Chem25, Spring 2014, SJCC, FinalTest 56-5=51 69 120 131 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 = 56+(27x3=)81=131

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 (with units) how many cubic inches (in^3) are in 15615 cubic decimeter (dm^3) (given 1 dm = 0.1 m, 1 cm = 0.01 m, and 2.54 cm = 1 in)? (8 pts.)

1) 95 2715.07 in^3

$1\ dm^3 = 1000\ cm^3$

$15615\ dm^3 = 15615 \times 10^3\ cm^3$

$1\ in^3 = 16.39\ cm^3$

$15615 \times 10^3\ cm^3 = 952715.07\ in^3$

$$15615\ dm^3 \times \frac{(0.1\ m)^3}{(1\ dm)^3} \times \frac{(1\ cm)^3}{(.01\ m)^3} \times \frac{(1\ in)^3}{(2.54\ cm)^3}$$

$$= \frac{(15615)(.1)^3}{(.01)^3(2.54)^3}\ in^3 = 952715.07\ in^3$$

2) Show your calculation to determine the empirical formula of a compound that is composed of 40.92% C, 4.58% H, and 54.50% O. (8 pts.)

2) $C_3H_4O_3$

$C = \frac{40.92}{12} = 3.41$

$H = \frac{4.58}{1} = 4.58$

$O = \frac{54.5}{16} = 3.4$

Empirical: $C_3H_4O_3$

$C_{3.41}H_{4.58}O_{3.4}$

$= (C_1H_{1.3}O_1) \times 3 \rightarrow C_3H_4O_3$

3) Calculate the mass (in grams) of 1.56×10^{21} atoms of magnesium. (6 pts.)

3) 0.063 g

$n = \frac{1.56 \times 10^{21}}{6.022 \times 10^{23}} = 2.6 \times 10^{-3}$

$m = 2.6 \times 10^{-3} \times 24.3 = 0.063\ g$

$$1.56 \times 10^{21}\ atoms \times \frac{1\ mol}{6.022 \times 10^{23}\ atoms} \times \frac{24.3\ g\ Mg}{1\ mol\ Mg}$$

$$= \frac{(1.56 \times 10^{21})(24.3)}{(6.022 \times 10^{23})} = 0.0630\ g$$

$n = 6.022 \times 10^{23}$

1.56

$n-1 = n - 6.022 \times 10^{23}$

4) Calculate how many grams of HNO_3 is produced when 2.0 moles of NO_2 reacts with water in the following reaction: H_2O (l) + 3 NO_2 ---> NO (g) + 2 HNO_3 (aq) (6 pts.)

4) 84 g

1 3 1 2

$n_{HNO_3} = \frac{2 \times 2}{3} = \frac{4}{3}$ mol

$m_{HNO_3} = n\,M = \frac{4}{3} \cdot 63 = 84$ g

$2 \text{ mole } NO_2 \times \frac{2 \text{ mol } HNO_3}{3 \text{ mol } NO_2} \times \frac{63 \text{ g } HNO_3}{1 \text{ mol } HNO_3}$

$= \frac{2 \times 2 \times 63}{3}$ g HNO_3

$= 84$ g HNO_3

5) An inflated baloon has a volume of 6.0 L at 1.0 atm pressure and at 22°C. Calculate its volume when it ascends to an altitude where the pressure is 0.45 atm and the temperature is -21°C. (6 pts.)

5) 11.4 L

$P_1 = 1$ atm

$V_1 = 6$ L

$T_1 = 295.15$ °k

$P_2 = 0.45$ atm

$T_2 = 252.15$

$V_2 = ?$

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

$V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{(1)(6)(252.15)}{(295.15)(0.45)}$

$V_2 = 11.4$ L ✓

6) Use a noble gas core to draw the ground state electron configuration for (4 pts./each; Total = 8pts.)

