Candidate's Name : .....

Signature : .....

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(Do not write your School / Centre Name or Number anywhere on this booklet.)

545/1
CHEMISTRY
Paper 1
Oct./Nov. 2022
1½ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

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* **blue** *or* **black** *ink in the box provided on the right-hand side of each question.*

Do **not** *use pencil. Any question answered in* **pencil** *will* **not** *be marked.*

For Examiners' Use Only

Turn Over

1. Which one of the following is used to separate a mixture of water and oil?

A. Filter funnel.
B. Dropping funnel.
C. Thistle funnel.
D. Separating funnel.

2. Which one of the following metals does not react with cold water?

A. Aluminium.
B. Calcium.
C. Potassium.
D. Sodium.

3. The particles responsible for transmission of electric current through a substance in a molten or an aqueous state are

A. electrons.
B. ions.
C. atoms.
D. protons.

4. Which one of the following chlorides does not sublime when heated?

A. Aluminium chloride.
B. Ammonium chloride.
C. Iron(III) chloride.
D. Potassium chloride.

5. Which one of the following nitrates decomposes on heating to give an oxide, nitrogen dioxide and oxygen?

A. Magnesium nitrate.
B. Sodium nitrate.
C. Potassium nitrate.
D. Silver nitrate.

6. Which one of the following non-metallic elements reduces concentrated nitric acid?

A. Nitrogen.
B. Chlorine.
C. Carbon.
D. Fluorine.

7. Which one of the following gases extinguishes a burning splint?

A. Nitrogen.
B. Hydrogen.
C. Oxygen.
D. Carbon monoxide.

8. Which one of the following solutions will have a pH lower than 7?

A. $NH_3(aq)$.
B. $(NH_4)_2\,SO_4\,(aq)$.
C. $NaCl\,(aq)$.
D. $Ca(OH)_2\,(aq)$.

9. Which one of the metals; zinc, lead, sodium and copper will displace the others from their compounds?

A. Zinc.
B. Lead.
C. Sodium.
D. Copper.

10. The type of bond formed when atom $^{16}_{8}\mathbf{T}$ reacts with atom $^{32}_{16}\mathbf{Q}$ is

A. covalent bond.
B. metallic bond.
C. dative bond.
D. electrovalent bond.

11. In the extraction of sodium from sodium chloride, the melting point of sodium chloride is lowered by addition of

A. calcium sulphate.
B. calcium fluoride.
C. calcium chloride.
D. calcium carbide.

12. Which one of the following gases is produced when aqueous chlorine is exposed to sunlight?

A. Water vapour.
B. Hydrogen chloride.
C. Chlorine.
D. Oxygen.

13. The formula of the compound formed between a metal Q and a non-metal R is Q_3R_2. Which one of the following is the ion formed by R?

A. R^{2-}.
B. R^{3-}.
C. R^{2+}.
D. R^{3+}.

14. The role of vanadium(V) oxide in the contact process is to

A. speed up the conversion of sulphur dioxide to sulphur trioxide.
B. oxidise sulphur dioxide to sulphur trioxide.
C. accelerate formation of sulphur dioxide from sulphur.
D. speed up the formation of sulphuric acid from sulphur trioxide.

15. When carbon dioxide is bubbled through lime water the solution turns to a white precipitate and finally colourless solution. The colourless solution formed is

A. calcium oxide.
B. calcium carbonate.
C. calcium hydrogencarbonate.
D. calcium hydroxide.

16. 24.5 cm^3 of a solution containing 0.046 mol of an acid $\mathbf{H_nX}$ per litre was completely neutralized by 22.6 cm^3 of a solution containing 0.15 mol of sodium hydroxide per litre. The value of **n** in the formular, $\mathbf{H_nX}$ is

A. 4.
B. 3.
C. 2.
D. 1.

17. Which one of the following contains the same number of moles as 4.6 g of sodium? (*Na =23, Ca = 40, O =16, Cl =35.5, Cu = 63.5*)

A. 18.0 g of copper.
B. 17.75 g of chlorine gas.
C. 10.0 g of calcium.
D. 6.4 g of oxygen gas.

18. Which one of the following hydrocarbons is an example of unsaturated hydrocarbon?

A. C_4H_{10}.
B. C_3H_8.
C. CH_4.
D. C_2H_4.

19. Which one of the following is observed when concentrated nitric acid is added to iron(II) sulphate solution?

A. Brown fumes.
B. Brown solution.
C. Yellow solution.
D. Brown precipitate.

20. Which one of the following will be the volume occupied by 2.0 g of carbon disulphide vapour, CS_2, at s.t.p?
(*C=12, S=32, 1 mole of a gas occupies 22.4 l at s.t.p.*)

A. 0.59 litres.
B. 1.02 litres.
C. 3.93 litres.
D. 6.79 litres.

21. Which of the following explains the black vapour observed when dry chlorine is passed over hot iron? The

A. iron(III) chloride absorbs moisture.
B. iron(II) chloride absorbs moisture.
C. iron(III) chloride sublimes.
D. iron(II) chloride sublimes.

