

-
- 8.** CO₂ is released into the atmosphere by one of the following processes (1)
- A. Animals eat plants and release CO₂ by photosynthesis
 - B. Plants consume atmospheric carbon dioxide during photosynthesis
 - C. Utilization of electrical energy as energy sources
 - D. Natural fires and volcanoes release CO₂ into the air
-
- 9.** One of the following is NOT a common application of silicon (1)
- A. in the control of the frequency of television transmissions
 - B. in the construction of transistors and microprocessors
 - C. in coating iron to prevent it from rusting
 - D. in the production of polish body parts cars
-
- 10.** The branch of chemistry that is involved in separation, identifying and determining the relative amounts of components in a sample of material is known as (1)
- A. analytical chemistry
 - B. biochemistry
 - C. inorganic chemistry
 - D. physical chemistry
-
- 11.** Significant figures are figures with (1)
- A. measured values with the highest accuracy
 - B. measured values with the highest precision
 - C. exactly known digits with the last digit uncertain
 - D. measured values with the highest uncertainty
-
- 12.** For the determination of the density of a new ceramic, a student measured the mass of a piece on an analytical balance and obtained 3.8056 gram and its volume 2.5 mL by displacement of water in a graduated cylinder. The correct reported density of the ceramic should be (1)
- A. 1.5224 g/mL
 - B. 1.5222 g/mL
 - C. 3.5 g/mL
 - D. 1.5 g/mL
-
- 13.** The scientific method is (1)
- A. a method of arriving at an organized body of knowledge based on reproducible experiments and observations
 - B. a collection of scientific guesses and hypotheses by seeking patterns in the observations
 - C. the result of fortunate, accidental discovery in the development of science
 - D. the sum total of unique guidelines for the practice of science in the world
-
- 14.** One of the following is NOT a cause of uncertainty in measurement? (1)
- A. The person doing the experiment
 - B. The type of material measured
 - C. The environment where the measurement is made
 - D. The measuring device

15. Hydrogen bonding occurs in compounds that contain H-N, H-O and H-F bonds. These bonds are stronger than the ordinary dipole-dipole interactions because (1)
- A. the H-N, H-O and H-F bonds are less polar than ordinary covalent bonds
 - B. the partially positive H of one molecule is attracted to the partially negative lone pairs on the N, O or F of another molecule
 - C. the H-N, H-O and H-F bonds are non-polar and thus do not interact with neighboring molecules
 - D. the small sizes of N, O and F makes these atoms so electropositive that their covalently bonded H is highly negative
16. Which of the following is an example of exception to the octet rule? (1)
- A. CCl_4
 - B. NH_3
 - C. PCl_5
 - D. H_2O
17. When the boiling point of hydrides of group VIA elements, H_2O , H_2S , H_2Se and H_2Te are arranged in the order of increasing boiling point. The trend is $\text{H}_2\text{Te} < \text{H}_2\text{Se} < \text{H}_2\text{S} < \text{H}_2\text{O}$, water having the highest boiling point, this is due to (1)
- A. the basic different structures of each hydride
 - B. the small size of O compared to the other group VIA elements
 - C. hydrogen bonding present in H_2O molecules
 - D. increasing boiling points with increasing molecular mass
18. Which one of the following is a common reaction of tin? (1)
- A. $\text{Sn (s)} + \text{H}_2\text{O (g)} \rightarrow \text{SnO}_2 \text{ (s)}$
 - B. $\text{Sn (s)} + \text{dil. 2HCl (aq)} \rightarrow \text{SnCl}_2 \text{ (aq)} + \text{H}_2 \text{ (g)}$
 - C. $\text{Sn (s)} + 2\text{Cl}_2 \text{ (g)} \rightarrow \text{SnCl}_2 \text{ (s)}$ in cold media
 - D. $\text{Sn (s)} + 2\text{H}_2\text{O (g)} \rightarrow \text{Sn(OH)}_4 \text{ (s)}$
19. A chemistry teacher has added different reactants and reagents in three different test tubes as described below: (1)
- I . Into the test tube A, he added ethanol, sodium dichromate, sulphuric acid. II . Into the test tube B, he added acetaldehyde, sodium borohydride and water. III . Into the tube C, he added methyl acetate and ethanol and sodium hydroxide. In which test tube would a reaction take place that provide acetic acid?
- A. I and II
 - B. III
 - C. I
 - D. II and III
20. One of the following examples of polymers is correctly matched with its uses (1)
- A. Polypropylene; electrical insulation
 - B. Polyethylene; food containers
 - C. Polytetrafluoroethylene; making shoes
 - D. Polyvinyl chloride; making pipes
21. Natural polymers are (1)
- A. polymers produced by condensation reaction of monomer units
 - B. polymers produced by the addition reaction of monomer units.
 - C. polymers produced by the substitution of one or more atoms in the monomer units.
 - D. polymers found in some substances like rubber in nature.
22. Oils are unsaturated fatty acids. The process of converting oils to solid fats involves (1)
- A. saponification with NaOH.
 - B. esterification of the acids.
 - C. halogenations of the C-C double bonds.
 - D. hydrogenation of the C-C double bonds.

