AGA KHAN UNIVERSITY EXAMINATION BOARD

SECONDARY SCHOOL CERTIFICATE

CLASS IX

ANNUAL EXAMINATIONS 2022

Chemistry

Total Time: 1 hour 40 minutes

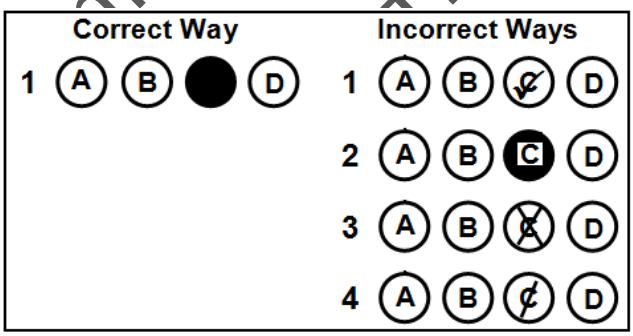
Total Marks: 50 (40-Theory & 10-Alternate to Practical)

INSTRUCTIONS

1. Read each question carefully.
2. Answer the questions on the separate answer sheet provided. DO NOT write your answers on the question paper.
3. There are 100 answer numbers on the answer sheet. Use answer numbers 1 to 50 only.
4. Question Distribution:

Theory	Alternate to Practical (ATP)
40 MCQs	10 MCQs

5. In each question, there are four choices A, B, C, D. Choose ONE. On the answer grid, black out the circle for your choice with a pencil as shown below.



Candidate's Signature

6. If you want to change your answer, ERASE the first answer completely with a rubber, before blacking out a new circle.
7. DO NOT write anything in the answer grid. The computer only records what is in the circles.
8. The marks obtained on the 40 MCQs will be equated to the total marks of 65 for the theory examination results.
9. You may use a simple calculator if you wish.

THEORY (Questions 1-40)

1. The formula of an ionic compound containing a metal ion (M^{+3}) and a non-metal ion (X^{-1}) is

   A. 3MX.
   B. M_3X.
   C. MX_3.
   D. M_3X_3.

2. Which of the following is NOT an empirical formula?

   A. CH_2
   B. CH_2O
   C. $C_2H_4N_2$
   D. $C_3H_6O_2$

3. A sample of hydrocarbon undergoes complete combustion to produce carbon dioxide (CO_2) and water (H_2O).

   (**Note**: Atomic mass of C = 12 amu, O = 16 amu and H = 1 amu)

   If 8.80 g of carbon dioxide is obtained, then what will be the mass of carbon present in it?

   A. 2.4 g
   B. 3.8 g
   C. 12.0 g
   D. 32.3 g

4. The values of **w**, **x**, **y** and **z** in the given chemical equation are

   $$\underline{\mathbf{w}}\,Al_{(s)} + \underline{\mathbf{x}}\,CuSO_{4(aq)} \rightarrow \underline{\mathbf{y}}\,Cu_{(s)} + \underline{\mathbf{z}}\,Al_2(SO_4)_{3(aq)}$$

	w	**x**	**y**	**z**
A	2	1	1	2
B	2	3	2	1
C	2	3	3	1
D	3	2	2	1

5. Which type of chemical reaction is shown in the given equation?

   $$H_2S_{(g)} + Cl_{2(g)} \rightarrow S_{(s)} + 2HCl_{(g)}$$

   A. Combustion
   B. Decomposition
   C. Single displacement
   D. Double displacement

6. The reactants of a double displacement reaction are

   A. two elements.
   B. two ionic compounds.
   C. two diatomic molecules.
   D. an element and an ionic compound.

7. Which of the following actions will result in a combustion reaction?

   A. Freezing a juice bottle
   B. Lighting a scented candle
   C. Cutting an apple into slices
   D. Mixing iron filings with sand

8. Deuterium and tritium are atoms of the same element, i.e. hydrogen. They both have the same

   I. atomic mass
   II. atomic number
   III. number of neutrons
   IV. number of electrons

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

9. If an element has 3 electrons in its valence (M) shell, then what will be its atomic number?

   A. 15
   B. 13
   C. 10
   D. 5

10. How many electrons, protons and neutrons are there in a nitrogen ($^{14}_{7}N^{-3}$) ion?

	Number of Electrons	Number of Protons	Number of Neutrons
A	4	7	10
B	7	7	7
C	10	7	7
D	17	14	7

11. The electronic configuration provides information about all of the following features of an atom EXCEPT the

    A. group and the period it belongs to.
    B. type of chemical bond it can form.
    C. presence of neutrons in the nucleus.
    D. distribution of electrons in different shells.

