Candidate's Name: .....

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545/1

CHEMISTRY

Paper 1

July/Aug. 2023

1½ hours

HOIMA DIOCESE EXAMINATIONS BOARD

UCE Mock Examination, 2023

CHEMISTRY

Paper 1

1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of **50** *objective-type questions.*

Answer **all** *questions.*

You are required to write the correct answer; **A**, **B**, **C** *or* **D** *in the box provided on the right-hand side of each question.*

Do **not** *use pencil.*

For Examiners' Use Only		

1. Steel is a form of iron which contains

A. carbon
B. magnesium
C. oxygen
D. sulphur

2. Nitrogen and oxygen in the air can be separated by fractional distillation because they have different

A. densities
B. solubilities
C. melting points
D. boiling points.

3. Which of the following represents the electron arrangement of a period 3 element?

A. 2 : 5
B. 2 : 3
C. 2 : 8 : 3
D. 2 : 8 : 8 : 2

4. Which one of the following elements burns in oxygen to produce a residue which dissolves in an acid?

A. Carbon
B. Magnesium
C. Phosphorus
D. Sulphur

5. During the manufacture of sulphuric acid, sulphur trioxide is not dissolved in water but in concentrated sulphuric acid in order to

A. increase the percentage yield of the acid.
B. avoid the formation of sulphur trioxide fumes.
C. increase the rate of reaction.
D. produce a very concentrated acid.

6. Elements ***P***, ***Q***, ***R*** and ***S*** have atomic numbers 8, 11, 13 and 17 respectively. Which pair of atoms will form a molecular compound?

A. Two atoms of ***P***.
B. Two atoms of ***Q***.
C. An atom of ***P*** and an atom of ***R***.
D. An atom of ***R*** and an atom of ***S***.

7. Which one of the following forms a colourless aqueous solution which reacts with acidified lead (II) nitrate to give a white precipitate?

A. Calcium iodide
B. Iron (II) iodide
C. Copper (II) chloride
D. Sodium chloride

8. A salt whose mass remains the same upon strong heating is likely to be a carbonate of

A. calcium
B. copper
C. magnesium
D. potassium

9. A stream of ammonia was passed over heated iron wool and a lighted splint placed at the other end of the combustion tube was extinguished with a 'pop' sound. The iron wool in this experiment acts as

A. a dehydrating agent.
B. an oxidising agent.
C. a catalyst.
D. a reducing agent.

10. The isotopes $^{35}_{17}Cl$ and $^{37}_{17}Cl$ have similar chemical properties because they have

A. the same number of electrons.
B. the same mass number.
C. different numbers of neutrons.
D. the same chemical symbol.

11. Which one of the following contains layers of carbon atoms?

A. Diamond
B. Lamp black
C. Graphite
D. Wood charcoal

12. A dibasic acid, H_2J has a concentration of 0.5 M. Which of the following expressions gives the volume of 1.0 M potassium hydroxide that can neutralise 25.0 cm^3 of the H_2J acid solution?

A. $\left(\frac{0.5 \times 25}{2}\right) cm^3$
B. $(0.5 \times 25)\ cm^3$
C. $(0.5 \times 25 \times 2)\ cm^3$
D. $(25 \times 2)\ cm^3$

Turn Over

13. The table below shows some properties of substances *H*, *I*, *J* and *K*.

Substance	Melting point	Boiling point	Electrical conductivity	
			in liquid state	in aqueous state
H	low	Low	none	None
I	low	Low	none	Good
J	high	High	none	None
K	high	High	good	Good

Which one of the substances could be hydrogen chloride?

A. *H*
B. *I*
C. *J*
D. *K*

14. What is the concentration of nitrate ions, NO_3^- in 1000 cm^3 of 2 M lead (II) nitrate solution, $Pb(NO_3)_2$?

A. 0.38 M
B. 0.50 M
C. 2.00 M
D. 4.00 M

15. From which of the following will a gas be produced?

A. Adding calcium to water.
B. Adding dilute hydrochloric acid to silver.
C. Adding dilute sulphuric acid to copper.
D. Adding sodium oxide to water.

16. Some synthetic products are said to be non-biodegradable because they

A. are not decomposed by strong heat.
B. are not harmful to living organisms.
C. are not broken down by microorganisms.
D. cannot be obtained from plant or animal matter.

17. The change which takes place when a chlorine atom becomes a chloride ion is that the

A. atomic number of chlorine increases by 1.
B. atom loses 1 electron.
C. mass number of chlorine decreases by 1.
D. electrons in the atom increase by 1.