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- 23.** The difference between colloids and suspension is that (1)
- A. most colloids and suspensions appear cloudy.
 - B. colloidal particles are small enough and do not settle down unlike in a suspension.
 - C. colloids are as transparent as solutions.
 - D. both colloids and suspensions are heterogeneous mixtures.
-
- 24.** The solubility of a substance is the amount of a substance that (1)
- A. dissolves more amount of solute than it can normally dissolve.
 - B. gives an unsaturated solution of substance at given temperature.
 - C. dissolves double the amount of solute than it can normally dissolve.
 - D. gives a saturated solution of the substance at a given temperature.
-
- 25.** 50 mL of the supernatant saturated solution of NaCl was taken in an evaporating dish (weight= w_0) and evaporated over a Bunsen burner until all the water has evaporated and dry sodium chloride is left in the evaporating dish. The evaporating dish with the dry sodium chloride is weighed (weight= w_1). Given the following information, $w_0=47.5$ g and $w_1=66.2$. Calculate the solubility of NaCl in water assuming 50 mL of the solution is equal to 50 mL of the solvent (1)
- A. 113.7 g/100 g of water
 - B. 37.4 g/100 g of water
 - C. 187 g/100 g of water
 - D. 18.7g/100 g of water
-
- 26.** One of the following given pairs represents examples of buffer systems (1)
- A. $\text{NH}_4\text{Cl}/\text{H}_2\text{O}$ and $\text{H}_2\text{O}/\text{CH}_3\text{COONa}$
 - B. NaOH/HCl and HNO_3/KOH
 - C. $\text{NH}_4\text{OH}/\text{NH}_4\text{Cl}$ and $\text{CH}_3\text{COOH}/\text{CH}_3\text{COONa}$
 - D. $\text{NH}_4\text{OH}/\text{CH}_3\text{COOH}$ and $\text{NH}_4\text{Cl}/\text{CH}_3\text{COONa}$
-
- 27.** The reaction between a weak acid and strong base as represented by the reaction between acetic acid and NaOH gives a basic solution because (1)
- A. CH_3COO^- as a strong base picks up H^+ and causes excess OH^- ions.
 - B. Na^+ is a strong acid and causes high concentration of H^+ .
 - C. CH_3COOH does not produce sufficient amount of H^+ ions.
 - D. The OH^- ions from NaOH are not completely neutralized.
-
- 28.** An acid is a substance that (1)
- A. produces more OH ions in water than H^+ ions.
 - B. has a bitter taste.
 - C. donates a pair of electrons to a chemical species.
 - D. donates a proton in a chemical reaction.
-
- 29.** One of the following given mass of acids constitutes the corresponding equivalent of the acid (1)
- A. $\text{HCl} = 36.5 \text{ g} = 2$ equivalents
 - B. $\text{H}_2\text{SO}_4 = 98 \text{ g} = 2$ equivalent
 - C. $\text{H}_3\text{PO}_4 = 98 \text{ g} = 2$ equivalents
 - D. $\text{H}_2\text{SO}_4 = 49 \text{ g} = 4$ equivalents
-
- 30.** One of the following pairs shows Brønsted-Lowry acids behavior in water? (1)
- A. H_3O^+ and NH_3
 - B. HNO_3 and NO_3^-
 - C. HCl and NH_4^+
 - D. HPO_4^{2-} and PO_4^{3-}