12. According to Rutherford atomic model, the nucleus in an atom is

    A. large and hard.
    B. small and dense.
    C. neutral and hollow.
    D. light and revolving.

13. In nuclear reactors, the radioactive isotope used to produce energy is

    A. cobalt-60.
    B. iodine-131.
    C. strontium-90.
    D. uranium-235.

14. Given are the characteristics of an element **X**.

    - A salt former
    - Found in liquid state
    - Reddish brown in colour
    - Exists as a diatomic molecule

    The element **X** identified is

    A. sodium.
    B. chlorine.
    C. bromine.
    D. beryllium.

15. The electronic configuration of an element of group IIA and period 3 is

    A. $1s^2, 2s^1$
    B. $1s^2, 2s^2, 2p^1$
    C. $1s^2, 2s^2, 2p^3$
    D. $1s^2, 2s^2, 2p^6, 3s^2$

16. With reference to the different groups of the modern periodic table, the information that stands CORRECT is that all the elements in group

    A. 13 are metals.
    B. 16 form 2+ cations.
    C. 17 produce basic oxides.
    D. 18 exist in gaseous state.

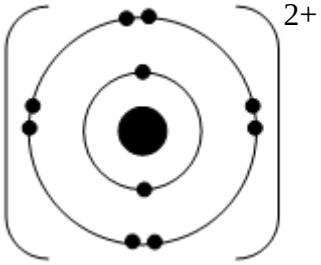
17. When an atom **M** combines with another atom **X**, an ionic bond is formed. In this reaction, the atomic radius of the atom **X** increases because

    A. it loses electrons to atom **M**.
    B. it gains electrons from atom **M**.
    C. its protons get tightly packed inside the nucleus.
    D. its ionisation energy increases on forming the ionic bond.

18. The quantity of energy that an isolated, gaseous atom in the ground electronic state must absorb to discharge an electron is termed as

    A. kinetic energy.
    B. shielding effect.
    C. electron affinity.
    D. ionisation energy.

19. The given ion is formed from an element belonging to group



    A. IIA.
    B. IVA.
    C. VIA.
    D. VIIIA.

20. The ionic compound whose both ions represent the same electronic configuration as that of neon atom ($^{20}_{10}$Ne) is

    (**Note**: $^{24}_{12}$Mg, $^{39}_{19}$K, $^{35}_{17}$Cl and $^{16}_{8}$O)

    A. K_2O
    B. KCl
    C. MgO
    D. $MgCl_2$

21. Which of these elements will gain an electron to form an anion?

    A. Boron
    B. Argon
    C. Lithium
    D. Chlorine

22. The table shows information about species **P** and **Q**.

Species	Number of Protons	Number of Neutrons	Electronic Structure
P	8	8	2, 8
Q	16	16	2, 8, 8

Based on the given information, species **P** and **Q** are the

A. atoms of inert gases.
B. positively charged ions.
C. negatively charged ions.
D. isotopes of the same element.

23. Which of the following statements stands TRUE for the formation of lithium chloride?

(**Note**: $^{7}_{3}$Li and $^{35}_{17}$Cl)

A. A lithium atom gives an electron to the chlorine atom.
B. A chlorine atom gives an electron to the lithium atom.
C. A chlorine atom shares an electron with the lithium atom.
D. A lithium atom accepts a pair of electrons from the chlorine atom.

24. Which set of property and example is TRUE for polar covalent compounds?

	Property	Example
A	Electrons are pulled equally by bonded atoms	CCl_4
B	Electrons are pulled unequally by bonded atoms	CCl_4
C	Electrons are pulled equally by bonded atoms	HCl
D	Electrons are pulled unequally by bonded atoms	HCl

