

6. Which of the following is the correct order for electrons filling in orbitals? (1)

- A. 3s, 3p, 4s, 3d
B. 2p, 3s, 3p, 3d
C. 3p, 4s, 3d, 5s
D. 4s, 3d, 4p, 4d

7. The normal human eye responds to visible light of wavelength ranging from about 390nm to 710nm. What is the frequency range of the human eye? (1)

- A.** $7.7 \times 10^{14} \text{s}^{-1}$ to $4.2 \times 10^{14} \text{s}^{-1}$ **B.** $4.2 \times 10^{14} \text{s}^{-1}$ to $7.7 \times 10^{14} \text{s}^{-1}$
C. $1.3 \times 10^{-15} \text{s}^{-1}$ to $2.4 \times 10^{-15} \text{s}^{-1}$ **D.** $2.4 \times 10^{-15} \text{s}^{-1}$ to $1.3 \times 10^{-15} \text{s}^{-1}$

8. How many different types of orbitals are there in the third energy level? (1)

- A. 2
B. 3
C. 6
D. 7

9. The Heisenberg uncertainty principle states that (1)

- A. Two atoms of the same element must have the same number of protons.
- B. No two electrons in the same atom can have the same set of four quantum numbers.
- C. It is impossible to determine both position and momentum of an electron simultaneously.
- D. Electrons of atoms in ground state enter energetically equivalent set of orbitals singly before they pair any orbitals of the set.

10. Which of the following transitions will have minimum wavelength? (1)

- A. $n_4 \rightarrow n_1$ B. $n_2 \rightarrow n_1$
C. $n_4 \rightarrow n_2$ D. $n_3 \rightarrow n_1$

11. What is the energy associated with one photon of a microwave radiation having a frequency of $2.45 \times 10^9 \text{ s}^{-1}$? (1)

- A.** $1.62 \times 10^{24} \text{ J}$
- B.** $2.45 \times 10^9 \text{ J}$
- C.** $2.45 \times 10^{-9} \text{ J}$
- D.** $1.62 \times 10^{-24} \text{ J}$

12. What is the frequency of a radiation (in Hz) from an atom if its wavelength is 1.0×10^{-9} nm? (1)

- A.** 3.3×10^{-27} **B.** 3.0×10^{17}
C. 3.0×10^8 **D.** 3.0×10^{26}

13. Which of the following particle was discovered by the cathode rays experiment? (1)

- A.** Electron **B.** Neutron
C. Nucleus **D.** Proton

14. Which of the following is NOT a laboratory safety rule? (1)

- A. You should tie back loose hair.
- B. You should never add acid to water.
- C. Do not suck solution in the pipette by mouth.
- D. When lighting a Bunsen Burner, you should light the match stick before turning on the gas.

15. Which of the following is the correct relationship between picometer (PM) and nanometer (nm)? (1)

- A.** 1Pm = 10nm
B. 1pm = 100nm
C. 1nm = 10pm
D. 1nm = 1000pm

16. How many significant figures has the sum of 2.453, 4.6 and 8.14? (1)
- A. 2
B. 3
C. 4
D. 5
17. Which one of the following measurements has the greatest number of significant figures? (1)
- A. 0.00046
B. 0.0046
C. 460
D. 4.6×10^6
18. Which of the following methods is used to convert oils into fats? (1)
- A. Esterification reaction using strong bases like NaOH or KOH
B. Saponification reaction using strong bases like NaOH or KOH
C. Hydrolysis reaction in the presence of water and a catalyst
D. Hydrogenation reaction at high temperature and in the presence of a catalyst
19. The solubility of compounds containing the carboxylic acid group can be increased by reaction with (1)
- A. Sulphuric acid
B. Sodium hydroxide
C. Water
D. Benzoic acid
20. What products will be formed when a carboxylic acid reacts with an alcohol? (1)
- A. Ketone and water
B. Amide and water
C. Acid chloride and water
D. Ester and water
21. Consider the reaction $AB_3(g) \rightleftharpoons A(g) + 3B(g)$ What is the equilibrium constant expression if the initial concentration of AB_3 , is 0.1M and the equilibrium concentration of A is expressed by x? (Assume the initial concentrations of A and B are both zero.) (1)
- A. $\frac{x - 3x}{0.1 - x}$
B. $\frac{x \cdot 3}{(0.1 - 3x)^3}$
C. $\frac{x - x^3}{(0.1 - 3x)^3}$
D. $\frac{x(3x)^3}{0.1 - x}$
22. Consider the following reaction at equilibrium. $2CO_2(g) \rightleftharpoons 2CO(g) + O_2(g)$ $\Delta H^0 = -514\text{KJ}$ What does Le Chatelier's principle predict when the temperature for the reaction is increased? (1)
- A. The value of the equilibrium constant will increase.
B. The value of the equilibrium constant will decrease.
C. The partial pressure of $O_2(g)$ at equilibrium will increase.
D. The partial pressure of $CO_2(g)$ at equilibrium will increase.
23. For one component system, when would the degree of freedom becomes one? (1)
- A. When only one phase is present.
B. When two phases are present at equilibrium.
C. When three phases are present at equilibrium.
D. At all times.
24. Which one of the following is correct when a reaction reaches equilibrium? (1)
- A. The reaction rate for the forward direction is decreased to zero.
B. The rate of the forward and reverse reaction becomes equal.
C. The rate of the reverse reaction is reached a maximum.
D. The amounts of reactants and products becomes equal.