22. The heat produced when 0.38 g of ethanol (C_2H_5OH) was completely burnt raised the temperature of 100 g of water by 23.5 °C. The molar heat of combustion of ethanol in kJ mol^{-1} is
(*specific heat capacity of water* = $4.2Jg^{-1}K^{-1}$, *H=1, C=12, 0 =16*)

A. $\left(\frac{46\times23.5\times4.2\times100}{0.38\times1000}\right)$.

B. $\left(\frac{4.2\times23.5\times0.38\times100}{46\times1000}\right)$.

C. $\left(\frac{46\times100\times4.2\times23.5}{0.38}\right)$.

D. $\left(\frac{23.5\times4.2\times0.38\times1000}{100}\right)$.

23. Which one of the following statements is true about permanent hardness of water? It

A. can be removed by boiling the water.
B. is caused by calcium hydrogencarbonate.
C. can be removed by sodium carbonate.
D. does not form scum with soap.

24. 0.1 mole of a compound $X(HCO_3)_2$ weighs 14.6 g. The formula mass of th sulphite of *X* is
(*S=32, O =16, C=12, H=1*)

A. 191.
B. 146.
C. 120.
D. 104.

25. The electronic structure of **W** is 2:8:2. Which one of the following is true about the oxide of **W**? It

A. conducts electricity when in aqueous solution.
B. is a gas at room temperature.
C. is a covalent compound.
D. is insoluble in water.

26. A gas **X** reacts with aqueous lead(II) ions to form a white precipitate soluble in hot water. Which one of the following sodium salts is used in the laboratory preparation of gas **X**?

A. $NaHCO_3$.
B. $NaNO_3$.
C. Na_2S.
D. $NaCl$.

27. A pungent smelling gas **Y**, gave dense white fumes with concentrated hydrochloric acid. The most suitable method for collecting gas **Y** is

A. over water.
B. downward delivery.
C. over brine.
D. upward delivery.

28. The process by which a compound, $H_2C = CH_2$ is converted into another compound $\leftarrow H_2C - CH_2 \rightarrow_n$ is known as

A. condensation.
B. oxidation.
C. polymerisation.
D. crystallisation.

29. A compound **Q**, consists of carbon and hydrogen atoms only in a mole ratio of 1:2 respectively. 2.5 g of **Q** occupy 2×10^3 cm^3 at s.t.p. The molecular formula of **Q** is
(*1 mole of a gas occupies 22.4 dm^3 at s.t.p.*)

A. C_2H_4.
B. C_3H_6.
C. C_4H_8.
D. C_5H_{10}.

30. Which one of the following statements is true about the atoms of elements in the same period of the Periodic Table?

A. They have the same atomic size.
B. They have the same number of electron shells.
C. They have incomplete filled outermost electron shells.
D. Their outermost shells have the same number of valence electrons.

31. When sodium hydroxide solution was added until in excess to a solution of **Q** and the mixture warmed, a green precipitate and an alkaline gas were observed. Which of the following pairs of ions did **Q** contain?

A. NH_4^+ and Cu^{2+}.

B. NH_4^+ and Al^{3+}.

C. NH_4^+ and Fe^{2+}.

D. NH_4^+ and Fe^{3+}.

32. During electrolysis of dilute solution of copper(II) chloride using graphite electrodes, the element produced at the cathode is

A. oxygen.

B. copper.

C. hydrogen.

D. chlorine.

33. Which of the following ions reacts with excess aqueous ammonia and dilute sulphuric acid separately to form a white precipitate?

A. Al^{3+}.

B. Pb^{2+}.

C. Mg^{2+}.

D. Zn^{2+}.

34. Dry blue and red litmus papers were lowered into a gas jar containing a dry gas from a heated mixture of copper and concentrated sulphuric acid. Which one of the following is correct about the effect of the gas on the litmus papers?

A. Blue litmus paper turned red.

B. Red litmus paper turned blue.

C. Blue litmus paper turned red and was bleached.

D. There were no observable changes on the litmus papers.

35. An element **W** reacted with oxygen to form a yellow solid which dissolved in water with effervescence. **W** is

A. sodium.

B. lead.

C. magnesium.

D. copper.

36. Sodium carbonate reacts with dilute nitric acid as shown in the equation below.

$$Na_2CO_3(aq) + 2HNO_3(aq) \longrightarrow 2NaNO_3(aq) + H_2O(l) + CO_2(g)$$

What is the mass of sodium nitrate that would be formed, if 2.75 g of sodium carbonate reacted completely with nitric acid?
(*Na=23, O =16, C=12, N=14, H=1*)

A. $\left(\frac{2.75\times85}{106}\right)$g.

B. $\left(\frac{2.75\times2\times85}{106}\right)$g.

C. $\left(\frac{2.75\times85}{106\times2}\right)$g.

D. $\left(\frac{85\times2}{2.75\times106}\right)$g.

37. Zinc nitrate decomposes on heating according to the following equation.

$$2Zn(NO_3)_2(s) \longrightarrow 2ZnO(s) + 4NO_2(g) + O_2(g)$$

What is the total volume of gases produced measured at s.t.p. when 1.2 g of Zinc nitrate is heated to a constant mass?