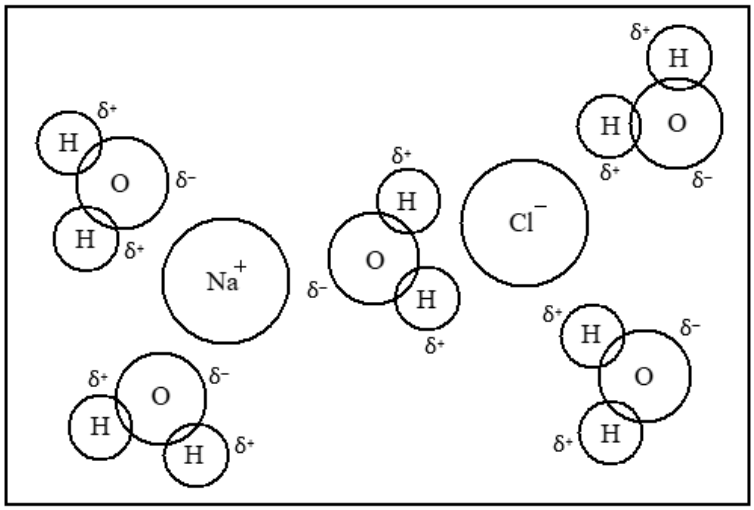
25. A coordinate covalent bond is formed when

A. one atom shares an electron pair with another atom.
B. one atom loses electrons and the other atom acquires them.
C. two like atoms share their unpaired electrons with each other.
D. two unlike atoms share their unpaired electrons with each other.

26. Which type of attractive forces are present between I_2 molecules?

A. Ionic bonding
B. Dispersion forces
C. Hydrogen bonding
D. Dipole-dipole forces

27. The given figure exemplifies the process of



A. dissolution.
B. neutralisation.
C. crystallisation.
D. decomposition.

28. Bronze is an alloy consisting of 88% copper and 12% tin. Therefore, it is a solution of

A. solid in solid.
B. liquid in solid.
C. solid in liquid.
D. liquid in liquid.

29. A sugar solution is prepared by dissolving 10 g of sugar in 55 g of water.

The mass percent of solvent in the given solution is

A. 15.38%.
B. 18.18%.
C. 81.82%.
D. 84.62%.

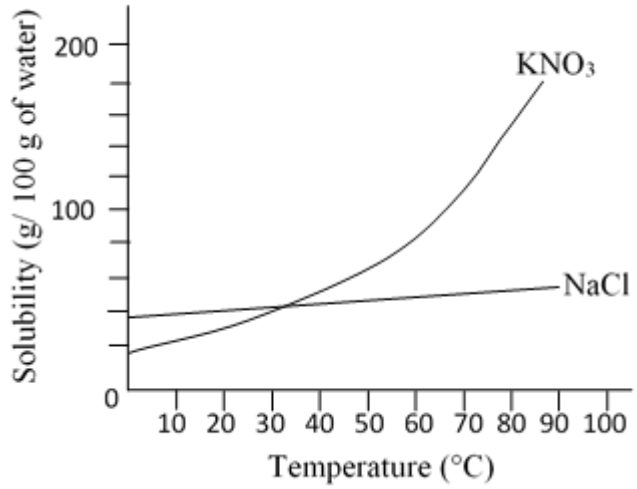
30. Consider the given characteristics of the particles of a mixture.

- Large but cannot be seen with naked eyes
- Big but can pass through the filter paper
- Quite stable and do not settle down for a long time

The mixture to which these characteristics BEST fit is

A. lemonade.
B. soap lather.
C. sand in water.
D. milk of magnesia.

31. The given graph shows variation in the solubility of potassium nitrate and sodium chloride salts with temperature.



The TRUE interpretation of the given graph is that, with the rise in temperature, the solubility of

A. both salts increases with the release of heat.
B. both salts increases with the absorption of heat.
C. NaCl increases while that of KNO_3 shows loss of heat.
D. KNO_3 increases while that of NaCl shows no change in heat.

32. The method that can be used to investigate the presence of different food colours in a beverage is

A. alloying.
B. crystallisation.
C. decomposition.
D. chromatography.

33. A mixture is formed when chalk is added to water. The particles in this mixture

A. cannot be seen by the naked eye.
B. settle over time if left undisturbed.
C. have a diameter less than 1000 nm.
D. cannot be separated through filtration.

34. The term, 'oxidation' of a substance means

A. gain of electron and loss of oxygen atom.
B. gain of oxygen atom and loss of electron.
C. gain of electron and loss of hydrogen atom.
D. gain of hydrogen atom and loss of electron.

