Chem25, Winter 2012, Foothill College, Test2 74-0=74 75 149/164 Name KEY

Please read all the questions VERY carefully before answering. If you do not understand any question, please ask. Use the reverse side of the question paper as scratch. Use the periodic table and constant chart in the last page. No outside paper is allowed. Total points = 74+(30x3=)90=164

SHORT ANSWER. Please write the set-up equation and insert the raw data with units in the equation before doing your calculations. Write the word or phrase that best completes each statement or answers the question.

1) Calculate the number of moles of Cu in 1.48×10^{25} Cu atoms. (6 pts.)

1) 24.6 moles of Cu

$$1.48 \times 10^{25}\ \text{Cu atoms} \times \frac{1\ \text{mol Cu}}{6.022 \times 10^{23}\ \text{Cu atoms}} = 24.6\ \text{moles of Cu}$$ ✓

2) An element has atomic mass of 35.45 amu. It has two stable isotopes: Iso-1 with mass 34.9689 amu & Iso-2, with mass 36.9695 amu. Show your calculation to find the natural abundances of Iso-1 & Iso-2. (10 pts.)

2) Iso-1 = 75.95%
Iso-2 = 24.05%

$$(34.9689\ \text{amu} \cdot X) + (36.9695\ \text{amu} \cdot (1-X)) = 35.45\ \text{amu}$$

$$34.9689x + 36.9695 - 36.9695x = 35.45$$

$$-2.0006x = -1.5195$$

$$x = 0.7595$$ ✓

Iso-1 = x → 75.95%
Iso-2 = 1-x → 24.05%

3) Calculate the number of atoms in 15.6 grams of silicon. (6 pts.)

3) 3.34×10^{23} atoms Si

$$15.6\ \text{g Si} \times \frac{1\ \text{mol Si}}{28.09\ \text{g Si}} \times \frac{6.022 \times 10^{23}\ \text{atoms Si}}{1\ \text{mol Si}} = 3.34 \times 10^{23}\ \text{atoms Si}$$ ✓

4) Show your calculation to detemine the number of molecules in 78.0 grams of sulfur trioxide. (8 pts.)

4) 5.87×10^{23} molecules SO_3

Molecular mass $SO_3 = (32.07_g \times 1) + (16_g \times 3) = 80.07 g/mol$

$$78.0\,g\,SO_3 \times \frac{1\,mol\,SO_3}{80.07\,g\,SO_3} \times \frac{6.022 \times 10^{23}\,molecules\,SO_3}{1\,mol\,SO_3} = 5.87 \times 10^{23}\,molecules\,SO_3$$

5) Calculate the amount (in grams) of phosphorous in a 15.5 gram sample of diphosphorous pentoxide. (10 pts.)

5) 6.76 g P

Molecular mass $P_2O_5 = (30.97_g \times 2) + (16_g \times 5) = 141.94 g/mol$

$$15.5\,g\,P_2O_5 \times \frac{1\,mol\,P_2O_5}{141.94\,g\,P_2O_5} \times \frac{2\,mol\,P}{1\,mol\,P_2O_5} \times \frac{30.97\,g\,P}{1\,mol\,P} = 6.76\,g\,P$$

6) Calculate the mass percent of carbon in oxalic acid, $H_2C_2O_4$. (10 pts.)

6) 26.68%

Molecular mass $H_2C_2O_4 = (1.01_g \times 2) + (12.01 \times 2) + (16 \times 4) = 90.04\,g$

$$\frac{2 \times 12.01_g\,C}{90.04\,g\,H_2C_2O_4} \times 100 = 26.68\%$$

7) A compound with the empirical formula $C_{12}H_{17}O_2$ has a molecular mass of 386.6 g/mol. Calculate the value of n necessary to find the molecular formula? (6 pts.)

7) $n = 2$

Empirical mass $C_{12}H_{17}O_2 = (12.01g \times 12) + (1.01g \times 17) + (16g \times 2) = 193.29 g/mol$

$$\frac{\text{Molecular Mass}}{\text{Empirical Mass}} = n \qquad \frac{386.6\ g/mol}{193.29\ g/mol} = 2$$

8) An acid has 40% C, 6.7% H, 53.3% O and its molar mass is 60.05 g/mol. Show your calculation to find the molecular formula of the acid? (10 pts.)

