FRESHMAN



EXAMS

Use the following information if it is necessary

$^{127}_{53}I$, $^{32}_{16}S$, $^{16}_{8}O$, $^{48}_{22}Ti$, $^{24}_{12}Mg$, $^{35.5}_{17}Cl$, $^{1}_{1}H$, $^{12}_{6}C$, $^{14}_{7}N$, $^{39}_{19}K$, $^{23}_{11}Na$, $^{9}_{4}Be$ $^{31}_{15}P$, $^{131}_{54}Xe$, $^{80}_{35}Br$

Part I: Multiple choice item (40%)

Choose the best answer from the given alternatives for the following questions and write the letter of the correct choice on the answer sheet provided on page 8.

1. The number of iodine atoms present in 1 cm^3 of its 0.1 M solution is

   A. 6.02×10^{23} B. 6.02×10^{22} C. 6.02×10^{19} D. 1.204×10^{20}

2. Identify the false statement from the given alternatives

   A. Dilution is the process whereby the concentration of a solution is lessened by the addition of solvent

   B. Generally solute is a component of a solution that is typically present at a much lower concentration than the solvent

   C. One mole of any element contains the same number of atoms as one mole of any other element

   D. Dilution process change the amount of solute in the solution

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3. Concentrated H_2SO_4 has a density of 1.9 g/mL and is 99% by weight. The molarity of this acid is

   A. 19.19 B. 38.38 C. 9.595 D. None of these

4. A tooth paste has 0.2 g/liters fluoride. It concentration in ppm will be

   A. 2000 B. 200 C. 400 D. 4000

5. The volume of distilled water that should be added to 10.0 mL of 6.00 M HCl(aq) in order to prepare a 0.500 M HCl(aq) solution is approximately

   A. 50.0 mL B. 100 mL C. 110 mL D. 120 mL

6. A compound was analyzed and found to be 12.1% C, 71.7% Cl, and 16.2% O. What is the empirical formula for this compound?

   A. C_2OCl B. CCl_2O C. CO_2Cl_2 D. C_2O_2Cl

7. Which statement is true about the percent composition by mass in $C_6H_{12}O_6$?

   A. Carbon is 6.7% by mass C. Oxygen is 53.3% by mass

   B. Carbon is 72% by mass D. Hydrogen is 12% by mass

26. Silicon has an atomic number equal to 14 To what period does silicon belong?

A. Period 2 B. Period 3 C. Period 4 D. Period 5

27. The property of the element with atomic number 37 resembles that of the element with atomic number_____

A. 8 B. 9 C. 18 D. 19

28. Which of the following ions will be the smallest in the isoelectronic series O^{2-}, F^-, Na^+, and Mg^{2+}?

A. O^{2-} B. F^- C. Na^+ D. Mg^{2+}

29. Which one is not the property of ionic compounds?

A. Insoluble in non- polar solvent
B. Exist as discrete, neutral molecules
C. Conduct electricity in molten state
D. Typically solids with high melting points

30. Which substance is not correctly paired with the type of bonding found between the atoms of that substance?

A. CaO — ionic bonds
B. CH_4 — covalent bonds
C. Cl_2 — polar covalent bonds
D. H_3O^+ — coordinate covalent bonds

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31. One of the following molecule obeys octet rule, identify.

A. NO B. NO^- C. BeH_2 D. $AlCl_3$

32. What is the angle between electron groups in the Trigonal planar electron geometry?

A. 180° B. 120° C. 109.5° D. 90°

33. Which molecule has octahedral electron geometry?

A. ClF_3 B. PF_5 C. SF_4 D. XeF_4

34. What is the formal charge on each atom in dichloromethane, CH_2Cl_2?

A. C = 0, H = 0, Cl = 0
B. C = 0, H = -1, Cl = +1
C. C = 0, H = +1, Cl = -1
D. C = -2, H = +1, Cl = +1

35. What is the predicted molecular geometry of BrF_5 using VSEPR theory?

A. Octahedral
B. Square planar
C. Square pyramidal
D. Triangular bipyramidal

36. In what condition does the electron pair arrangement and geometry of molecules become identical?

A. When the number of bonding electrons is equal to the number of non-bonding electrons
B. When the number of bonding electrons become even
C. When the sum of non-bonding electron become odd
D. When there are no non-bonding electrons on the central atom

