West Spring Secondary School
Preliminary Examination 2020

CHEMISTRY **6092/01**

Paper 1 Multiple Choice

SECONDARY 4 EXPRESS

Name _____ ( ) **Date** **2 Sept 2020**

Class _____ **Duration** **1 hour**

Additional materials: Laminated Periodic Table and Optical Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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 **soft pencil** on the separate Answer Sheet.

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.

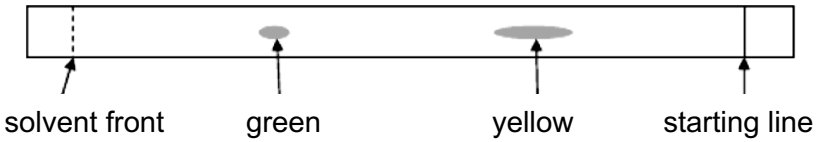
A copy of the Periodic Table is provided separately.

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

This document consists of **15** printed pages.

Setter: Mdm Sharena **[Turn over**

1 The chromatogram of a pen ink is shown.

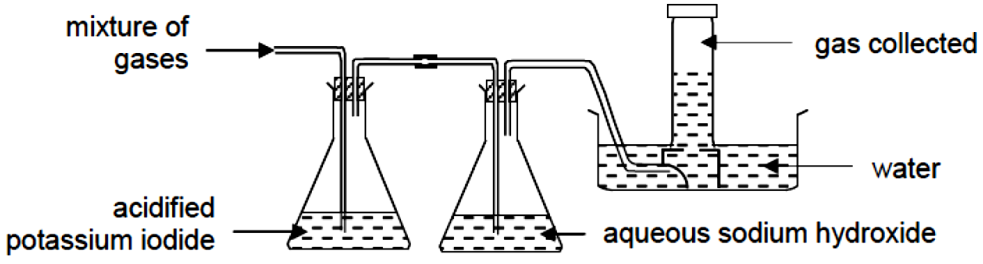


Which of the following statements can be deduced from the chromatogram?

A The pen ink is a pure substance.
B The green dye is more soluble in the solvent than the yellow dye.
C The molecules of the yellow dye are larger than that of the green dye.
D The R_f value of the yellow dye is greater than that of the green dye.

2 A gaseous mixture of hydrogen, ammonia, nitrogen dioxide and chlorine is passed through the apparatus shown.

Only one of the gases is collected at the end.



Which of the following is a property of the gas collected?

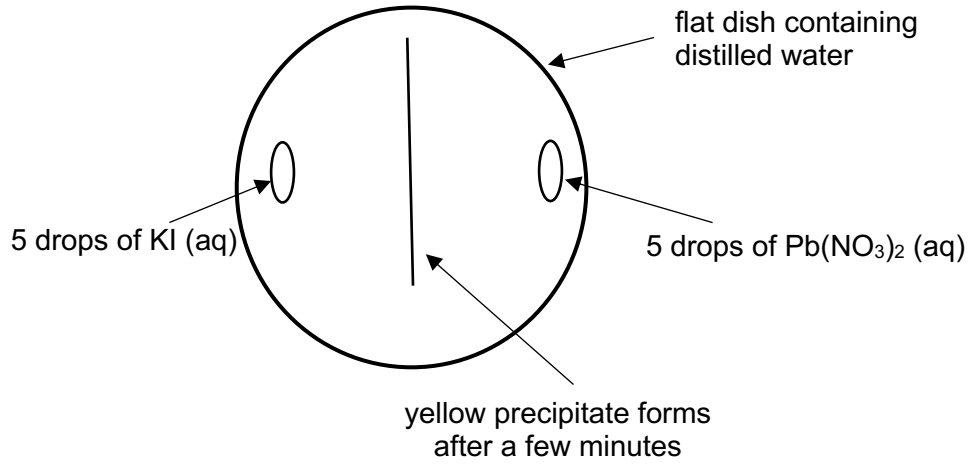
A Gas bleaches damp blue litmus paper.
B Gas turns damp red litmus paper blue.
C Gas extinguishes a lighted splint with a 'pop' sound.
D Gas decolourises acidified potassium manganate(VII) solution.

