

CH 107 Introductory Chemistry Final Test used as a practice for CH 109 Placement Test December 14, 2005 (am)

Choose the BEST answer for each multiple choice. For all equilibrium reactions the arrow will be double-headed (\leftrightarrow). Remember to balance any chemical reactions before calculating if appropriate.

- The number of significant figures in the number 3005 is?
 - 1
 - 2
 - 3
 - 4
 - 2 or 4
- Convert 115 lb/min to mg/sec (454 g = 1.0 lb; you are expected to know metric conversions)
 - 8.70×10^{-3} mg/sec
 - 869 mg/sec
 - 15.2 mg/sec
 - 8.69×10^5 mg/sec
 - 4.32×10^6 mg/sec
- What is true about potassium (K)?
 - It is a nonmetal.
 - It is a group II element.
 - It is a liquid at room temperature.
 - It is very unreactive.
 - Its Lewis dot structure looks like K•
- Convert 33 millimeters to meters.
 - 3.3×10^{-3} m
 - 3.3×10^{-2} m
 - 150 m
 - 0.33 m
 - none of these
- One quart of juice costs 75¢ and one liter of juice costs 78¢. Which is the better buy? (0.946 L = 1.0 qt quarts)
 - the liter
 - the quart
 - they are of equal value
 - more information is needed
- What is true about isotopes?
 - they are different forms of an element differing in mass
 - they are always radioactive
 - hydrogen has no isotopes
 - they are different forms of an element differing in numbers of electrons
 - none of these

7. The total number of electrons Na^+ has is?

- a. 10 b. 11 c. 12 d. 23 e. 1

8. Which of the following elements would have the most similar properties to Br?

- a. Na b. S c. Be d. Cl e. Ar

9. Choose the most stable ion for oxygen.

- a. O^- b. O^+ c. O^{2-} d. O^{2+} e. doesn't make ions

10. The formula for the compound made from calcium and sulfur is?

- a. $\text{Ca}=\text{S}$
b. Ca_2S
c. CaS_6^{3-}
d. CaS_2
e. CaS

11. The charge on phosphate is?

- a. 0 b. +2 c. +3 d. -3 e. -1

12. Draw the Lewis dot structure for $\begin{array}{c} \text{O} \\ || \\ \text{H}-\text{C}-\text{H} \end{array}$ the shape of this molecule is?

- a. linear
b. trigonal pyramidal
c. bent or angular
d. trigonal planar
e. tetrahedral

13. "Like dissolves like" means that certain types of substances will dissolve more easily in water. Which type of substance would dissolve most easily in water?

- a. nonpolar
b. polar
c. noble gases
d. the diatomic gases such as O_2 , H_2 , and N_2
e. hydrocarbons like oil and gasoline

14. How many moles are contained in 96.00 g of O_2 ?

- a. 0.500 b. 1.000 c. 2.000 d. 3.000 e. 4.000

Use the following reaction to answer the next two questions.



15. If 14.5 g of C_3H_8 react completely in the presence of unlimited amounts of oxygen, how many grams of water will be made? (*You will need to calculate molecular weights.*)

- a. 5.92 g b. 36.0 g c. 73.8 g d. 23.7 g e. 8.75 g

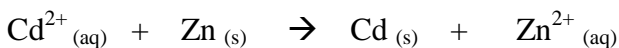
16. If 5 moles of C_3H_8 and 15 moles of O_2 are present, which reagent (reactant) will limit the reaction?

- a. C_3H_8 b. O_2 c. neither d. H_2O e. need more info

17. Based on solubility rules choose the compound that is NOT soluble in water.

- a. KOH d. PbSO_4 c. $\text{Al}(\text{NO}_3)_3$ b. $\text{Mg}(\text{CH}_3\text{COO})_2$ e. NH_4Cl

18. In the reaction shown below, which species is being reduced?



- a. $\text{Zn}_{(\text{s})}$
 b. $\text{Zn}^{2+}_{(\text{aq})}$
 c. Cd^{2+}
 d. $\text{Cd}_{(\text{s})}$
 e. it depends upon the solubility of the ions

19. If an ideal gas at *constant pressure* and a volume of 10.00 L and a temperature of 25.00 °C, is allowed to expand to 50.00 L, what will the new temperature be?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

- a. 125.0 °C b. 273.0 °C c. 1490 °C d. 1217 °C e. 37.00 °C

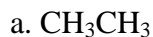
20. What is the volume of 0.75 moles of a gas at 37 °C if the pressure is 5.0 atm? $PV = nRT$

- a. 3.8 L b. 0.46 L c. 38 L d. 21 L e. 0.83 L

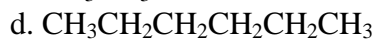
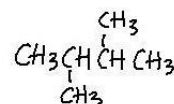
21. Which is NOT a type of intermolecular force?

- a. London dispersion forces c. dipole-dipole forces
 b. hydrogen bonding d. ionic bonding

22. Which compound will have the highest boiling point?



c.