15. How much of KOH is needed to completely neutralize 75 liters of 0.75 M HNO3?

A. 6.3 g B. 2.81 g C. 3.15 g D. 5.61 g

16. In Bohr model of the hydrogen atom, the energy of the electron in its lowest orbit is

A. Infinite energy B. Maximum energy C. Minimum energy D. Zero energy

17. Which of the following statements is incorrect?

A. Hund's rule states that the electrons fill orbitals so that there is the maximum number of parallel spins

B. The Pauli Exclusion Principle states that no two electrons can have the same four quantum numbers

C. The Aufbau principle states that it impossible for two electrons in the same orbital to have the same spin

D. The uncertainty principle states that it is impossible to know simultaneously the momentum of an electron and its location in space

18. Which one of the following is incorrect about an orbital?

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A. An orbital is a wave function

B. An orbital has energies, shapes and orientation in space

C. An orbital is a path the electron follows around the nucleus of an atom

D. An electron in a given orbital is defined by four quantum numbers

19. Which of the following is correct about quantum numbers?

A. Magnetic quantum number describes the orientation of an orbital

B. Principal quantum number describes the size and energy of an orbital

C. Angular momentum quantum number describes the shape of an orbital

D. All of these

20. What is the total number of orbitals for n = 3, where n is the principal quantum number is_____

A. 18 B. 9 C. 4 D. 8

21. Maximum number of electrons in a subshell (s, p, d, f) can be determined by

A. $4l + 2$ B. $4l - 2$ C. $2l + 1$ D. $2n^2$

22. Which one of the following combination of quantum numbers is incorrect?

A. $n=6, l=0, m_l=+1$ B. $n=5, l=4, m_l=0$ C. $n=4, l=1, m_l=-1$ D. $n=3, l=4, m_l=0$

23. The idea of arranging the elements in the periodic table according to their atom number is attributed to

A. Moseley B. Mendeleev C. Bohr D. Ra

24. Which two periods in the periodic table have the same number of elements?

A. 2 and 4 B. 3 and 4 C. 4 and 5 D. 5 and 6

25. Elements in a group in the periodic table can be expected to have similar

A. Atomic masse B. Atomic numbers C. Number of shells D. Number of valence

37. Which molecule is a polar molecule?

A. KCl B. H_2O C. CH_4 D. CO_2

38. Of the following molecules, which has the largest dipole moment?

A. CO_2 B. O_2 C. HF D. F_2

39. Which of the following molecules has the shortest bond length?

A. N_2 B. O_2 C. Cl_2 D. Br_2

40. According to the VSEPR model, the progressive decrease in the bond angles in the series of molecules CH_4, NH_3, and H_2O is best accounted for by the_____

A. Increasing strength of the bonds

B. Decreasing size of the central atom

C. Increasing electronegativity of the central atom

D. Increasing number of unshared pairs of electrons

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Part II: TRUE or FALSE questions (10 %)

Directions: Write 'TRUE' if the statement is correct and write 'FALSE' if the statement is incorrect on the answer sheet provided on page 8.

41. The solubility of solids in water generally increases with increasing temperature

42. The oxidation number of Mn in $KMnO_4$ is +5.

43. The electron density at any point is proportional to the wave function of the electron wave at that point.

44. The electronic structure of the SO_2 molecule is best represented as a resonance hybrid of three equivalent structures.

45. For a molecule with an octahedral electronic geometry, the molecular geometry is square planar if there are two lone pairs of electrons on the central atom.

46. Ionic bond is formed from two high electronegative elements

47. Gravimetric analysis describes a set of methods used in analytical chemistry for the quantitative determination of an analyte based on its mass.

48. Despite the trend in increasing first ionization energy values across a period, the first ionization energy for oxygen is slightly less than that for nitrogen.