3 When a saturated aqueous solution of potassium sulfate is cooled from 70°C to room temperature, crystals are formed.

Which of the following statements is true, about what happens during the cooling process?

A the concentration of the solution remains the same.
B the mass of the solute in the solution decreases.
C the mass of the solvent in the solution increases.
D the solubility of potassium sulfate increases as the temperature falls.

4 A yellow precipitate is formed in an experiment as illustrated in the diagram.



Which of the following is a correct sequence of how the precipitate forms?

A Particles collide, diffuse and then react.

B Particles collide, react and then diffuse.

C Particles diffuse, collide and then react.

D Particles diffuse, react and then collide.

5 The table below shows the melting and boiling points of substances W to Z.

substance	melting point / °C	boiling point / °C
W	−120	−15
X	−4	42
Y	40	229
Z	413	899

Which of the following statements are true?

I X is a volatile liquid.
II Particles of Y and Z vibrate and rotate in fixed positions at room temperature.
III Two of the above substances undergo a change of state when heated from room temperature to 80°C.

A I and II only

B II and III only

C I and III only

D All of the above

6 Argon is used to prolong the lifespan of the tungsten filament in electric bulbs.

Argon has three isotopes: argon-36, argon-38 and argon-40.

Which statement is **not** true about these isotopes?

A They have the same arrangement of electrons.
B They have the same chemical properties.
C They have the same number of protons.
D They have the same rate of diffusion.

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

A chlorine
B fluorine
C magnesium
D oxygen

8 The table shows information about particles X and Y.

particle	number of protons	number of neutrons	electronic structure
X	12	12	2, 8
Y	20	20	2, 8, 8

Which statement is correct for both X and Y?

A They are positive ions.
B They are atoms of metals.
C They are atoms of noble gases.
D They are isotopes of the same element.

9 Which of the following contains a mixture of a metal and a non-metal?

A brass
B copper
C graphite
D mild steel

10 When blue hydrated copper(II) sulfate crystals are heated, a white solid E and a colourless liquid F are produced.

Which one of the following correctly describes E and F?

	E	F
A	has a variable composition by mass	has a fixed composition by mass
B	has a fixed composition by mass	has a variable composition by mass
C	has a variable composition by mass	has a variable composition by mass
D	has a fixed composition by mass	has a fixed composition by mass

11 Two particles X and Y have the composition shown in the table.

particle	number of electrons	number of neutrons	number of protons
X	10	8	8
Y	10	9	8

Which statement is correct about X and Y?

A X and Y are cations.

B X and Y are isotopes.

C X and Y belong to Group 0.

D X is a metal while Y is a non-metal.

12 The table shows some properties of four substances.

Which substance is an ionic compound?

	melting point/°C	dissolves in water	conducts electricity when solid	conducts electricity when aqueous solution
A	−32	√	x	√
B	301	√	x	x
C	801	√	x	√
D	3550	x	√	x

13 The structural formula of ethylene molecule is shown below.

What is the total number of shared electrons?

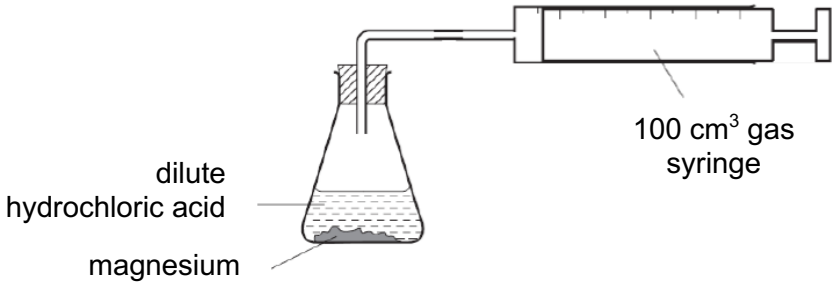
A 3 **B** 5 **C** 6 **D** 10

14 Two elements are in the same group of the Periodic Table.

Which property will be the same for both elements?

A The charge on their ions.
B Their reactivity with water.
C The electronic structure of their ions.
D The number of electrons in their atom.

