40 simple-choice questions

1. When 3.0 L of hydrogen gas (H_2) reacts with 1.0 L of nitrogen gas (N_2), 2.0 L of gaseous product are formed. All volumes of gases are measured at the same temperature and pressure. What is the formula of the product?

   (a) N_2H_6

   (b) NH_3

   (c) NH_4

   (d) NH

   (e) N_2H_3

2. How many protons, neutrons, and electrons does the atom ^{39}K have?

   (a) 19 protons, 19 neutrons, 30 electrons

   (b) 20 protons, 20 neutrons, 30 electrons

   (c) 19 protons, 19 neutrons, 19 electrons

   (d) 20 protons, 19 neutrons, 20 electrons

   (e) 19 protons, 20 neutrons, 19 electrons

3. Indium has atomic number 49 and atomic mass 114.8 g. Naturally occurring indium contains a mixture of indium-112 and indium-115, respectively, in an atomic ratio of approximately

   (a) 6/95

   (b) 25/75

   (c) 50/50

   (d) 75/25

   (e) 94/6

4. Phosphorus has the molecular formula P_4 and sulfur has the molecular formula S_8. How many grams of phosphorus contain the same number of molecules as 6.41 g of sulfur?

   (a) 3.10 g

   (b) 3.21 g

   (c) 6.19 g

   (d) 6.41 g

   (e) None of these

5. Consider five solutions that each has the same mass of solute in 100.0 mL of solutions. Which has the highest concentration as measured in molarity?

   (a) KCl

   (b) NaCl

   (c) Na_2SO_4

   (d) NaF

   (e) $CaCl_2$

6. What volume of 12.0 M HCl is required to prepare 16.0 L of 0.250 M hydrochloric acid?

   (a) 130 mL

   (b) 333 mL

    (c) 585 mL

    (d) 768 mL

    (e) None of these

7. Consider a sample of neon gas in container fitted with a moveable piston (assume the piston is massless and frictionless). The temperature of the gas is increased from 20.0 $^{\circ}$C to 40.0 $^{\circ}$C. The density of neon

    (a) Increases less than 10%

    (b) Decreases less than 10%

    (c) Increases more than 10%

    (d) Decreases more than 10%

    (e) None of these

8. What volume of carbon dioxide measured at STP will be formed by the reaction of 1.30 mol of oxygen with 9.00×10^{-1} mol of ethyl alcohol (CH_3CH_2OH)?

    (a) 8.70 L

    (b) 19.4 L

    (c) 28.0 L

    (d) 40.3 L

    (e) 91.9 L

9. The value of the equilibrium constant K depends on

    (I)   the initial concentrations of the reactants

    (II) the initial concentrations of the products

    (III) the final concentrations of the reactants

    (IV) the final concentrations of the products

    (a) I, II

    (b) II, III

    (c) III, IV

    (d) It is dependent on three of the above

    (e) None of these

10. At a certain temperature K for the reaction $2NO_2 = N_2O_4$ is 7.5 liters/mole. If 2.0 moles of NO_2 are placed in a 2.0-liter container and permitted to react at this temperature, calculate the concentration of N_2O_4 at equilibrium.

    (a) 0.39 moles/liter

    (b) 0.65 moles/liter

    (c) 0.82 moles/liter

    (d) 0.75 moles/liter

    (e) 0.99 moles/liter

11. At 0 $^{\circ}$C, the ion-product constant of water, Kw, is 1.2×10^{-15}. What is the pH of pure water at 0 $^{\circ}$C?

    (a) 7.00

    (b) 6.88

(c) 7.56

(d) 7.46

(e) None of these

12. Calculate the [H+] in a solution that has a pH of 9.15..

    (a) 4.85 M

    (b) 9.15 M

    (c) 7.1×10^{-10} M

    (d) 1.5×10^{-5} M

    (e) None of these

13. Which of the following will not produce a buffered solution?

    (a) 100 mL of 0.1 M Na_2CO_3 and 50 mL of 0.2 M HCl

    (b) 100 mL of 0.1 M Na_2CO_3 and 25 mL of 0.2 M HCl

    (c) 100 mL of 0.1 M Na_2CO_3 and 75 mL of 0.1 M HCl

    (d) 50 mL of 0.2 M Na_2CO_3 and 5 mL of 0.1 M HCl

    (e) 100 mL of 0.1 M Na_2CO_3 and 50 mL of 0.1 M HCl

14. A solution of hydrochloric acid of unknown concentration was titrated with 0.10 M NaOH. If a 100 mL sample of HCl solution required exactly 10 mL of the NaOH solution to reach the equivalent point, what was the pH of the HCl solution?

   (a) 1.0

    (b) 2.0

    (c) 0

    (d) 12.0

    (e) -1.0

15. For a particular process q= − 10kJ and w= + 25kJ. Which of the following statements is true?

    (a) Heat flows from the surroundings to the system

    (b) The system does work on the surroundings.

    (c) $\Delta E = -35kJ$

    (d) All of the above are true

    (e) None of the above are true.

16. The heat of formation of Fe_2O_3 is − 826kJ/mol. Calculate the heat of the reaction $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$ when a 55.8 g sample of iron is reacted.

    (a) − 206 kJ

    (b) − 413 kJ

    (c) − 826 kJ

    (d) − 1650 kJ

    (e) − 3.30×10^3 kJ

17. For the dissociation reaction of the acid HF

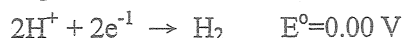 $HF(aq) = H^+(aq) + F^-(aq)$
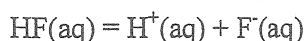
    Why is ΔS negative?

    (a) Each HF molecule produces two ions when it dissociate.