23. Which compound can form hydrogen bonds to itself?



24. The name of the process in which a solid turns into a gas is called?

a. condensation

b. solidification

c. evaporation

d. sublimation

e. super-saturation

25. If the solubility of AgNO_3 is 63.7 g/100 mL water and you have 4.37 g dissolved in 10 mL of water, your solution is?

a. cloudy

b. unsaturated

c. green, but clear

d. saturated

e. super-saturated

26. The molarity of a 0.50 L of solution that contains 186.9 g of MgF_2 (FW = 62.3 g/mol) is ?

a. 0.50 M

b. 1.0 M

c. 2.0 M

d. 4.0 M

e. 6.0 M

27. What volume of a 12 M stock solution of HCl would be needed to make 835 mL of a 0.95 M solution?

$$M_1V_1 = M_2V_2$$

a. 26 mL

b. 13 mL

c. 66 mL

d. 0.013 mL

e. 86 mL

28. The % (w/v) of 8.00 g of sucrose in 200.0 mL of coffee is?

a. 3.00 %

b. 2.00 %

c. 4.00 %

d. 11.6 %

e. 4.32 %

29. Which compound will be least soluble in water?

- a. glucose ($C_6H_{12}O_6$) d. CH_2F_2
 b. HCl e. NaOH
 c. CH_3CH_3

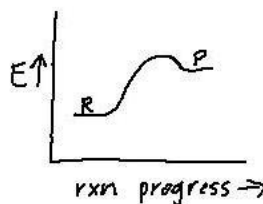
30. A particular blood cell has an internal osmolarity of 0.30 osmol. Which solution should this cell be placed in if one wanted to cause crenation (cause the cell to shrivel)?

$$\text{Osmol} = nM; \quad \text{where } M \text{ is molarity and } n = \text{number of particles}$$

- a. 0.50 M NaCl
 b. 0.10 M Na_2SO_4
 c. 0.15 M glucose ($C_6H_{12}O_6$)
 d. 0.0050 M CH_3OH
 e. need to know the size of the blood cell

31. An endothermic reaction can be described as?

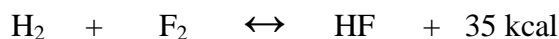
- a. a reaction that has heat as a product
 b. a reaction that has a large K_{eq} value
 c. a reaction that has a small K_{eq} value
 d. a really fast reaction
 e. what is shown on the plot at the right



32. Which effect does a catalyst have on an equilibrium reaction?

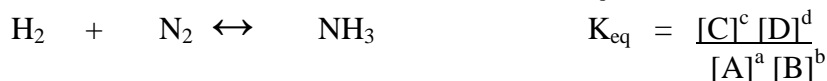
- a. the equilibrium shifts to the products
 b. equilibrium is reached faster
 c. the equilibrium shifts to the reactants
 d. the equilibrium constant gets much larger
 e. it depends on the particular reaction

33. For the equilibrium reaction shown below predict what would happen if more hydrogen fluoride was added, according to Le Chatelier's principle.



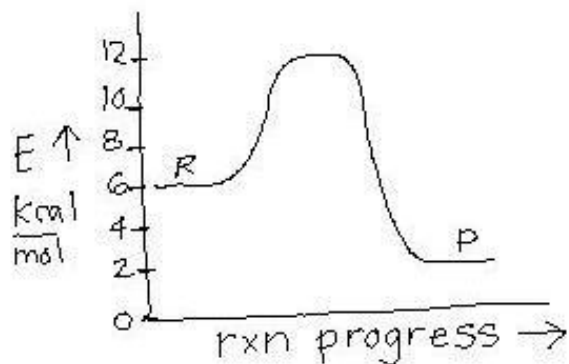
- a. the equilibrium shifts to the left
 b. the equilibrium shifts to the right
 c. there is no effect on equilibrium
 d. the value for K_{eq} changes
 e. more than one of these is true

34. For the reaction shown below calculate the $[H_2]$ if the K_{eq} is 8.00, $[N_2] = 0.250 \text{ M}$, and $[NH_3] = 1.50 \text{ M}$.



- a. 1.42 M b. 0.750 M c. 1.04 M d. 0.843 M e. 0.228 M

Use the following energy diagram to answer the next two questions.



35. The energy for the overall reaction is?

- a. 6 kcal/mol b. 4 kcal/mol c. 12 kcal/mol d. 10 kcal/mol e. 2 kcal/mol

36. The activation energy of this reaction is?

- a. 6 kcal/mol b. 4 kcal/mol c. 12 kcal/mol d. 10 kcal/mol e. 2 kcal/mol

37. If $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-9} \text{ M}$, then $[\text{OH}^-] = ?$ $K_w = [\text{OH}^-][\text{H}_3\text{O}^+]; K_w = 1.0 \times 10^{-14}$

- a. $1.0 \times 10^{-14} \text{ M}$
 b. $1.0 \times 10^{-9} \text{ M}$
 c. $1.0 \times 10^{-5} \text{ M}$
 d. $1.0 \times 10^{-23} \text{ M}$
 e. $1.0 \times 10^{-7} \text{ M}$

