

Chemistry, 2014 EC, natural science, entrance exam, round 1

Grade 12 · Chemistry · 2014 E.C.

Time allowed: 120 minutes

Questions: 58

Total marks: 58

Name _____ Grade _____ ID No. _____ Date _____

1. What is the difference between reversible and irreversible reactions? (1)
 - A. In reversible reactions, the reaction goes to completion.
 - B. In irreversible reactions, there is a mixture of products and reactants.
 - C. In reversible reactions, there is equilibrium between reactants and products.
 - D. In irreversible reactions, there is equilibrium between reactants and products.
2. Consider the reactions all given below are in gaseous state. For which of the following reactions is K_p less than K_c ? (1)
 - A. $N_2O_4 \rightleftharpoons 2NO_2$
 - B. $2SO_2 + O_2 \rightleftharpoons 2SO_3$
 - C. $2H_2 \rightleftharpoons H_2 + I_2$
 - D. $N_2 + O_2 \rightleftharpoons 2NO$
3. The general formula for saturated monocarboxylic acids is (1)
 - A. $RCOOH$
 - B. $RCOR$
 - C. $RCHO$
 - D. ROR
4. What is enthalpy change? It is (1)
 - A. the amount of heat given out or absorbed in a reaction at constant pressure and volume
 - B. the amount of heat absorbed in a reaction
 - C. the amount of heat given out in a reaction
 - D. the amount of heat given out or absorbed in a reaction at constant pressure
5. What is oxidation? Oxidation is (1)
 - A. the addition of electron(s) to the oxidizing agent
 - B. the reduction of the oxidation state of the oxidizing agent
 - C. the addition of hydrogen to a substance and the removal of oxygen from a substance
 - D. the loss of electrons by a species, accompanied by an increase in oxidation number
6. What is meant by preferential discharge, if a number of ions are present in a solution? It means that the one which requires (1)
 - A. highest energy will be liberated first at a given electrode
 - B. highest energy will be liberated last at a given electrode
 - C. least energy will be liberated first at a given electrode
 - D. least energy will be liberated last at a given electrode
7. Which of the following is a property of covalent compounds? Covalent compounds (1)
 - A. is generally insoluble in water
 - B. is crystalline solids at room temperature
 - C. is non-volatile
 - D. has high melting and boiling points

8. Which of the following is a covalent molecule? (1)

- A. $\text{[NH}_4\text{]}^+$ B. CO_3^{2-}
C. PCl_3 D. NaCl

9. What is the concentration of a solution? It is (1)

- A. the amount of solute needed to make a concentrated solution
B. number of moles of solute and number of moles of solvent
C. the quantity of solute in a given quantity of solution
D. the amount of solvent needed to dissolve a solute

10. How many moles of $C_{12}H_{22}O_{11}$ (sucrose Molecular weight= 342.91 g/mol) is needed there to prepare 2.0 L of 0.3 M solution?

- A. 0.6
B. 6.6
C. 0.15
D. 0.43

11. At 75°C, the vapor pressure of pure water is 39 kPa. Which one of the vapor pressure of a solution obtained by dissolving 34.2 g sucrose in 180 mL of water? (Assume that the density of water is 1.000 g/mL)

- A. 41.1 kPa
B. 44.5 kPa
C. 31.2 kPa
D. 38.6 kPa

12. Which of the following statements is NOT true about the colligative properties of electrolytes and non-electrolytes? (1)

- A. The effect of non-electrolytes on colligative properties is very low compared to electrolytes
B. The effect of non-electrolytes on colligative properties is the same as those of electrolytes
C. The effect of electrolytes on colligative properties is very high compared to non-electrolytes
D. The colligative properties of non-electrolytes are not considerably changed

13. What is the purpose of synthetic cryolite in the extraction of aluminum by the Hall's process? (1)

- A. Cryolite increases the melting point of alumina.
- B. Cryolite is used as a catalyst in the extraction of aluminum.
- C. Cryolite increases the purity of the extracted aluminum.
- D. Cryolite reduces the melting point of alumina.

14. Which of the following is a chemical property of aluminum? (1)

- A.** Aluminum is a good conductor of heat and electricity.
- B.** Aluminum has a lower density than any other commercial metal.
- C.** Aluminum liberates hydrogen gas from dilute acids like HCl and H_2SO_4 .
- D.** Aluminum is a grey metal in color.