31. Covalent compounds are liquids or gases at room temperature and have statements low melting and boiling points. Which of the following statements explains these properties of covalent compounds? (1)
- A. The unit of particles in covalent compounds are ions.
 - B. The intermolecular forces of attraction in covalent compounds are strong.
 - C. Covalent compounds exist as separate molecules.
 - D. There are no forces of attraction between the molecules in covalent compounds.
-
32. Both carbonyl sulphide, COS (SCO), S=C=O and carbon dioxide (CO₂) O=C=O are linear molecules. COS is polar whereas CO₂ is non-polar. This is because (1)
- A. the C=O bonds in both COS and CO₂ are polar.
 - B. CO₂ has a net dipole moment of zero.
 - C. sulphur is more electronegative than oxygen.
 - D. regions of high negative charge is distributed equally around the central atom in COS.
-
33. Which of the following statements is true about the formation of CH₄ according to valence bond theory? (1)
- A. The 2s and three 2p orbitals in carbon hybridize to form four sp³ orbitals.
 - B. The 2s and two 2p orbitals in carbon hybridize to form three sp² orbitals.
 - C. Carbon can form two hybrid orbitals as it has got only two half-filled orbitals.
 - D. The 2s and one 2p orbitals in carbon hybridize to form two sp orbitals.
-
34. Phosphorus (Z=15) has the electronic configuration 1s²2s²2p⁶3s²3p³, what kind of hybridization does phosphorus undergo in the formation of phosphorus pentachloride (PCl₅)? (1)
- A. sp³d
 - B. sp³
 - C. sp
 - D. sp²
-
35. One of the following reactions illustrates the formation of coordinate covalent bond? (1)
- A. $\text{Be} + 2\text{F}_2 \rightarrow \text{BeF}_2$
 - B. $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 - C. $\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
 - D. $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4^+ + \text{Cl}^-$
-
36. In the production of NH₃ by the Haber process according to the equation $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ $\Delta H = -92 \text{ kJ mol}^{-1}$ What are the favorable conditions for the production of high yield of NH₃? (1)
- A. High pressure and low temperature
 - B. Low pressure and low temperature
 - C. Low pressure and high temperature
 - D. High pressure and high temperature
-
37. Which one of the following statements describes laboratory and industrial preparation of acetic respectively? (1)
- A. Reduction of ethanol by NaBH₄ and fermentation of propanol.
 - B. Reduction of toluene by KMnO₄ and reduction of ethanol by sodium dichromate.
 - C. The oxidation of ethanol by sodium dichromate and fermentation of ethanol.
 - D. Oxidation of toluene by KMnO₄ and fermentation of ethanol.
-
38. One of the following reactions illustrates the formation of coordinate covalent bond? (1)
- A. $\text{Be} + 2\text{F}_2 \rightarrow \text{BeF}_2$
 - B. $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 - C. $\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
 - D. $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4^+ + \text{Cl}^-$
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- A. High pressure and low temperature
 - B. Low pressure and low temperature
 - C. Low pressure and high temperature
 - D. High pressure and high temperature

