is the formula of X?

- A** C₆H₆
- B** C₆H₈
- C** C₆H₁₀
- D** C₁₂H₁₅

- 37** A mono-chlorinated compound is a substance containing only one chlorine atom.

Compound V undergoes a substitution reaction with limited chlorine gas.

The structure of compound V is shown below.



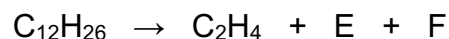
How many different mono-chlorinated products can be formed from the substitution reaction?

- A** 1 **B** 2 **C** 3 **D** 5

- 38** Which of the following statements about methanol is correct?

- A** It can be made from an alkene through the addition reaction with steam.
- B** It can decolourise aqueous bromine.
- C** It is produced through yeast fermentation of glucose.
- D** It undergoes combustion to form carbon dioxide and water.

- 39** The equation for the cracking of dodecane, $C_{12}H_{26}$ is shown.

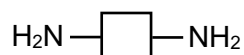


E is a saturated hydrocarbon with two more carbon atoms than F.
F decolourises aqueous bromine.

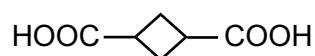
What are the chemical formulae of E and F?

	E	F
A	C_4H_{10}	C_6H_{12}
B	C_5H_{10}	C_5H_{12}
C	C_5H_{12}	C_5H_{10}
D	C_6H_{14}	C_4H_8

- 40** The diagram shows four monomers.



How many of these monomers would react with the molecule below to form a polymer?



A 1

B 2

C 3

D 4

—End of Paper—