35. The oxidation number of phosphorus in NaH_2PO_4 is

A. – 5
B. – 3
C. + 3
D. + 5

36. Which substance gets reduced when a piece of magnesium is dipped into a copper(II) salt solution?

A. Copper ions
B. Copper atoms
C. Magnesium ions
D. Magnesium atoms

37. Consider the given substances.

I. Fe
II. $FeCl_2$
III. $FeCl_3$

The substance(s) that can be used as a reducing agent is/ are

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

38. Given are the properties of a solution.

- Does not conduct electricity
- Solute is dissolved completely
- Solute is not dissociated into ions

Based on the given properties, the solution identified is

A. dilute solution of non-electrolyte.
B. dilute solution of strong electrolyte.
C. concentrated solution of weak electrolyte.
D. concentrated solution of strong electrolyte.

39. During the manufacturing process of caustic soda in Nelson's cell, the by-product that is obtained at anode is/ are

A. chlorine gas.
B. hydrogen gas.
C. sodium metal.
D. water vapours.

40. The term, 'rusting' refers to the corrosion of

A. iron.
B. copper.
C. chromium.
D. aluminium.

<u>ALTERNATE TO PRACTICAL</u> (ATP: Questions 41-50)

41. A student used solvent **X** to separate a mixture of salt and sugar because sugar is soluble in **X** while salt is not.

Based on this information, the solvent **X** used by the student is

A. oil.
B. water.
C. ethanol.
D. acetic acid.

42. In a science laboratory, Mariam prepared a mixture of SiO_2 and $K_2SO_4.Al_2(SO_4)_3.24H_2O$ in water. She then applied the process of filtration on the mixture.

An inference Mariam must have made through this experiment is that

A. SiO_2 is insoluble in water.
B. SiO_2 easily passes through the filter paper.
C. $K_2SO_4.Al_2(SO_4)_3.24H_2O$ is an amorphous solid.
D. $K_2SO_4.Al_2(SO_4)_3.24H_2O$ easily settles down in water.

43. A student accidently dropped some iron filings in a bottle of sodium chloride.

Which step(s) should he/ she follow to remove the iron filings?

A. Use a magnet only
B. Dissolve the mixture in water and filter it
C. Dissolve the mixture in water, filter it and crystallise the filtrate
D. Use a magnet, dissolve the mixture in water, filter and evaporate it

44. When sucrose is dissolved in water, its solubility increases with the rise in temperature because sucrose

A. evolves heat in water.
B. ionises completely in water.
C. absorbs heat from the water.
D. reacts chemically with water.

45. Oxalic acid is a primary standard substance because of its high

A. density.
B. stability.
C. solubility.
D. reactivity.

46. In a laboratory, Altamash is provided with a 250 mL volumetric flask to prepare 0.1 M oxalic acid solution.

How much mass of oxalic acid ($H_2C_2O_4.2H_2O$) does he require to accomplish his task?

(**Note**: ${}^{12}_{6}C$, ${}^{1}_{1}H$ and ${}^{16}_{8}O$)

A. 2.25 g
B. 3.15 g
C. 25.0 g
D. 50.4 g

Use the given information to answer Q.47 and Q.48.

The following steps are ensured when preparing crystals of pure copper sulphate ($CuSO_4.5H_2O$) from an impure sample of blue vitriol.

- A few drops of dilute sulphuric acid are added to the aqueous solution of sample.
- The filtrate should be evaporated only up to the crystallisation point.

47. The purpose of adding dilute sulphuric acid is to

A. breakdown copper sulphate into its ions.
B. prevent the hydrolysis of copper sulphate.
C. cause the decomposition of copper sulphate.
D. remove impurities present in copper sulphate.

48. If heating is exceeded (beyond the crystallisation point) to dryness, then this causes

I. disappearance of blue colour
II. loss of water of crystallisation
III. disappearance of the compound
IV. loss of turbidity from the solution

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

49. Electroplating is a redox reaction that is performed to prevent iron from corrosion.

Considering this information, all of the following statements are true EXCEPT that this process involves the

A. transfer of electrons between reactants.
B. use of a salt bridge for the migration of ions.
C. use of electrical energy to initiate the reaction.
D. electrolyte of the same metal being coated on iron.

50. Consider the given table.

Electrolytic Cell			
	X	**Y**	**Z**
Observation of Bulb	No light	A dim light	A bright light

Based on the given observations, the electrolyte that would be MOST likely present in the electrolytic cells **X**, **Y** and **Z** are

	X	**Y**	**Z**
A	potassium chloride	sugar	acetic acid
B	sugar	ethanol	hydrochloric acid
C	acetic acid	hydrochloric acid	sugar
D	ethanol	acetic acid	potassium chloride

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