-
- 40.** Which one of the following statements describes laboratory and industrial preparation of acetic respectively? (1)
- A. Reduction of ethanol by NaBH_4 and fermentation of propanol.
 - B. Reduction of toluene by KMnO_4 and reduction of ethanol by sodium dichromate.
 - C. The oxidation of ethanol by sodium dichromate and fermentation of ethanol.
 - D. Oxidation of toluene by KMnO_4 and fermentation of ethanol.
-
- 41.** Which of the following is true about carboxylic acids? (1)
- A. Methanoic, Ethanoic and Citric acids are monocarboxylic acids.
 - B. Carboxylic acid with the formation RCOOH .
 - C. Citric acid is a typical dicarboxylic acid.
 - D. Propanedioic acid is the simplest dicarboxylic acid.
-
- 42.** What is the IUPAC name for the branched carboxylic acid: $\text{CH}_3\text{-CH(Cl)-CH(CH}_3\text{)-CH(CH}_3\text{)-COOH}$ (1)
- A. 4-chloro-2, methyl 1-pentanoic acid
 - B. 1, 2-dimethyl-4-chloro 1-pentanoic acid
 - C. 4-chloro-1-methyl-1-pentanoic acid
 - D. 4-chloro-2, 3-dimethyl-1-pentanoic acid
-
- 43.** Esters are characterized by the following properties EXCEPT (1)
- A. esters have lower boiling point compared to the carboxylic acid alcohols
 - B. esters have pleasant odors of perfumes and food flavoring
 - C. esters have higher boiling point than carboxylic acid and alcohol
 - D. all esters are soluble in inorganic solvents and organic
-
- 44.** The sanitizer in wide use for protection against Covid-19 is labelled 83% alcohol. How can one scientifically check the concentration? (1)
- A. experimentation
 - B. forming hypothesis
 - C. making observation
 - D. collection of data
-
- 45.** According to Hund's rule equal energy (degenerate) orbitals are filled with (1)
- A. maximum number of unpaired electrons with parallel spins
 - B. two electrons of opposite spins placed in the first orbitals
 - C. maximum number of unpaired electrons with opposite spins
 - D. two electrons of parallel spins placed in the first orbital
-
- 46.** In the modern periodic table (1)
- A. elements with similar properties are placed in the same period
 - B. non-metals are placed on the right side of the periodic table
 - C. transition and inner-transition elements are placed in the middle of the periodic table
 - D. metals are placed on the right hand side of the periodic table
-
- 47.** The electrolysis of liquid (molten) NaCl in the set-up for the electrochemical cell is given in the following figure below. Which of the following statements is true about the electrolysis of molten sodium chloride? (1)
- A. Na is oxidized at the anode
 - B. Cl_2 is formed at the cathode
 - C. O_2 is produced at the anode due to the oxidation of water
 - D. The net reaction produces Cl_2 at the anode and Na at the cathode.