38. What is the $[\text{H}_3\text{O}^+]$ in a solution that has a pH of 3.12? $\text{pH} = -\log[\text{H}_3\text{O}^+]$

- a. $1.32 \times 10^3 \text{ M}$
 b. $1.32 \times 10^{-11} \text{ M}$
 c. $6.23 \times 10^{-6} \text{ M}$
 d. $7.59 \times 10^{-4} \text{ M}$
 e. $1.0 \times 10^{-4} \text{ M}$

39. If the hydronium ion (H_3O^+) concentration is $1 \times 10^{-10} \text{ M}$, the pH of the solution is?

- a. 1 b. 2 c. 4 d. 7 e. 10

40. The products of the first dissociation of carbonic acid (H_2CO_3) in water are?

- a. $\text{H}_2\text{O}, \text{CO}_3^{2-}$
 b. $\text{H}_3\text{O}^+, \text{CO}_3^{2-}$
 c. $\text{OH}^-, \text{HCO}_3^-$
 d. $\text{H}_3\text{O}^+, \text{HCO}_3^-$
 e. $\text{OH}^-, \text{H}_2\text{CO}_3$

41. Choose the strongest acid.

- a. HCOOH b. HCN c. H₃PO₄ d. H₃BO₃ e. HBr

42. Choose the weakest base.

- a. NH₃ b. KOH c. LiOH d. Ba(OH)₂ e. NaOH

43. What is true about weak acids?

- a. they are all diprotic or triprotic
 b. they completely dissociate in water
 c. HCl is one
 d. the K_a for the reaction is always less than 1.0
 e. the pH of a weak acid solution is always higher than 12

44. If a substance is amphoteric it means the substance is/can?

- a. catalyze chemical reactions
 b. positively charged
 c. a transition metal
 d. act as both an acid and a base
 e. insoluble in water

45. For a buffer solution made of 0.500 M sodium acetate and 0.0500 M acetic acid, the pH would be?

$$\text{pH} = \text{pK}_a + \log \frac{[\text{A}^-]}{[\text{HA}]}$$

- a. 3.75
 b. 4.75
 c. 5.75
 d. 4.98
 e. 2.66

46. Which acid would be in a buffer if the pH was 9.41 and the solution was made from 4.50 M acid and 1.50 M conjugate base.

$$\text{pH} = \text{pK}_a + \log \frac{[\text{A}^-]}{[\text{HA}]}$$

- a. lactic acid
 b. acetic acid
 c. phosphoric acid
 d. boric acid
 e. phenol

47. Buffers are important to biological organisms because?

- a. they maintain an organism's temperature at 37 °C
 b. they provide a source of fresh water for drinking
 c. they keep organisms from damaging delicate internal organs
 d. they maintain the organism's pH at a relatively constant value
 e. they provide electronic interfaces between the organism and environmental odors

48. What is true about the dyes that function as pH indicators?

- a. they change color based on the pH of a solution
- b. a mixture of them in one solution is called “universal” indicator
- c. a popular one called phenolphthalein turns dark pink in the presence of base
- d. they can be used to make colorful demos in a chemistry lecture
- e. all of these are true

49. Choose the substance that would have a pH of greater than 7.

- a. lemon juice
- b. drain cleaner
- c. vinegar
- d. pure water
- e. gastric (stomach) juice

50. A 0.50 M base is used to titrate 150 mL of 0.15 M HCl to its endpoint. How much base was needed?

$$M_a V_a = M_b V_b$$

- a. 5.0×10^2 mL
- b. 11 mL
- c. 45 mL
- d. 5.0×10^{-4} mL
- e. 32 mL

51. If 25 mL of 1.0 M HCl are neutralized by NaOH, how many moles of base must have been present at the point of neutralization?

- a. 1.0
- b. 0.25
- c. 5.0
- d. 0.025
- e. need more info

52. The normality of a 2.0 M solution of H₂SO₄ is?

- a. 1.0 N
- b. 2.0 N
- c. 4.0 N
- d. 6.0 N
- e. 0.5 N

53. Rutherford’s experiment showed that some radiation consists of?

- a. transition metals and therefore is colorful
- b. charged particles
- c. uranium atoms
- d. heavy water
- e. all of these

54. In the following transmutation reaction, what is the other product?



- a. ${}^{241}\text{Cf}$
- b. ${}^{249}\text{Pu}$
- c. ${}^{243}\text{Am}$
- d. ${}^{249}\text{Es}$
- e. ${}^{241}\text{Pu}$

55. The main danger to the human body from ionizing radiation is?

- a. creation of highly reactive free radicals like $\bullet\text{OH}$ which damage DNA
- b. termination of hair growth
- c. drastic changes in blood pH
- d. accelerated growth in extremities
- e. induction of autoimmune diseases like lupus and MS

56. If a lead-lined box had 400.0 g of ^{32}P (half-life of approximately 14.0 days) how much would be left after 70.0 days?

- a. 80.0 g b. 25.0 g c. 225 g d. 12.5 g e. 105 g