15 An excess of hydrochloric acid is added to 0.10 mol of magnesium in the apparatus shown.



Why is it impossible to measure the volume of hydrogen produced using this apparatus?

A There is air in the tube.
B The reaction takes place too quickly.
C Hydrogen is soluble in hydrochloric acid.
D The gas syringe is too small to contain the hydrogen gas produced.

16 A substance has the following composition by mass.

C: 41.9%, H: 3.1%, Cl: 55.0%

If its relative molecular mass is 258, what is its molecular formula?

A $C_3H_5Cl_2$
B CH_3Cl_2
C $C_9H_8Cl_4$
D $C_3H_9Cl_6$

17 Rubidium, Rb, is an element in Group I of the Periodic Table.

Which statement(s) about rubidium is/are true?

I Rubidium conducts electricity in both solid and molten state.
II Rubidium has a higher melting point than caesium.
III Rubidium reacts explosively with water.
IV Rubidium reacts with water and forms a solution of pH < 7.

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

18 An experiment is carried out to determine the change in mass when different copper-based solids are added to excess nitric acid.

Solids of similar masses are added to the nitric acid as shown.

Beaker X: 10.0 g of copper foil added to 1.00 dm^3 of nitric acid
Beaker Y: 10.0 g of powdered copper(II) oxide added to 1.00 dm^3 of nitric acid
Beaker Z: 10.0 g of powdered copper(II) carbonate added to 1.00 dm^3 of nitric acid

Which of the following correctly shows the changes in mass for each beaker?

	Beaker X	Beaker Y	Beaker Z
A	decreases	no change	no change
B	increases	increases	increases
C	no change	decreases	decreases
D	no change	no change	decreases

19 Bromobutane, C_4H_9Br, can be made from butanol, C_4H_9OH, as shown in the following equation.

$$C_4H_9OH + HBr \rightarrow C_4H_9Br + H_2O$$

In an experiment, 10 g of butanol produced 12 g of bromobutane.

What is the percentage yield of bromobutane?
[M_r : C_4H_9OH, 74; C_4H_9Br, 137]

A 45% **B** 54% **C** 65% **D** 83%

20 What volume of 0.10 mol/dm^3 aqueous silver nitrate reacts with 20.0 cm^3 of 0.20 mol/dm^3 barium chloride?

A 10 cm^3 **B** 20 cm^3 **C** 40 cm^3 **D** 80 cm^3

21 The following table gives the colour of various indicators and the pH range at which the indicator changes colour.

indicator	colour in acidic solution	pH range at which indicator changes colour	colour in alkaline solution
methyl orange	red	3 – 5	yellow
quinaldine red	colourless	1 – 3	red
phenolpthalein	colourless	8 – 10	pink

What is the colour of the solution all three indicators are added to pure water?

A colourless
B orange
C red
D yellow

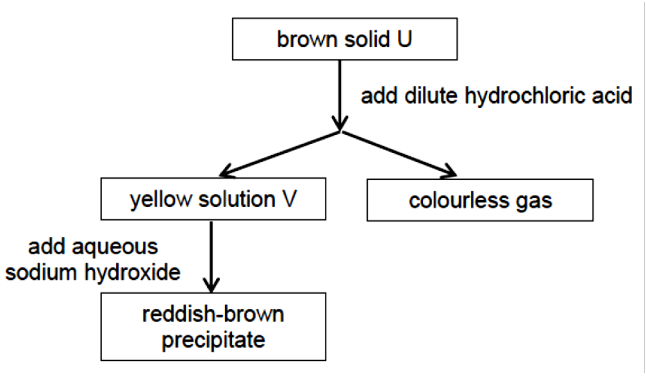
22 An acidic solution contains _____.

A hydrogen ions only
B more hydrogen ions than hydroxide ions
C more hydroxide ions than hydrogen ions
D equal number of hydrogen and hydroxide ions

23 Which of the following salts can be prepared by the methods indicated?

	prepared by the use of an acid and an insoluble carbonate	prepared by the use of two aqueous salts
A	lead(II) sulfate	barium nitrate
B	iron(II) sulfate	calcium sulfate
C	sodium chloride	zinc carbonate
D	copper(II) nitrate	magnesium sulfate

24 The flowchart shows the tests and observations obtained for an unknown salt.



How many of the following observations is(are) **not** obtained when excess sodium metal is added to solution V?