18. Which **one** of the following gases constitutes the most chemically active part of air?

A. Nitrogen
B. Oxygen
C. Carbon dioxide
D. Rare gases

19. Which of the following salts can be prepared by the neutralisation method?

A. Aluminium sulphate
B. Ammonium sulphate
C. Copper (II) sulphate
D. Iron (II) sulphate

20. Which of the following reactions will take place readily?

A. $Zn\,(s) + CuSO_4\,(aq) \longrightarrow ZnSO_4\,(aq) + Cu\,(s)$
B. $Fe\,(s) + ZnSO_4\,(aq) \longrightarrow FeSO_4\,(aq) + Zn\,(s)$
C. $Mg\,(s) + CaCl_2\,(aq) \longrightarrow MgCl_2\,(aq) + Ca\,(s)$
D. $3Zn\,(s) + Al_2(SO_4)_3 \longrightarrow 3ZnSO_4\,(aq) + 2Al\,(s)$

21. Carbon disulphide reacts with oxygen according to the following equation:

$$CS_2\,(l) + 3O_2\,(g) \longrightarrow CO_2\,(g) + 2SO_2\,(g)$$

What volume of oxygen is required to react with excess carbon disulphide to produce 10 litres of carbon dioxide?

A. $30\,l$
B. $10\,l$
C. $\left(\frac{22.4}{3}\right)l$
D. $(3 \times 22.4)\,l$

22. Elements ***K*** and ***L*** have atomic numbers 6 and 9 respectively. What is the likely formula of the compound formed between K and L?

A. KL_3
B. KL_4
C. K_2L
D. K_2L_3

23. In which of the following reactions is dilute nitric acid **not** behaving as an acid?

A. $Mg\,(s) + 2HNO_3\,(aq) \longrightarrow Mg(NO_3)_2\,(aq) + H_2\,(g)$
B. $Fe(OH)_2\,(aq) + 2HNO_3\,(aq) \longrightarrow Fe(NO_3)_2\,(aq) + H_2O\,(l)$
C. $ZnCO_3\,(s) + 2HNO_3\,(aq) \longrightarrow Zn(NO_3)_2\,(aq) + CO_2\,(g) + H_2O\,(l)$
D. $3Cu\,(s) + 8HNO_3\,(aq) \longrightarrow 3Cu\,(NO_3)_2\,(aq) + 2NO\,(g) + 4H_2O\,(l)$

Turn Over

24. Methanoic acid, HCOOH, neutralises barium hydroxide solution according to the following equation:

$$2HCOOH\,(aq) + Ba(OH)_2\,(aq) \longrightarrow (HCOO)_2Ba\,(aq) + 2H_2O\,(l)$$

What is the mass of methanoic acid that is just enough to react with 1000 cm^3 of 0.02 M barium hydroxide solution? ($H = 1$, $C = 12$, $O = 16$)

A. $\left(\frac{2 \times 46}{1 \times 0.02}\right)$ g

B. $\left(\frac{2 \times 0.02}{1 \times 46}\right)$ g

C. $\left(\frac{1 \times 0.02 \times 46}{2}\right)$ g

D. $(2 \times 0.02 \times 46)$ g

25. When a substance *T* is heated strongly, it releases a colourless gas that forms a white precipitate with aqueous calcium hydroxide and leaves a white residue on cooling. What is substance *X*?

A. Zinc carbonate
B. Sodium carbonate
C. Lead (II) carbonate
D. Copper (II) carbonate

26. Gas ***X***, with a pungent smell burn in oxygen rich air to form a colourless gas ***Y*** which is insoluble in water and neither burns nor supports combustion. Identify gases ***X*** and ***Y***.