(b) The ions are hydrated

(c) The reaction is expected to be exothermic and thus ΔS should be negative.

(d) The reaction is expected to be endothermic and thus ΔS should be negative.

(e) None of these

18. Consider the freezing of liquid water at -10oC. For this process what are the signs for ΔH, ΔS and ΔG?
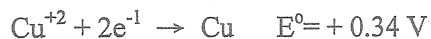
	ΔH	ΔS	ΔG
(a)	+	−	0
(b)	−	+	0
(c)	−	+	−
(d)	+	−	−
(e)	−	−	−

19. Which of the following is the best reducing agent?

$Cl_2 + 2e^{-1} \rightarrow 2Cl^-$　　$E^o = 1.36$ V

$Mg^{+2} + 2e^{-1} \rightarrow Mg$　　$E^o = -2.37$ V

$2H^+ + 2e^{-1} \rightarrow H_2$　　$E^o = 0.00$ V

(a) Cl_2

(b) H_2

(c) Mg

(d) Mg^{+2}

(e) Cl^-

20. A cell is set up with copper and lead electrodes in contact with $CuSO_4(aq)$ and $Pb(NO_3)(aq)$, respectively, at 25oC. The standard reduction potentials are:

$Pb^{+2} + 2e^{-1} \rightarrow Pb$　　$E^o = -0.13$ V

$Cu^{+2} + 2e^{-1} \rightarrow Cu$　　$E^o = +0.34$ V

If sulfuric acid is added to the $Pb(NO_3)$ solution, forming a precipitate of $PbSO_4$, the cell potential:

(a) Increases

(b) Decreases

(c) Is unchanged

(d) Can't tell what will happen

21. How many f orbitals have the value n=3?

(a) 0

(b) 3

(c) 5

(d) 7

(e) 1

22. For which element are the d orbitals completely filled in the neutral atom?

(a) potassium

(b) vanadium

(c) phosphorus
(d) iron
(e) bromine

23. Which of the following molecules has a dipole moment?

(a) SCl_6
(b) BH_3
(c) CO_2
(d) OF_2
(e) None of the above has a dipole moment.

24. Choose the molecule with the strongest bond.

(a) HF
(b) HCl
(c) HBr
(d) HI

25. What is the hybridization of each N atom in the molecule N_2H_4?

(a) sp
(b) sp^2
(c) sp^3
(d) dsp^3
(e) d^2sp^3

26. Describe the bonding in C_2H_2 requires what carbon hybridization?

(a) sp^3
(b) sp
(c) sp^2
(d) d^2sp^3
(e) dsp^2

27. The rate expression for a particular reaction is rate = k [A] [B]^2. If the initial concentration of B is increased from 0.1 M to 0.3 M, the initial rate will increase by which of the following factors?

(a) 2
(b) 6
(c) 12
(d) 3
(e) 9

28. For which of the following is the half-life directly dependent on the concentration of the reactant?

(a) zero-order reaction
(b) first-order reaction
(c) second-order reaction
(d) two of the above
(e) all of the above (a-c).

29. Which of the following substances would you expect to have the lowest boiling point?
    (a) diamond
    (b) methane
    (c) sodium nitrate
    (d) glycerine
    (e) copper

30. A certain solid substance that is very hard, has a high melting point and is nonconducting unless melted is most likely to be:
    (a) I_2
    (b) NaCl
    (c) CO_2
    (d) H_2O
    (e) Cu

31. An aqueous solution contains 50.0 g of propanol in 150.0 g of solution. What is the mole fraction of the propanol
    (a) 0.091
    (b) 3.00
    (c) 0.130
    (d) 0.333
    (e) None of these

32. Liquid A have vapor pressure x. Liquid B have vapor pressure y and x>y. What is the mole percent of the liquid mixture if the vapor above the solution is 50% A?:
    (a) y/(2x+2y)
    (b) x/(2x+2y)
    (c) x/(x+y)
    (d) y/(x+y)
    (e) None of these

33. Choose the element with the highest melting point.
    (a) Li
    (b) Na
    (c) K
    (d) Rb
    (e) Cs

34. What element is found in the structural minerals that make up our bones and teeth?
    (a) strontium
    (b) barium
    (c) calcium
    (d) silicon
    (e) magnesium

35. Choose the element with smallest ionization energy

    (a) N

    (b) P

    (c) As

    (d) Sb

    (e) Bi

36. Choose the species with the largest bond strength

    (a) F_2

    (b) Cl_2

    (c) Br_2

    (d) I_2

    (e) All are the same.

37. Which of the following complexes shows geometric isomerism?

    (a) $[Co(NH_3)_5Cl]SO_4$

    (b) $[Co(NH_3)_6]Cl_3$

    (c) $[Co(NH_3)_5Cl]Cl_2$

    (d) $K[Co(NH_3)Cl_4]$

    (e) None of these

38. For the process $Co(NH_3)_5Cl^{+2} + Cl^- \rightarrow Co(NH_3)_4Cl_2^{+2} + NH_3$ what would be the ratio of cis to trans isomer in the product?

    (a) 1:1

    (b) 1:2

    (c) 1:4

    (d) 4:1

    (e) 2:1

39. The half-life of ^{90}Sr is 28.1 years. How long will it take a 10.0 g sample of ^{90}Sr to decompose to 0.1 g.

    (a) 80 yr

    (b) 140 yr

    (c) 190 yr

    (d) 2800 yr

40. Oxidation of 2-methyl-1-butanol could yield

    (a) 2-methyl-*l*-butanone

    (b) 2-methyl-*l*-butanol

    (c) 2-methylbutanoic acid

    (d) Both b and c

    (e) Both a and c