25. A possible mechanism for the reaction, $A + 2B \rightarrow AB_2$ is Step: $A + B \rightarrow AB$ Slow Step: $AB + B \rightarrow AB_2$ (1)
Fast Overall: $A + 2B \rightarrow AB_2$ According to the mechanism, what will be the rate law?
- A. Rate = $K[A][B]$ B. Rate = $K[B]^2$
C. Rate = $K[A][B]^2$ D. Rate = $K[A]$
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26. The initial rate of a reaction $A + B \rightarrow$ products was measured for several different starting concentrations of A (1)
and B, with the following results. What is the initial rate of reaction when $[A]_0 = 0.12M$ and $[B]_0 = 0.015M$?
[Figure: A four-column, three-row data table between the two halves of the stem. Column headings: 'Exp', '[A]', '[B]', 'Initial rate of formation of C M/s'. Row 1: Exp 1, [A] 0.04, [B] 0.04, rate 9.6×10^{-6} . Row 2: Exp 2, [A] 0.08, [B] 0.04, rate 1.92×10^{-5} . Row 3: Exp 3, [A] 0.02, [B] 0.02, rate 9.6×10^{-6} .]
- A. $0.006M s^{-1}$ B. $0.006M^{-2}s^{-1}$
C. $1.08 \times 10^{-5}M s^{-1}$ D. $1.08 \times 10^{-4}M s^{-1}$
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27. Given the following data for the reaction: $NH_4^+(aq) + NO_2^-(aq) \rightarrow N_2(g) + 2H_2O(l)$ What will be the rate (1)
law for the given reaction?
[Figure: A four-column, three-row data table directly under the equation. Column headings: 'Experiment', ' $[N_4^+]$ ', ' $[N_2^-]$ ', 'Rate'. Row 1: Experiment 1, 0.010M, 0.020M, 0.020M/s. Row 2: Experiment 2, 0.015M, 0.020M, 0.03M/s. Row 3: Experiment 3, 0.010M, 0.010M, 0.005M/s. The column headings are printed as $[N_4^+]$ and $[N_2^-]$, which does not match the NH_4^+ and NO_2^- of the equation.]
- A. Rate = $K[NH_4^+][NO_2^-]$ B. Rate = $K[NH_4^+]^2[NO_2^-]$
C. Rate = $K[NH_4^+]^2[NO_2^-]^2$ D. Rate = $K[NH_4^+][NO_2^-]^2$
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28. The rate of a reaction increases with increasing the concentration of reactant molecules, because (1)
- A. The average kinetic energy of the molecules increases.
B. The frequency of molecular collisions increase.
C. The order of the reaction increases
D. The activation energy increases.
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29. Consider the following reactions: $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$ At a certain temperature, the rate of (1)
decomposition of $N_2O_5(g)$ is 2.5×10^6 mol/s. What will be the rate of formation of NO_2 ?
- A. 1.0×10^{-5} mol/s B. 2.5×10^{-6} mol/s
C. 1.3×10^{-6} mol/s D. 5.0×10^{-6} mol/s
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30. Which of the following refer to a reaction that is NOT dependent on the concentration of a reactant? (1)
- A. Second order reaction B. First order reaction
C. Zero order reaction D. Third order reaction
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31. What is the bond order of a superoxide anion, with the chemical formula O_2^- ? (1)
- A. 3 B. 2.5
C. 2 D. 1.5
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32. What kind of hybrid orbitals are utilized by the carbon atom in CF_4 molecules? (1)
- A. sp B. sp^2
C. sp^3 D. sp^3d