	X	***Y***
A.	Sulphur dioxide	Sulphur trioxide
B.	Ammonia	Nitrogen
C.	Hydrogen sulphide	Sulphur dioxide
D.	Nitrogen monoxide	Nitrogen dioxide

27. Methane burns in oxygen according to the following equation:

$$CH_4\,(g) + 2O_2\,(g) \longrightarrow CO_2\,(g) + 2H_2O\,(l)$$

When 1 g of methane is burnt, 56 kJ of energy is released. The enthalpy of combustion of methane is (C = 12, H = 1)

A. $\left(\frac{56}{16}\right)$ kJ mol^{-1}

B. $\left(\frac{56}{2}\right)$ kJ mol^{-1}

C. (56×2) kJ mol^{-1}

D. (56×16) kJ mol^{-1}

28. When sulphuric acid is heated with substance X, sulphur dioxide is produced. From this fact, substance X must be

A. an oxidising agent
B. a reducing agent
C. a metal
D. a base

29. What is the volume occupied by 22 g of carbon dioxide at s.t.p? (Molar volume of a gas at s.t.p is 22.4 dm^3)

A. $(22.4 \times 22)\ dm^3$
B. $\left(\frac{22.4 \times 22}{44}\right) dm^3$
C. $\left(\frac{44 \times 22}{22.4}\right) dm^3$
D. $\left(\frac{44 \times 22.4}{22}\right) dm^3$

30. During the process of water treatment, a calculated amount of chlorine is added to the water in order to

A. prevent tooth decay.
B. sediment the impurities.
C. kill any bacteria present.
D. remove any dissolved salt.

31. Which one of the following equations represents a redox reaction?

A. $H_2SO_4\ (aq) + 2NaOH\ (aq) \longrightarrow Na_2SO_4\ (aq) + 2H_2O\ (l)$
B. $CuSO_4\ (aq) + 5H_2O\ (l) \longrightarrow CuSO_4.5H_2O\ (aq)$
C. $Na_2CO_3\ (aq) + Pb(NO_3)_2\ (aq) \longrightarrow PbCO_3\ (s) + 2NaNO_3\ (aq)$
D. $2FeCl_3\ (aq) + SnCl_2\ (aq) \longrightarrow 2FeCl_2\ (aq) + SnCl_4\ (aq)$

32. The equation below shows the reaction of calcium and chlorine gas.

$$Ca\ (s) + Cl_2\ (g) \longrightarrow CaCl_2\ (s)\ \Delta H = -900\ kJ\ mol^{-1}$$

What is the mass of calcium that reacts with chlorine gas to release 360 kJ of heat energy? (Ca = 40, Cl = 35.5)

A. $\left(\frac{40 \times 900}{360}\right) g$
B. $\left(\frac{40 \times 360}{900}\right) g$
C. $\left(\frac{900}{369 \times 40}\right) g$
D. $\left(\frac{360}{40 \times 900}\right) g$

Turn Over

33. Which of the following reactants will produce the highest rate of reaction with excess zinc powder?

A. 25 cm^3 0.1 M nitric acid.
B. 25 cm^3 of 0.1 M ethanoic acid.
C. 25 cm^3 of 0.1 M sulphuric acid
D. 25 cm^3 of 0.1 M hydrochloric acid.

34. The reaction between hydrochloric acid and sodium carbonate is shown below.

$$Na_2CO_3\ (aq) + 2HCl\ (aq) \longrightarrow 2NaCl\ (aq) + CO_2\ (g) + H_2O\ (l)$$

Given that 2.0 g of hydrated sodium carbonate ($Na_2CO_3.nH_2O$) requires 25.0 cm^3 of 1.0 M hydrochloric acid for complete reaction, what is the value of n? ($Na_2CO_3 = 106$)

A. 3
B. 5
C. 7
D. 10

35. Which one of the following reactions is suitable for the laboratory preparation of carbon dioxide?

A. $CaCO_3\ (s) + H_2SO_4\ (aq) \longrightarrow CaSO_4\ (s) + H_2O\ (l) + CO_2\ (g)$
B. $PbCO_3\ (s) + H_2SO_4\ (aq) \longrightarrow PbSO_4\ (s) + H_2O\ (l) + CO_2\ (g)$
C. $PbCO_3\ (s) + 2HNO_3\ (aq) \longrightarrow Pb(NO_3)_2\ (s) + H_2O\ (l) + CO_2\ (g)$
D. $PbCO_3\ (s) + 2HCl\ (aq) \longrightarrow PbCl_2\ (s) + H_2O\ (l) + CO_2\ (g)$

36. The table below gives information about three metals ***X***, ***Y*** and ***Z***.

Metal	Method of extraction of metal
X	Found uncombined.
Y	Electrolysis of molten oxide.
Z	Heating oxide with carbon.

In which of the following orders are the metals arranged in decreasing ease of extraction?