48. In the reaction mixture of two species NH_4OH and NH_4Cl , which one of the following is true about the reaction mixture? (1)
- The presence of NH_4^+ ion suppresses the dissociation of the weak based NH_4OH .
 - The NH_4^+ ion is a spectator ion in the reaction mixture.
 - The reaction equilibrium is shifted towards the right due to the presence of NH_4^+ ions.
 - The presence of NH_4^+ in the reaction mixture makes the solution more basic.
-
49. Which one of the following is correct about K_w at different temperature? The ionic product of water K_w equals (1)
- $K_w = 1.0 \times 10^{-14}$ at 25°C $K_w = 2.92 \times 10^{-14}$ at 40°C $\sqrt{K_w} = 1 \times 10^{-7}$ $\sqrt{K_w} = 1 \times 10^{-7}$
- At 40°C pure water is no more neutral
 - Water dissociates to a higher extent at 40°C than at 25°C .
 - Hydroxyl ion concentration is higher at 40°C than hydrogen ion concentration
 - Hydrogen ion concentration at 25°C is higher than at 40°C .
-
50. What is reduction? Reduction is (1)
- loss of electrons and decrease in oxidation number
 - gain of electrons and increase in oxidation number
 - gain of electrons and no change in oxidation number
 - gain of electrons and decrease in oxidation number
-
51. During the electrolysis of dilute aqueous sulphuric acid, the ions present in solution are H^+ , OH^- and SO_4^{2-} . (1)
- Which ions are preferentially discharged at the cathode and anode, respectively?
- Anode = $\text{SO}_4^{2-}(\text{aq}) + 4\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{SO}_2(\text{g}) + 2\text{H}_2\text{O}$, Cathode = $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$
 - Anode = $4\text{OH}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g}) + 4\text{e}^-$, Cathode = $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$
 - Anode = $2\text{H}_2\text{O}(\text{l}) \rightarrow \text{O}_2(\text{g}) + 4\text{H}^+(\text{aq}) + 4\text{e}^-$, Cathode = $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$
 - Anode = $4\text{OH}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g}) + 4\text{e}^-$, Cathode = $2\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g}) + 2\text{OH}^-(\text{aq})$
-
52. Which one of the following is NOT correct about electrodes and electrochemical cells? (1)
- The overall cell potential is calculated by the formula $E^\circ_{\text{cell}} = E^\circ_{\text{Cathode}} - E^\circ_{\text{Anode}}$
 - Electrons flow spontaneously from negative to positive electrodes
 - The difference in the electrical potential of the electrode is positive that is positive cell
 - E°_{cell} is greater than zero for non-spontaneous process
-
53. Which one of the following is NOT correct about electrodes and electrochemical cells? (1)
- The overall cell potential is calculated by the formula $E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$
 - Electrons flow spontaneously from negative to positive electrodes.
 - The difference in the electrical potential of the electrode is positive that is positive cell.
 - E°_{cell} is greater than zero for non-spontaneous process.
-
54. The "like dissolves like" rule accounts for one of the following observation (1)
- The solubility of C_2H_6 in H_2O .
 - The solubility of C_6H_6 in CCl_4 .
 - The insolubility of I_2 in H_2O .
 - The solubility of KBr in C_7H_8 .

55. The concentrated sulphuric acid H_2SO_4 we use in the laboratory is 98% H_2SO_4 by mass and has a density of 1.83 g/mL. Below are given the concentrations of the acid in various units, which of the given alternatives correctly describes the concentration of the acid? (1)
- A. Molarity 36.6 M, Normality 18.3 N, Mole fraction 0.1
B. Molarity 18.3 M, Normality 36.6 N, Mole fraction 0.9
C. Molarity 1.83 M, Normality 3.66 N, Mole fraction 0.9
D. Molarity 18.3 M, Normality 3.66 N, Mole fraction 0.9
-
56. In the electrolysis of copper sulphate solution using graphite electrodes, O_2 is liberated at the anode and copper metal is deposited at the cathode. If the electrolysis of CuSO_4 is performed using copper electrode, what happens at the anode and cathode? (1)
- A. At the anode H_2 is liberated, whereas copper is deposited at the cathode.
B. At the anode the copper electrode dissolves and copper metal is deposited at the cathode.
C. No electrochemical reaction takes place involving copper.
D. At the anode copper is reduced, whereas copper is oxidized at the cathode.
-
57. The statement 'the amount of a substance consumed or of produced in an electrolytic cell is directly proportional to the amount of electricity that passes through the cell' is known as (1)
- A. Raoult's law. B. Dalton's law.
C. Henry's law. D. Faraday's law.
-
58. Given the following electromotive series of selected metals with their standard reduction potentials Which of the following statements is correct about reactivity of the metals? (1)
- A. K is the strongest reduction agent among the metal silver.
B. Cu is the strongest reducing agent in the group.
C. Pb is more easily oxidized than Al.
D. The reaction $\text{Cu} + \text{Zn}^{2+} \rightleftharpoons \text{Cu}^{2+} + \text{Zn}$ is spontaneous.
E. Al is the most reactive metal in the series.
-
59. One of the following is NOT true about the effects of corrosion? (1)
- A. It causes enormous damage to buildings, bridges, ships and cars.
B. It causes deterioration of metals by spontaneous chemical process.
C. Corrosion forms protection oxide layers to prevent damage.
D. Damage from corrosion costs billions of dollars annually.
-
60. Which statement is true about catalysts? (1)
- A. A positive catalyst decreases the rate of a reaction by increasing the activation energy.
B. A catalyst slows down or speeds up a reaction, itself being consumed.
C. The role of a catalyst is to increase or decrease the rate of a reaction by lowering or increasing the activation energy.
D. A negative catalyst increases the rate of a reaction by decreasing the value of activation energy.