I Sodium metal dissolves and becomes smaller.
II Yellow solution turns colourless.
III Grey solid is formed.
IV Bubbles of gas are produced.

A 0 **B** 1 **C** 2 **D** 3

25 Test on a sample of water gave the following results.

reagent added	observations
aqueous ammonia	white precipitate, insoluble in excess
nitric acid, then barium nitrate	white precipitate

Which compound could have been present in the water?

A zinc chloride
B zinc sulfate
C aluminium chloride
D aluminium sulfate

26 In the Haber process for the manufacture of ammonia, which statements are correct?

I The reaction is never complete.
II The catalyst used is a transition metal.
III An increase in pressure will produce a higher yield of ammonia.
IV Both reactants are obtained from fractional distillation of liquid air.
V An increase in temperature will produce a higher yield of ammonia.

A I, II, III **B** I, III, IV **C** I, II, V **D** I, III, IV, V

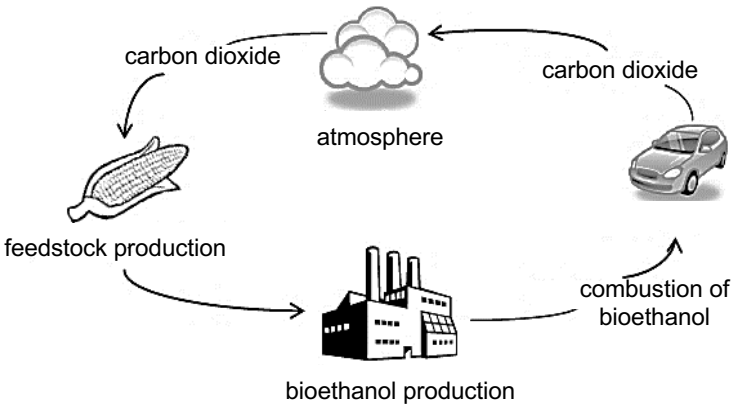
27 The data in the table gives the concentration, in parts of pollutant per million parts of air, of pollutant gases in four different cities.

In which city are limestone structures under the greatest threat from pollution?

	sulfur dioxide	carbon monoxide	nitrogen dioxide
A	15	20	50
B	15	50	40
C	20	20	30
D	25	25	25

28 Biofuels are fuels obtained from biological sources such as plant materials and animal fats.

The diagram shows the stages in the production of bioethanol, an example of biofuel.



Carbon dioxide is released during the production of bioethanol and also when it is used as a fuel in vehicles. However, this does not contribute to an increase in carbon dioxide released to the atmosphere.

Which of the following best explains this advantage of using bioethanol as a fuel?

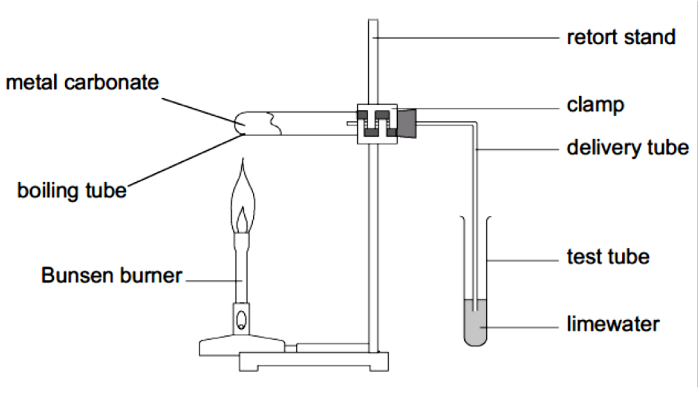
A Carbon dioxide is used up by plants during respiration.

B Less carbon dioxide is removed by plants during photosynthesis than is produced from the production and combustion of bioethanol.

C Plants take in as much carbon dioxide during photosynthesis as it is produced from the production and combustion of bioethanol.

D The carbon dioxide released into the atmosphere dissolves in rainwater.