33. Which statement about indicators is always correct? (1)
- A. The mid-point of the PH rage of an indicator is 7.0
B. The PH rage is greater with higher PKa values.
C. The colour red indicates an acidic solution.
D. The PKa values of the indicator is within its PH range.
34. The suppression of ionization of a weak acid or a weak base by adding one of its own ions is known as: (1)
- A. Buffer effect
B. Ionization effect
C. Common ion effect
D. Association effect
35. Nitrous acid, HNO_2 is 0.37% ionized in 3.0M solution. What is the K_a for this acid? (1)
- A. $\frac{3.0(0.0037)^2}{99.63}$
B. $\frac{(0.0037)^2}{0.9963}$
C. $\frac{3.0(0.0037)^2}{0.9963}$
D. $\frac{0.9963}{(0.0037)^2}$
36. Among the following acids, which has the lowest PK_a value? (1)
- A. $\text{CH}_3\text{CH}_2\text{COOH}$
B. HCOOH
C. $(\text{CH}_3)_2\text{CHCOOH}$
D. CH_3COOH
37. Which one of the following is a Lewis acid? (1)
- A. NH_3
B. CCl_4
C. AlCl_3
D. LiCl
38. Which of the following is the conjugate acid of the HS^- ion? (1)
- A. H_2S^-
B. S_2^-
C. S^-
D. H^2S
39. What will be the ration of the boiling point elevation of a 0.1M solution of sucrose, sodium sulphate and potassium bromide? (1)
- A. 1 : 3 : 1
B. 1 : 1 : 2
C. 1 : 3 : 2
D. 1 : 2 : 2
40. When the molecular equation: $\text{CaCl}_2(\text{aq}) + \text{Na}_2\text{CO}_3(\text{aq}) \rightarrow \text{CaCO}_3(\text{s}) + 2\text{NaCl}(\text{aq})$ Is written in terms of ionic equation, which one of the following pairs will be the spectator ions? (1)
- A. Na^+ and Cl^-
B. Ca^{2+} and Cl^-
C. Na_3^{2-} and Cl^-
D. Ca^{2+} and CO_3^{2-}
41. If 0.454kg of nitroglycerin explodes according to the following reaction: (1)
- $$2\text{C}_3\text{H}_5(\text{NO}_2)_3 \rightarrow 6\text{CO}_2 + 3\text{N}_2 + 5\text{H}_2$$
- What is the total volume of gases in dm^3 produced at STP?
- A. 44.8
B. 163
C. 397.7
D. 650
42. How many grams of methanol would have to be added to water to prepare 150ml of solution which is 2.0M methanol? (1)
- A. 2.4
B. 9.6
C. 9.6×10^3
D. 4.3×10^2

43. A certain 500g toothpaste sample has 0.2g of fluoride. What is the concentration of the fluoride in ppm? (1)

A. 200
B. 250
C. 400
D. 1000

44. What will be the normality of a 2.3M sulphuric acid solution? (1)

A. 0.23N
B. 0.46N
C. 2.3N
D. 4.6N

45. The solubility of NaCl in water at 20°C is 36g in 100g of water. A solution that contains 18g of NaCl in 50g of water at 20°C is (1)

A. Saturated
B. Unsaturated
C. Supersaturated
D. Dilute

46. Which of the following pairs of substances are miscible? (1)

A. Water and gasoline B. Water and oxygen
C. Water and salt D. Water and ethanol

47. Which of the following types of solution are possible? 1. Solid dissolved in a liquid 2. Gas dissolved in a gas 3. Gas dissolved in a liquid 4. Solid dissolved in a solid (1)

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

48. The chemical makeup of oil is esters of glycerol with three (1)

A. Identical saturated fatty acids. **B.** Predominantly saturated fatty acids.
C. Predominantly unsaturated fatty acids. **D.** Identical unsaturated fatty acids.

49. Which of the following general class of organic molecules do triglycerides belong to? (1)

A. Ketones **B. Carboxylic acids**
C. Esters **D. Ethers**

50. What type of polymerization occurs when amino acids react to form peptides and proteins? (1)

A. Addition polymerization **B.** Condensation polymerization
C. Substitution polymerization **D.** Hydration polymerization