15. How is tanning carried out? In tanning the hides or skins are (1)

- A. treated with chromium salts
- B. treated with dilute hydrochloric acid to remove the lime
- C. soaked in water for several days
- D. soaked in lime and water for several days

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16. How can a project of establishing an industry that consumes coal affect the environment? (1)
- A. Production of high level of lead in the atmosphere
 - B. By changing the pH of water
 - C. Increment in concentration of nitric oxide
 - D. Rise in global temperature
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17. Which of the following is a fundamental quantity SI unit? (1)
- A. Pressure
 - B. Length
 - C. Speed
 - D. Force
-
18. Which of the following postulates of Dalton's atomic theory was modified by the modern atomic theory? (1)
- A. Atoms are neither created nor destroyed in chemical reactions
 - B. Compounds are formed when atoms of more than one element combine
 - C. Atoms are the smallest particles of all elements
 - D. Atoms are indivisible and indestructible
-
19. Which of the following includes all of the known atomic models? (1)
- A. Bohr Model, Rutherford Mechanical Model
 - B. Thomson Model, Dalton's Atomic Model
 - C. Bohr Model, Thomson Model, Rutherford Model, Dalton's Atomic Model
 - D. Valence Bond Model, Quantum Mechanical Model, Thomson Model, Rutherford Model
-
20. What does Mendeleev's Periodic Law state? Properties of elements are (1)
- A. periodic functions of their electron configurations
 - B. atomic radius
 - C. atomic numbers
 - D. atomic masses
-
21. What is the mole ratio of oxygen gas to carbon dioxide gas in the following reaction? $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})$ (1)
- A. 2 mole oxygen gas to 3 mole carbon dioxide
 - B. 7 mole oxygen gas to 5 mole carbon dioxide
 - C. 10 mole oxygen gas to 6 mole carbon dioxide
 - D. 5 mole oxygen gas to 3 mole carbon dioxide
-
22. Consider the following chemical equation for the combustion of ethane (C_2H_6) in the presence of oxygen to produce carbon dioxide and water: $\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$ In this reaction: (1)
- A. Water is formed at a rate equal to $\frac{2}{3}$ the rate of formation of CO_2
 - B. CO_2 is formed twice as fast as ethane is consumed
 - C. The rate of consumption of ethane is 7 times faster than the rate of consumption of oxygen
 - D. The rate of formation of CO_2 equals the rate of formation of water
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23. Which of the following factors DOES NOT affect the rate of a reaction? (1)
- A. Temperature
 - B. Enthalpy
 - C. Concentration
 - D. Surface area

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- 24.** How does a catalyst increase the rate of a reaction? (1)
- A. By lowering the activation energy B. By changing the equilibrium constant
C. By forming an intermediate complex D. By increasing the activation energy
-
- 25.** Which of the following statements correctly describes Boyle's Law? (1)
- A. The volume of a gas at a given temperature is proportional to the square root of the applied pressure
B. The volume of a gas at a given temperature is inversely proportional to the square root of the applied pressure
C. The volume of a gas at a given temperature is directly proportional to the applied pressure
D. The volume of a gas at a given temperature is inversely proportional to the applied pressure
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- 26.** What are intermolecular forces? They are forces due to the attraction between (1)
- A. nuclei and electron pair B. cations and delocalized electrons
C. molecules D. cations and anions
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- 27.** Which of the following belongs to chemical bonding theories? (1)
- A. Molecular orbital theory and kinetic-molecular theory
B. Valence bond theory and valence shell electron pair repulsion theory
C. Kinetic-molecular theory and valence shell electron pair repulsion theory
D. Valence bond theory and molecular orbital theory
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- 28.** In which of the following molecules is the central atom sp² hybridized? (1)
- A. SO₂ B. CO
C. CO₂ D. N₂O
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- 29.** The half-life of a reaction is the time taken for the (1)
- A. rate constant to decrease by 50% of its initial value
B. complete conversion of a reactant into a product
C. reactant concentration to decrease by 50% of its initial value
D. rate constant to increase by 50% of its initial value
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- 30.** In the scientific method, a predictive statement that can be tested experimentally is: (1)
- A. proof B. hypothesis
C. truth D. evidence
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- 31.** Which of the following is NOT true about cathode rays? Cathode rays (1)
- A. contain particles, which are positively charged
B. are common constituents of all matter and their m/e is constant for all gases
C. contain particles, which are negatively charged
D. travel in straight lines from cathode to the anode
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- 32.** Which of the following statements is correct about the energy of a photon? (1)
- A. It is directly related to the intensity of the light
B. It is directly proportional to the wavelength of the light
C. It is directly proportional to the observed frequency of the light
D. It is inversely proportional to the observed frequency of the light