29 An experiment was carried out to investigate the effect of heat on the carbonates of three metals, X, Y and Z, using the setup shown.



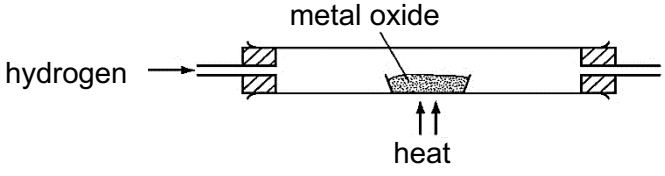
The table shows the results of the experiment.

metal	observations with limewater
X	slight effervescence, white precipitate
Y	no observable change
Z	vigorous effervescence, white precipitate

If the time set for each experiment to take place was the same, what is the order of reactivity of metals X, Y and Z?

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

30 The reaction of a metal oxide with hydrogen is shown below.

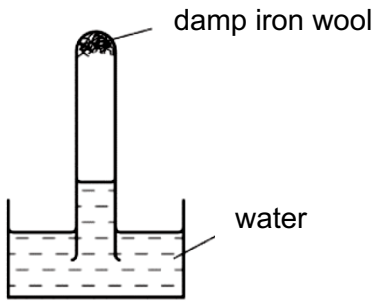


Which of the following is correct?

	metal oxide	mass of solid remaining
A	copper(II) oxide	decrease
B	copper(II) oxide	increase
C	magnesium oxide	decrease
D	magnesium oxide	increase

31 A test-tube containing damp iron wool is inverted in water.

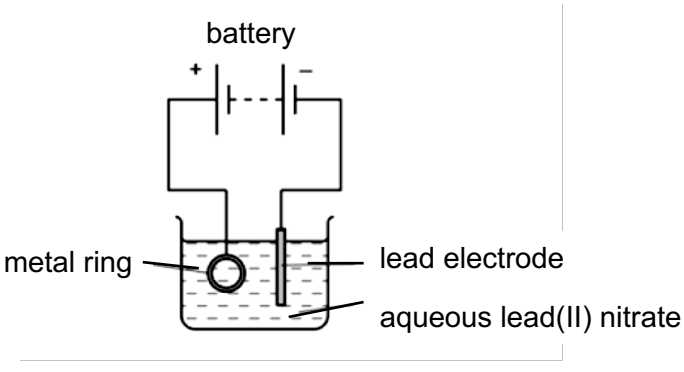
After three days, the water level inside the test-tube has risen.



Which statement correctly explains the rise in the water level inside the test-tube?

A Carbon dioxide has been formed.
B Hydrated iron (III) oxide has been formed.
C Iron wool has been reduced.
D Temperature of the water has increased.

32 The diagram shows an apparatus used in an attempt to electroplate a metal ring with lead.



The experiment did not work. What change should be made to the experiment to make it work?

A Add solid lead (II) sulfate to the electrolyte.
B Increase the temperature of the electrolyte.
C Replace the lead electrode with a carbon electrode.
D Reverse the terminals of the battery.

33 When zinc metal is added to the copper(II) sulfate solution, the blue solution gradually fades to a pale blue and a reddish brown metal is formed.

$$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$$

Which of the following statement is true for the above reaction?

A Copper(II) sulfate is the reducing agent.

B Copper metal reduces to copper(II) sulfate.

C Zinc sulfate is the oxidising agent.

D Zinc metal displaces copper from aqueous copper(II) sulfate.

34 The diagram shows some magnesium blocks attached to the steel hull of a boat below the water line.

How does the attached magnesium blocks prevent the steel hull from rusting?

A Magnesium reacts with iron to form an alloy.

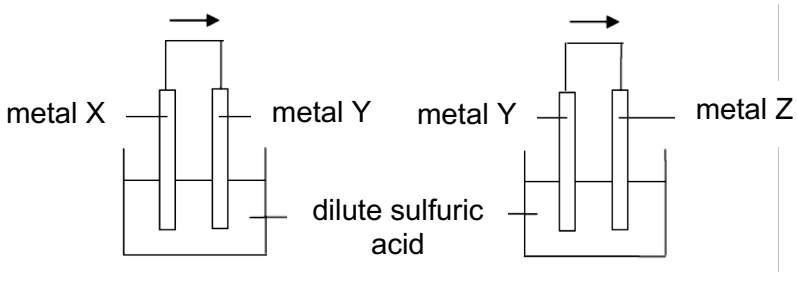
B Magnesium reacts with oxygen and water in preference to iron.