(*Zn= 65, N=14, O =16, 1 mole of a gas occupies 22.4 dm^3 at s.t.p*).

A. $\left(\frac{22.4\times5\times1.2}{2\times189}\right)$dm^3.

B. $\left(\frac{22.4\times1.2}{189}\right)$dm^3.

C. $\left(\frac{22.4\times1.2}{189\times2}\right)$dm^3.

D. $\left(\frac{5\times1.2\times22.4}{189}\right)$dm^3.

38. A fixed volume of dilute hydrochloric acid was added to four boiling tubes containing the same mass of calcium carbonate with a delivery tube connecting to a test tube with lime water of fixed volume. The boiling tube that turned lime water milky earliest contained

A. 1 g of calcium carbonate chips and a 2 M hydrochloric acid at 20 °C.

B. 1 g of calcium carbonate powder and a 2 M hydrochloric acid at 35 °C.

C. 1 g of calcium carbonate powder and a 2 M hydrochloric acid at 20 °C.

D. 1 g of calcium carbonate chips and a 2 M hydrochloric acid at 35 °C.

39. Ammonium chloride reacts with calcium hydroxide according to the following equation.

$2NH_4Cl(s) + Ca(OH)_2(s) \longrightarrow CaCl_2(s) + 2NH_3(g) + 2H_2O(l)$

The minimum mass of calcium hydroxide that would be required to produce 150.4 cm^3 of ammonia at s.t.p. is

(H=1, O=16, Ca =40, 1 mole of a gas occupies 22.4 dm^3 at s.t.p)

A. $\left(\frac{74\times150.4}{22.4\times1000\times2}\right)$g.

B. $\left(\frac{22.4\times1000\times2\times150.4}{74}\right)$g.

C. $\left(\frac{150.4\times22.4\times1000}{74\times2}\right)$g.

D. $\left(\frac{22.4\times74\times1000}{150.4}\right)$g.

40. Ethanol burns in air according to the following equation.

$C_2H_5OH(l) + 3O_2(g) \longrightarrow 2CO_2(g) + 3H_2O(l)$; $\Delta H = -1367\ kJ\ mol^{-1}$

The heat produced by burning 0.3 g of ethanol is *(H=1, C=12, O=16)*

A. $\left(\frac{1367\times46}{0.3}\right)$ kJ

B. $\left(\frac{0.3}{1367\times46}\right)$kJ

C. $\left(\frac{1367}{0.3}\right)$kJ

D. $\left(\frac{1367\times0.3}{46}\right)$kJ

Each of the questions **41** *to* **45** *consists of an assertion (statement) on the left-hand 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. *if 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.	Pigments in ink can be separated by chromatography	**because**	they have different solubilities and adsorption rates.	
42.	A reaction between copper and silver nitrate solution produces a blue solution	**because**	silver is displaced by copper.	
43.	Dry ammonia gas turns dry red litmus paper blue	**because**	ammonia is an alkaline gas.	
44.	Burning magnesium continues to burn in a jar full of carbon dioxide	**because**	carbon dioxide molecule contains oxygen.	
45.	When concentrated sulphuric acid is added to copper(II) sulphate crystals, the crystals change colour from white to blue	**because**	concentrated sulphuric acid has a high affinity for water.	

In each of the questions **46** *to* **50**, *one or more of the answers given may be correct. Read each question carefully and then indicate the correct answer according to the following:*

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

46. Which of the following oxide(s) can be reduced by carbon?

1. Zinc oxide.
2. Lead(II) oxide.
3. Copper(II) oxide.
4. Aluminium oxide.

47. Which of the following gases burns in air with a blue flame?

1. H_2.
2. NH_3.
3. CO.
4. CO_2.

48. Which of the following anions react(s) with lead(II) ions to form a precipitate?

1. OH^-.
2. I^-.
3. SO_4^{2-}.
4. NO_3^-.

49. Which of the following processes will produce hydrogen gas?

1. Addition of dilute sulphuric acid to copper.
2. Addition of dilute hydrochloric acid to magnesium.
3. Addition of iron powder to water.
4. Electrolysis of dilute sulphuric acid.

50. When copper is strongly heated in air,

1. a brown solid is formed.
2. there is decrease in mass.
3. there is no change in mass.
4. a black solid is formed.

END