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- 33.** Which of the following explains the emission spectra of atoms consisting of a series of fine lines? (1)
- A. The energy of the atoms is continuous with discrete frequencies
 - B. An electron that revolves around the nucleus emits specific energy values in an atom
 - C. An electron can have specific transition by energy changes corresponding to photon of specific wavelength
 - D. An electron undergoes a transition by energy changes corresponding to photon of specific wavelength
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- 34.** Which of the following is a polyprotic acid? (1)
- A. HF
 - B. HNO₃
 - C. HCl
 - D. H₃PO₄
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- 35.** Which of the following does represent a general property of a base? (1)
- A. Soluble bases release hydronium ion in aqueous solution
 - B. Aqueous solution of bases turns methyl orange to red
 - C. Solutions of strong bases are good conductors of electricity
 - D. Aqueous solution of bases turns blue litmus paper to red
-
- 36.** What are salts? Salts are (1)
- A. Ionic compounds that derive their cations from a base and their anions from an acid
 - B. Ionic compounds formed by partial replacement of ionizable hydrogen by metal cations
 - C. Ionic compounds formed by complete replacement of ionizable hydrogen by anions of the acid
 - D. Ionic compounds that result from the reaction between metal hydroxide and water
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- 37.** The process in which a compound absorbs electrical energy and decomposes into its elements is (1)
- A. hydrolysis
 - B. electropating
 - C. electrolysis
 - D. solvolysis
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- 38.** Which of the following is true about galvanic cells used in commercial lead storage batteries? In lead storage batteries, (1)
- A. half of the galvanic cells are connected in series
 - B. the galvanic cells are made up of PbO₂ of anodes
 - C. galvanic cells are connected in series
 - D. galvanic cells are connected in parallel
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- 39.** Sodium carbonate is a basic salt because it is a salt of (1)
- A. a weak acid and a weak base and the cation of the weak base can be hydrolyzed
 - B. a strong acid and a weak base and the anion of the strong acid can be hydrolyzed
 - C. a strong base and a weak acid and the anion of the weak acid can be hydrolyzed
 - D. a strong base and a strong acid and the anion of the strong acid can be hydrolyzed
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- 40.** Which of the following statements is true for an acid-base titration? (1)
- A. An acid-base titration is a method of quantitative analysis for determining the concentration of an acid or base
 - B. An acid-base titration is a method of qualitative analysis for determining the concentration of an acid or base
 - C. Indicators catalyze an acid-base titration to show the inflection point of the titration curve
 - D. Acid-base titrations cannot be carried out in the absence of indicators

41. What is the change in internal energy (ΔE) for a reaction, in which the system absorbs 650 J of heat and 125 J of work is done on the system? (1)

- A. -775 J B. -535 J
C. 775 J D. 535 J

42. Which statement describes the formation of a covalent bond? In covalent bond electrons are (1)

- A.** shared between non-metallic atoms
B. transferred from non-metallic atoms to metallic atoms
C. shared between metallic atoms
D. transferred from metallic atoms to non-metallic atoms

43. How do the elements of Group IIA form ions? (1)

- A.** By losing 2 electrons **B.** By gaining 2 electrons
C. By gaining one electron **D.** By losing one electron

44. How is hydrogen bonding formed? It is formed when a hydrogen atom is bonded to (1)

- A. highly electronegative elements, chlorine, oxygen and nitrogen
B. highly electronegative elements, fluorine, oxygen and nitrogen
C. highly electronegative elements, fluorine, chlorine and oxygen
D. highly electronegative elements, fluorine, oxygen and phosphorus