A. ***X, Y, Z***
B. ***Y, Z, X***
C. ***Z, Y, X***
D. ***X, Z, Y***

37. The carbonate of metal X decomposes when heated according to the following equation:

$$XCO_3(s) \longrightarrow XO(s) + CO_2(g)$$

What mass of the carbonate is needed to produce 492 cm^3 of carbon dioxide gas at s.t.p? (C = 12, O = 16, X = 52; Molar gas volume at s.t.p = 22.4 dm^3)

A. $\left(\frac{112 \times 492}{22.4}\right)$ g

B. $\left(\frac{112 \times 492}{22.4 \times 1000}\right)$ g

C. $\left(\frac{22.4}{112 \times 492}\right)$ g

D. $\left(\frac{22.4 \times 1000}{112 \times 492}\right)$ g

38. A solution forms a white precipitate with excess aqueous ammonia but not with excess aqueous sodium hydroxide. What cation could the solution contain?

A. Cu^{2+}
B. Zn^{2+}
C. Pb^{2+}
D. Ca^{2+}

39. Q and R are two elements in the same group of the Periodic Table. If the atomic number of Q is 7, the possible electron arrangement of R is

A. 2 : 7
B. 2 : 8 : 5
C. 2 : 8 : 7
D. 2 : 8 : 8 : 1

40. What is the mass of one molecule of nitrogen?

(N = 14; Avogadro constant = 6.02×10^{23} mol^{-1})

A. $\left(\frac{6.02 \times 10^{23}}{2 \times 14}\right)$ g

B. $\left(\frac{2 \times 14}{6.02 \times 10^{23}}\right)$ g

C. $\left(\frac{14}{2 \times 6.02 \times 10^{23}}\right)$ g

D. $\left(\frac{2 \times 6.02 \times 10^{23}}{14}\right)$ g

Each of the questions **41** *to* **45** *consists of an assertion (statement) on the left side and a reason on the right-hand side.*
Select

A. if both the assertion and reason are true statements and the reason is a correct explanation of the assertion.

B. if both the assertion and reason are true statements but the reason is not a correct explanation of the assertion.

C. if the assertion is true but the reason is not a correct statement.

D. it the assertion is not correct but the reason is a correct statement.

INSTRUCTIONS SUMMARISED

Assertion	Reason
A. True	True and is a correct explanation
B. True	True but is **not** a correct explanation
C. True	Incorrect
D. Incorrect	Correct

41. Nitrogen and oxygen in liquid air can be separated by fractional crystallisation **because** nitrogen is more volatile than oxygen. ☐

42. Sulphur dioxide is dried using concentrated sulphuric acid **because** concentrated sulphuric acid is an oxidising agent. ☐

43. When water containing magnesium hydrogen carbonate is boiled, it forms a lather readily with soap **because** the soluble magnesium hydrogen carbonate decomposes on heating to insoluble magnesium carbonate. ☐

44. Dry ammonia reacts with heated lead (II) oxide to form nitrogen **because** lead (II) oxide is an amphoteric oxide. ☐

45. The rate of a reaction increases with the increase in the concentration of the reactants **because** high concentration increases the possibility for collision between the reacting molecules. ☐

For each of the questions **46 - 50**, *one or more answers may be correct. Read question carefully and then write;*

A. If answers **1**, **2** and **3** only are correct
B. If answers **1** and **3** only are correct
C. If answers **2** and **4** only are correct
D. If only answer **4** is correct

46. When hydrogen chloride is dissolved in water, it reacts with

1. copper to form hydrogen.
2. zinc to form hydrogen.
3. sodium hydroxide to form an acid salt.
4. calcium carbonate to form carbon dioxide.

47. Which of the following molecular formulae is/are of alkanes?

1. C_2H_6
2. C_2H_4
3. C_3H_8
4. C_3H_6

48. Which of the following statement(s) is/are true about a solution with a pH of 7.5? The solution

1. accepts a proton.
2. turns red litmus paper blue.
3. gives a pink colour with phenolphthalein indicator.
4. contains hydrogen ions as the only positively charged ions.

49. Calcium carbonate, zinc powder, copper (II) oxide powder and aqueous potassium carbonate were separately placed in test tubes labelled ***P***, ***Q***, ***R*** and ***S*** respectively. A solution of hydrogen chloride in methylbenzene was poured into each of the four test tubes. In which test tube(s) did a reaction occur?

1. ***P***
2. ***Q***
3. ***R***
4. ***S***

50. Which of the following substance(s) is/are formed when calcium is burnt in air?

1. Calcium nitrate
2. Calcium nitride
3. Calcum nitrite
4. Calcum oxide

END