49. The kinetic energy of the ejected electrons from the surface of metal did not depend on the frequency of the light but increase with increasing intensity of the photon

50. The power of an atom to attract shared pair of electrons is called electron affinity

14. A chemical equation is balanced according to the law of
    A. multiple proportions
    B. constant compositions
    C. conservation of energy
    D. conservation of mass
    E. All

15. Which of the following procedures is not taking place while determining the density of liquid in the laboratory ?
    A. mass determination of the container
    B. mass determination of the container with the liquid
    C. calculation of mass to volume ratio of the liquid
    D. density determination of the container
    E. None

16. The physical property that could be used to test the purity of substances such as gold is
    A. weight B. Volume C. physical state D. density E. None

17. Which of the following subshells has the highest energy according to the Aufabau principle ?
    A. 3d B. 4p C. 5s D. 4d E. 3p

18. Which one of the following orbitals does not exist?
    A. *1s*
    B. *2p*
    C. *3p*
    D. *2d*
    E. *3d*

19. Which of the following sets of quantum numbers is not allowed for an electron in a *4f* orbital?
    A. $n = 4, l = 1, m_l = +1, m_s = +1/2$
    B. $n = 4, l = 3, m_l = +4, m_s = -1/2$
    C. $n = 4, l = 3, m_l = +2, m_s = +1/2$
    D. $n = 4, l = 2, m_l = +1, m_s = -1/2$
    E. None of the above

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20. A given orbital has a magnetic quantum number $m_l = +1$. This could not be
    A. *s* orbital
    B. *p* orbital
    C. *d* orbital
    D. *f* orbital
    E. *g* orbital

21. Bohr's model of the atom included the idea(s) that:
    A. The electron can have only certain energies
    B. Electrons absorb energy by moving to higher energy orbits.
    C. Electrons emit energy in the form of light when they move to lower energy orbits.
    D. All are correct.
    E. None of the above

22. Which of the following half-reactions is balanced?

A. $SO_4^{-2} + H_2O \rightarrow SO_3^{-2} + 2H^+ + 2e^-$

B. $SO_4^{-2} + H_2O + 2e^- \rightarrow SO_3^{-2} + 2H^+$

C. $SO_4^{-2} + 2H^+ + 2e^- \rightarrow SO_3^{-2} + H_2O$

D. $SO_4^{-2} + 2H^+ \rightarrow SO_3^{-2} + H_2O + 2e^-$

E. None of the above

23. Consider the following reaction: $3I_2 + 3H_2O \rightarrow 6H^+ + 5I^- + IO_3^-$

In this reaction, the I_2 atoms undergo:

A. oxidation only
B. both oxidation and reduction
C. reduction only
D. neither oxidation nor reduction

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24. The toxic pigment called white lead, $Pb_3(OH)_2(CO_3)_2$, has been replaced in white paints by rutile, TiO_2. How much rutile (g) can be prepared from 379 g of an ore that contains 88.3% ilmenite ($FeTiO_3$) by mass? (Molar mass(amu) : $FeTiO_3$ = 151.71, TiO_2 = 79.866)

$$2FeTiO_3 + 4HCl + Cl_2 \rightarrow 2FeCl_3 + 2TiO_2 + 2H_2O$$

A. 176.2 g B. 199.5 g C. 46.5 g D. 635.7 g E . None

25. Using complete subshell notation ($1s^22s^22p^6$, and so forth), predict the electron configuration of the Cr^{2+} ion. (Chromium has atomic number of 24)

A. $1s^22s^22p^63s^23p^64s^23d^6$ B. $1s^22s^22p^63s^23p^64s^23d^4$ C. $1s^22s^22p^63s^23p^63d^4$

D. $1s^22s^22p^63s^23p^63d^6$ E. None

26. A sample of 0.53 g of carbon dioxide was obtained by heating 1.31 g of calcium carbonate. What is the percent yield (%) for this reaction? (Molar mass (g/mol) : $CaCO_3$ =100 , CaO =56, CO_2 = 44)

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

A. 40.46 B. 91.38 C. 100 D. 89.43 E. 75.76

27. What is the radius, in angstroms, of the orbital of an electron with n = 5 in a hydrogen atom??

(a_0 = 0.53Å)

A. 13.25 B. 2.65 C. 47 D. 21 E. None

28. Which orbital is characterized by the quantum numbers n= 3, l = 0, m_l = 0?

A. 4s B. 4p C. 3s D.3p E. 3d