45. Which one of the following types of energy change occurs from the combustion of carbon in oxygen? (1)

- A.** heat energy **B.** solar energy
C. light energy **D.** electrical energy

46. What is the molar volume of a gas? (1)

- A. The volume of a gas at STP (standard temperature 0°C and pressure, 1 kPa), which is equal to 22.4 L/mol
- B. The volume of a gas at STP (standard temperature 25°C and pressure, 1 kPa), which is equal to 22.4 L/mol
- C. The volume of a gas at STP (standard temperature, 0°C and pressure, 1 atm), which is equal to 22.4 L/mol
- D. The volume of a gas at STP (standard temperature 25°C and pressure, 1 atm), which is equal to 22.4 L/mol

47. Which of the following assumptions of the kinetic molecular theory of gases explains the high compressibility of gases? (1)

- A. Particles are always in random motion
- B. Different particles have different speeds
- C. The actual volume of gas molecules is negligible
- D. There is no force of attraction between gas molecules

48. Consider a bottle containing water, water vapor and air in equilibrium. If the temperature decreases slightly, the amount of water vapor:

- A. will decrease and the vapor pressure will increase
B. and vapor pressure will decrease
C. and vapor pressure will increase
D. will increase and the vapor pressure will decrease

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- 49.** Why do water droplets collect on the outside of a glass of water on a hot day? (1)
- A. There will be a condensation of water vapor on the glass
 - B. There will be a sublimation of water vapor on the outside of a glass
 - C. There is heat exchange between the water in the glass and the surrounding
 - D. Water from the glass starts to vaporize
-
- 50.** What are hydrocarbons? Compounds that contain (1)
- A. benzene rings only
 - B. benzene and its derivatives only
 - C. hydrogen and carbon with no benzene rings
 - D. hydrogen and carbon only
-
- 51.** Which of the following statement is INCORRECT regarding the boiling points of alkanes? (1)
- A. Boiling points of straight chain alkanes is greater than that of branched chain alkanes
 - B. The boiling point of cycloalkanes is higher than that of linear alkanes
 - C. Boiling points increases with stronger Van der Waals forces
 - D. Surface area is the only factor that determines the boiling points of alkanes
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- 52.** Which of the following statements is NOT correct about minerals and ores? (1)
- A. Minerals are the natural forms in which various metals exist
 - B. Ores are usually used to extract metals economically
 - C. All minerals are ores
 - D. All ores are minerals
-
- 53.** Why is CaCl_2 added to NaCl in a 1:½ ratio in the Down's cell for the manufacturing of sodium metal? (1)
- A. CaCl_2 is used to lower the density of the mixture
 - B. CaCl_2 is used as an electrolyte
 - C. CaCl_2 is used as a catalyst
 - D. CaCl_2 is used to lower the melting temperature of NaCl
-
- 54.** Which of the following is NOT a major step in metallurgical processes? (1)
- | | |
|-------------------|--------------------------------------|
| A. Pretreatment | B. Extracting the metal and refining |
| C. Mining the ore | D. Concentrating the ore |
-
- 55.** Which monomers are used for the synthesis of Teflon? (1)
- | | |
|-----------------------|------------------------|
| A. Styrene and Phenol | B. Tetrafluoroethylene |
| C. Isoprene | D. Propylene |
-
- 56.** What is the rate of dissolution? It is (1)
- A. the rate at which a solid dissociates
 - B. the speed at which a solid sublimates
 - C. the rate at which a solid turns to liquid
 - D. the speed at which a solid substrate goes into solution

57. Which one of the following is correctly stated regarding solubility as an equilibrium process? (1)

- A. Supersaturated solution is a solution that contains more than the equilibrium amount of dissolved solute
- B. Supersaturated solution is more stable than saturated solution
- C. Unsaturated solution is a solution that is in equilibrium with respect to a given dissolved substance
- D. Unsaturated solution is a solution in which more of the solute can be dissolved

58. Which of the following carboxylic acids is a solid substance at room temperature? (1)

- | | |
|-------------------|------------------|
| A. Nonanoic acid | B. Decanoic acid |
| C. Heptanoic acid | D. Octanoic acid |

— END OF EXAMINATION —

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