51. Which of the following is the most abundant polysaccharide? (1)

A. Amylose
B. Cellulose
C. Starch
D. Sucrose

52. What is the other name for polymethyl methacrylate (PMMA)? (1)

A. Perspex
B. Teflon
C. Bakelite
D. Nylon- 6

53. What is the monomer of polyvinyl chloride (PVC)? (1)

A. Cloroethane **B.** Ethylene dichloride
C. Chloroform **D.** Ethyl chloride

54. The second step in the production of sulphuric acid is given by the reaction: $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ (1)
Which conditions would increase the yield of this reaction?
- A. High temperature and low pressure
B. Low temperature and high pressure
C. High temperature and high pressure
D. Low temperature and low pressure
55. Which of the following reactions is used in the production of industrially important chemical? (1)
- A. $\text{H}_2\text{S}_2\text{O}_7(\text{l}) + \text{H}_2\text{O}(\text{l}) \rightarrow 2\text{H}_2\text{SO}_4(\text{aq})$
B. $3\text{NO}_3(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow 2\text{HNO}_3(\text{aq}) + \text{NO}_2(\text{g})$
C. $(\text{NH}_4)_2\text{HPO}_4(\text{s}) + \text{NH}_3(\text{g}) \rightarrow \text{NH}_4\text{H}_2\text{PO}_4(\text{s})$
D. $2\text{Cr}(\text{s}) + \text{Al}_2\text{O}_3(\text{s}) \rightarrow \text{Cr}_2\text{O}_3(\text{s}) + 2\text{Al}(\text{s})$
56. Which one of the following metal is used for galvanization of iron sheets? (1)
- A. Nickel
B. Zinc
C. Chromium
D. Aluminium
57. In what way is the phosphorous cycle differs from the carbon and nitrogen cycle? (1)
- A. Phosphorus is more abundant than carbon and nitrogen
B. Phosphorus is less important than carbon and nitrogen
C. Phosphorus, once used by an organism does not cycle back to the environment
D. The reservoirs for phosphorus exists in mineral form in rocks than in the atmosphere
58. Which one of the following is needed for photosynthesis? (1)
- A. Carbon dioxide
B. Nitrogen
C. Oxygen
D. Phosphorus
59. Consider the reaction: $\text{Cu}^{2+}(\text{aq}) + \text{Fe}(\text{s}) \rightleftharpoons \text{Cu}(\text{s}) + \text{Fe}^{2+}(\text{aq})$, $E^\circ = 0.78\text{V}$ What is the value of E when (1)
[Cu^{2+}] is equal to 0.040M and [Fe^{2+}] is equal to 0.40M?
- A. 0.72V
B. 0.75V
C. 0.81V
D. 0.84V
60. For the electrochemical cell represented by: $\text{Zn}/\text{ZnSO}_4(\text{aq}) // \text{CuSO}_4(\text{aq})/\text{Cu}(\text{s})$ The standard reduction (1)
potentials for Cu^{2+}/Cu and Zn^{2+}/Zn are +0.34 and -0.76V, respectively, what will be the cell reaction that occurs spontaneously and its cell voltage?
- A. $\text{Cu} + \text{Zn}^{2+} = \text{Cu}^{2+} + \text{Zn}$ $E^\circ(\text{V}) = 1.10$
B. $\text{Zn} + \text{Cu}^{2+} = \text{Zn}^{2+} + \text{Cu}$ $E^\circ(\text{V}) = 0.42$
C. $\text{Cu}^{2+} + \text{Zn}^{2+} = \text{Zn} + \text{Cu}$ $E^\circ(\text{V}) = 0.42$
D. $\text{Cu}^{2+} + \text{Zn} = \text{Cu} + \text{Zn}^{2+}$ $E^\circ(\text{V}) = 1.10$
61. What product(s) is /are formed during the electrolysis of a concentrated aqueous solution of sodium chloride? (1)
- A. $\text{Cl}_2(\text{g})$
B. $\text{Cl}_2(\text{g})$ and $\text{H}_2(\text{g})$
C. $\text{NaOH}(\text{aq})$ and $\text{Cl}_2(\text{g})$
D. $\text{Cl}_2(\text{g})$, $\text{H}_2(\text{g})$ and $\text{NaOH}(\text{aq})$
62. In the reaction: $\text{Pb} + (\text{s}), \text{PbO}_2 + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow 2\text{PbSO}_4(\text{s}) + 2\text{H}_2\text{O}(\text{l})$ Which substance behaves as the (1)
oxidizing agent?
- A. Pb
B. PbSO_4
C. PbO_2
D. H_2SO_4
63. What mass of magnesium (Mg) is produced in the electrolysis of molten MgCl_2 , if a current of $7.50 \times 10^2 \text{ A}$ is (1)
passed through the molten salt for 1.00 hour?
- A. $3.4 \times 10^2 \text{ g}$
B. $9.92 \times 10^2 \text{ g}$
C. $1.7 \times 10^2 \text{ g}$
D. $4.96 \times 10^2 \text{ g}$