8) $C_2H_4O_2$

$C = 60.05\ g/mol \cdot 0.40 = 24.02\ g/mol$

$24.02\ g/mol\ C \cdot \frac{1\ mol\ C}{12.01\ g\ C} = 2\text{-}C$

$H = 60.05\ g/mol \cdot 0.067 = 4.02\ g/mol$

$4.02\ g/mol\ H \cdot \frac{1\ mol\ H}{1.01\ g\ H} = 4\text{-}H$

$O = 60.05\ g/mol \cdot 0.533 = 32.00\ g/mol$

$32\ g/mol\ O \cdot \frac{1\ mol\ O}{16\ g\ O} = 2\text{-}O$

molecular formula $= C_2H_4O_2$

9) In separating a mixture of sand and salt, a student had with following data:

9) 91% salt, 99% sand

(a) 1.11 g salt
(b) 1.11 g sand
(c) The mass of an empty beaker where he would collect the salt sample = 71.60 g
(d) The mass of the beaker with the dry salt residue = 72.61 g
(e) The mass of a empty watch glass + clean filter paper = 43.45 g
(f) The mass of a the watch glass + filter paper + dry sand = 44.55 g

Show all your calculations to find out the (1) the % recovery of salt (4 pts.) and (2) the % recovery of sand (4 pts.).

SALT

$72.61g - 71.60g = 1.01g$ recovered

$\frac{1.01g\ \text{recovered salt}}{1.11g\ \text{starting salt}} \times 100 = 90.99\%$ salt recovered

SAND

$44.55g - 43.45g = 1.10$ g recovered

$\frac{1.10\ g\ \text{recovered sand}}{1.11g\ \text{starting sand}} \times 100 = 99.10\%$

MULTIPLE CHOICE. On scantron, answer the questions starting from number 10. Choose the one alternative that best completes the statement or answers the question. (3 poins each)

10) Metalloids are located where on the periodic table? 10) A
A) zig-zag diagonal line
B) right side
C) left side
D) middle
E) none of the above

11) Group 2A elements are also called: 11) A
A) alkaline earth metals.
B) halogens.
C) noble gases.
D) alkali metals.
E) none of the above

12) Examine the elements listed below and identify the one element that is from a different periodic table group than the others. 12) D
A) Sn
B) Ge
C) Si
D) Ti
E) All of these are from the same group.

13) Ions are formed when atoms 13) B
A) gain or lose neutrons.
B) gain or lose electrons.
C) gain or lose protons.
D) Each of these results in ion formation.
E) None of these results in ion formation.

14) How many protons and electrons are present in O^{2-}? 14) C
A) 10 protons and 8 electrons
B) 8 protons and 8 electrons
C) 8 protons and 10 electrons
D) 16 protons and 8 electrons
E) none of the above

15) What is the charge on the ion formed by selenium? 15) B
A) 2+
B) 2-
C) 1-
D) 1+
E) none of the above

16) The number of protons in the nucleus of an atom 16) E

A) is called the atomic number.
B) identifies the atom as a particular element.
C) is given the symbol "Z."
D) is the same for all isotopes of an element.
E) all of the above

17) An atom that has the same number of neutrons as $^{138}_{56}Ba$ is: 17) B

A) $^{138}_{55}Cs$

B) $^{136}_{54}Xe$

C) $^{136}_{56}Ba$

D) $^{137}_{57}La$

E) none of the above

18) Chlorine has two stable isotopes, Cl-35 and Cl-37. If their exact masses are 34.9689 amu and 36.9695 amu, respectively, what is the natural abundance of Cl-35? (The atomic mass of chlorine is 35.45 amu) 18) D

A) 50.00% B) 35.00% C) 37.00% D) 75.95% E) 24.05%

$(34.9689 \cdot x) + (36.9695(1-x)) = 35.45$

19) The phosphorous-to-hydrogen mass ratio is $\frac{10.2}{1}$ for a compound. This ratio could correspond to the compound 19) C