C Magnesium reacts with oxygen to form an oxide layer on the iron.

D Magnesium stops oxygen in the water from getting to the iron.

35 Two cells were set up as shown in the diagram below.

The arrow shows the direction of electron flow in the external circuit.



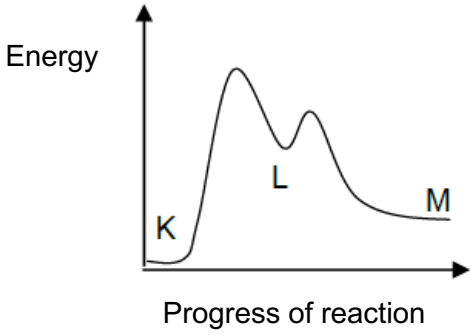
Which set of metals would give the electron flow in the direction shown?

	metal X	metal Y	metal Z
A	Pb	Cu	Zn
B	Cu	Pb	Zn
C	Zn	Pb	Cu
D	Cu	Zn	Pb

36 In the conversion of compound K to compound M, it was found that the use of a catalyst caused the reaction to proceed through the formation of an intermediate compound L.

The following graph shows the energy profile diagram for the reactions.

Step 1: Compound K → Compound L
Step 2: Compound L → Compound M



Which of the following can be deduced from the diagram?

A Both Steps 1 and 2 are endothermic.
B The overall reaction to convert K to M is exothermic.
C Step 1 has a lower activation energy as compared to Step 2.
D Step 1 requires more energy for bond breaking than Step 2.

37 When 1 g of ethane is burnt, 52 kJ of energy is released.

How much heat is released when 1 mole of ethane burns? [M_r of ethane = 30]

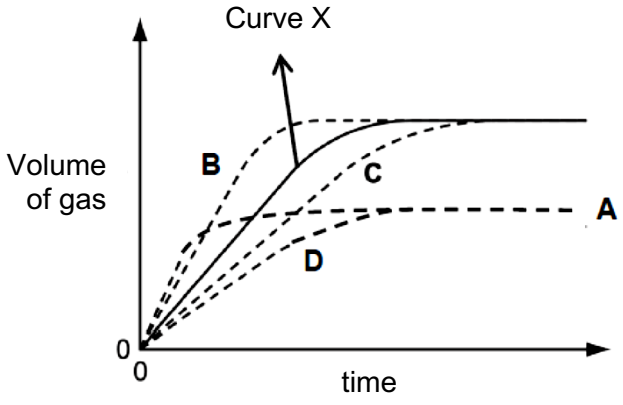
A 1.7 kJ/mol
B 52 kJ/mol
C 1456 kJ/mol
D 1560 kJ/mol

38 Which of the following conditions will cause the reaction between the dilute acid and zinc to produce the slowest rate of reaction?

A zinc chips and 40.0 cm^3 of 2.0 mol/dm^3 hydrochloric acid
B zinc powder and 20.0 cm^3 of 2.0 mol/dm^3 hydrochloric acid
C zinc chips and 20.0 cm^3 of 2.0 mol/dm^3 sulfuric acid
D zinc powder and 40.0 cm^3 of 2.0 mol/dm^3 sulfuric acid

39 A student decided to conduct an experiment by reacting 5.0 g of sodium with 0.05 mol of water.

The volume of hydrogen gas produced during the reaction was recorded in fixed time intervals and Curve X was obtained.



Which graph would be obtained if 5.0 g of potassium metal was reacted with 0.05 mol of water instead?

40 Which of the following statements about the effect of a catalyst is correct?

A It decreases the activation energy of the reaction by providing an alternative pathway.

B It decreases the enthalpy heat of reaction but increases the speed of reaction.

C It increases the speed of the reacting particles and frequency of effective collisions.

D It increases the yield of the products and the speed of reaction.

END OF PAPER 1