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61. According to the transition state theory (1)
- A. in the activated complex, the original bonds are weakened and the new bonds are partially formed.
 - B. the collision between two reacting species results in the formation of an activated complex, which has less energy than both the reactants and products.
 - C. the standard reaction enthalpy (ΔH°) depends on the magnitude of the activation energy (E_a).
 - D. the activation energy is the energy that must be absorbed or released by reactants to reach the activated complex.
-
62. Which of the following is true about the rate constant? (1)
- A. The value of a rate constant tells us how fast or slow a reaction is.
 - B. It expresses the relationship between the rate of a chemical reaction and the volume of reacting species.
 - C. A small rate constant indicates a faster reaction and a larger rate indicates a slower reaction.
 - D. The value of a rate constant is independent of reaction conditions.
-
63. The mathematical expression $\log k = (-E_a / 2.303R)1/T + \log A$ derived from the Arrhenius equation is of important as it shows (1)
- A. for a given value of activation energy the value of the rate constant increases as the temperature increases.
 - B. reactions with larger activation energies have higher values of k and are therefore faster.
 - C. for a given value of activation energy, the value of the rate constant decreases as the temperature increases.
 - D. reactions with larger activation energies, the value of the rate constant decreases as the temperature increases.
-
64. Which of the following is true about isotopes? Isotopes of an element have (1)
- A. different number of neutrons and same number of protons.
 - B. the same number of electrons and neutrons.
 - C. the same atomic mass but different atomic numbers.
 - D. different physical and chemical properties.
-
65. For a first order reaction, the concentration versus time of the reaction mixture is given by the following graph If a is the initial concentration of the reactant and if the half-life is the 1hr, after how many hours would be the concentration of reactant produced to $a/32$? (1)
- | | |
|--------|--------|
| A. 4hr | B. 1hr |
| C. 3hr | D. 5hr |
-
66. Silver ($Z=47$) has several known isotopes, but two occur naturally, ^{107}Ag and ^{109}Ag . Given the following mass spectrometric data, calculate the atomic mass of Ag (1)
- | | |
|---------------|--------------|
| A. 107.94 amu | B. 108.9 amu |
| C. 107.86 amu | D. 107.4 amu |
-
67. Which statement correctly describes Heisenberg's uncertainty principle? (1)
- A. A particle with a mass moving at a given speed can be described by the wave characteristic of material particles.
 - B. If we measure the momentum of a particle precisely then its position will be correspondingly precise.
 - C. Both the location and the momentum of a subatomic particle like the electron cannot be precisely known.
 - D. A small particle like the electron can behave both as a particle and a wave.
-
68. According to the Lewis definition of an acid, an acid is a substance that (1)
- | | |
|---------------------------------|---|
| A. accepts a H^+ ion. | B. dissociates in water to yield H_3O^+ . |
| C. accepts a pair of electrons. | D. donates an OH^- ion. |

69. Water is a weak electrolyte because

(1)

- A. it can accept a proton from an acid and donate a proton to a base.
- B. it has a very high ionic product, K_w .
- C. it acts both as Bronsted-Lowry acid and base.
- D. it undergoes a reversible dissociation with a very low ionic product, K_w .

— END OF EXAMINATION —

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