A) PH_2.
B) PH.
C) PH_3.
D) PH_6.
E) none of the above

20) How many of each type of atom are there in the formula $(NH_4)_2HPO_4$? 20) B

A) N = 2, H = 8, P = 1, O = 4
B) N = 2, H = 9, P = 1, O = 4
C) N = 1, H = 5, P = 1, O = 4
D) N = 2, H = 5, P = 1, O = 4
E) none of the above

N = 2
H = 9
P = 1
O = 4

21) Carbon monoxide is considered which of the following? 21) D

A) ionic compound
B) molecular element
C) atomic element
D) molecular compound
E) none of the above

22) What is the formula for an ionic compound made of aluminum and oxygen? 22) C

A) AlO
B) AlO_2
C) Al_2O_3
D) Al_3O_2
E) none of the above

23) What is the name of HIO_3? 23) B

A) hydroioidic acid
B) iodic acid
C) hydroiodous acid
D) iodous acid
E) none of the above

24) What is the formula mass for diboron tetrachloride? 24) C

A) 234.34 amu
B) 198.89 amu
C) 163.43 amu
D) 127.98 amu
E) none of the above

B_2Cl_5

$(10.81 \times 2) + (35.45 \times 5) =$

25) What is mass of 0.560 moles of chlorine gas? 25) C

A) 19.9
B) 63.3
C) 39.7
D) 127
E) none of the above

$0.560\ mol \times \frac{35.45\ g}{1\ mol}$

26) When the equation, $\_1\_ N_2 + \_3\_ H_2 \rightarrow \_2\_ NH_3$ is balanced, the coefficient of hydrogen is 26) D

A) 2
B) 4
C) 1
D) 3
E) none of the above

27) What are the coefficients for the following reaction when it is properly balanced? 27) C

2 NO 2 CO 1 N_2 2 CO_2

___nitrogen monoxide + ___carbon monoxide → ___nitrogen + ___carbon dioxide

A) 2, 1, 1, 2
B) 1, 1, 2, 2
C) 2, 2, 1, 2
D) 2, 2, 2, 1
E) none of the above

28) What are the coefficients for the following reaction when it is properly balanced? 28) B

$\_\_2\_\_O_2 + \_\_\_CH_4 \rightarrow \_\_\_CO_2 + \_\_2\_\_H_2O$

A) 2, 3, 2, 2
B) 2, 1, 1, 2
C) 2, 1, 3, 1
D) 1, 3, 2, 1
E) none of the above

29) Which of the following compounds is INSOLUBLE? 29) C
A) lithium carbonate
B) magnesium bromide
C) aluminum sulfide
D) potassium acetate
E) none of the above

30) Cr is a member of which family? 30) E
A) halogens
B) alkaline earth metals
C) alkali metals
D) noble gases
E) none of the above

31) Which of the following statements about ions is INCORRECT? 31) C
A) Cations are positive ions and anions are negative ions.
B) Anions are formed when an atom gains electrons.
C) Cations are formed when an atom gains protons.
D) Cations are formed when an atom loses electrons.
E) All statements are correct.

32) What is the charge on the ion formed by selenium? 32) C
A) 2+
B) 1−
C) 2−
D) 1+
E) none of the above

33) Isotopes are: 33) D
A) atoms of the same element that have different number of protons.
B) atoms of the same element that have the same number of neutrons.
C) atoms of the same element that have different number of electrons.
D) atoms of the same element that have different number of neutrons.
E) none of the above

34) An atom that has the same number of neutrons as $^{138}_{56}Ba$ is 34) D B

A) $^{138}_{55}Cs$

B) $^{136}_{54}Am$

C) $^{136}_{56}Ba$

D) $^{137}_{57}La$

E) none of the above

TRUE/FALSE. On scantron, choose "A" for a true answer and "B" for wrong answer. (3 points each)

35) An atom is the smallest identifiable unit of a compound. 35) B

36) Protons and electrons each have a mass of 1 amu. 36) B

37) One mole of chlorine gas has a mass of 35.45 grams. 37) B

38) $C_2H_6O_4$ could be an empirical formula. 38) B

39) Li^+, Na^+, K^+ and NH_4^+ compounds are soluble. 39) A