6) _____

(a) Vanadium (V; Z=23): $[Ar]\,4s^2\,3d^3$ ✓ −1

(b) Bromine (Br, Z=35) $[Ar]\,4s^2\,3d^{10}\,4p^5$ ✓ −1

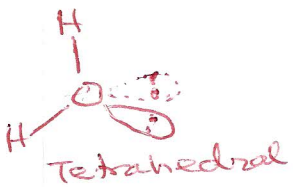
7) (a) Draw the Lewis structure of H_2O (2pts.)

7) _____

H – Ö – H ✓

(b) **Draw** and **name** the electronic geometry of H_2O (4 pts.)

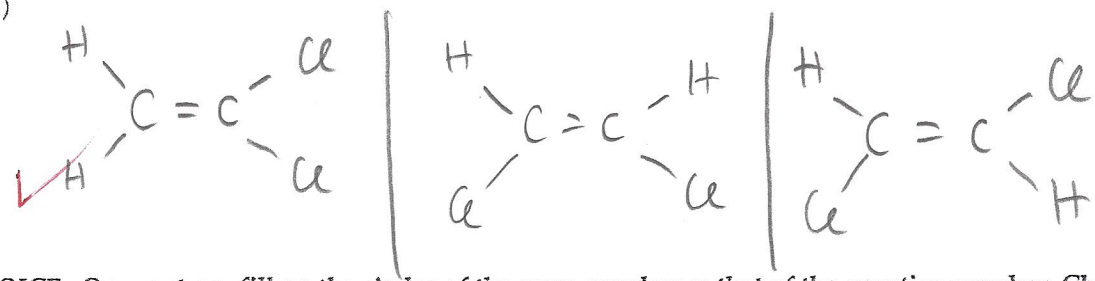
H – Ö – H linear −3



(c) Circle if H_2O molecule is **ploar** or **non-polar** (2pts.)

8) Draw the structure of all possible isomers for a compound with general formula $C_2H_2Cl_2$ 8) _____

(6 pts.)



MULTIPLE CHOICE. On scantron, fill up the circles of the same number as that of the question number. Choose the one alternative that best completes the statement or answers the question. (3 poins each)

9) Determine the answer to the following equation with correct number of significant figures: 9) D
$(17.103 + 2.03) \times 1.02521 =$ _____

A) 20
B) 19.6
C) 19.6153
D) 19.62
E) none of the above

10) What is the value of 27°C on the Fahrenheit scale? 10) C

A) 91 B) 52 C) 73 D) 81

11) Given the table of specific heat values below, what is the identity of a 10.0 g metal sample that increases by 14.0°C when 62.9 J of energy is absorbed? (Given: $\Delta H = m.c.\Delta T$). 11) B

Element	Specific Heat(J/g°C)
Au	0.128
Ag	0.235
Cu	0.385
Fe	0.449
Al	0.903

$\Delta H = mc\Delta T$

$62.9 \quad 10 \quad 14$

$c = \frac{62.9}{10.14}$

A) Au
B) Fe
C) Ag
D) Al
E) none of the above

12) An atom that has the same number of neutrons as $^{138}_{56}Ba$ is: 82 12) A

A) $^{136}_{54}Xe$ 82

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

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

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

E) none of the above

13) What is the formula mass of copper(II) fluoride? CuF_2 13) C

A) 146.10
B) 165.10
C) 101.55
D) 90.00
E) none of the above

14) How many atoms are in 5.80 moles of He? atom = n G. 14) B

A) 1.03×10^{23}
B) 3.49×10^{24}
C) 6.02×10^{23}
D) 4.00
E) none of the above

15) What is the mass percent of chlorine in hydrochloric acid? HCl 15) D

A) 70.1
B) 2.8
C) 35.5
D) 97.2
E) none of the above

16) Which of the following compounds would have a linear molecular geometry? 16) B

1. N_2 :N≡N:
2. H_2S H–S–H
3. CO_2 O=C=O

A) 1 and 2 only
B) 1 and 3 only
C) 1,2 and 3
D) 2 and 3 only
E) neither 1, 2,or 3

17) The elements with the highest electronegativity values tend to be found in the: 17) E

A) upper left-side of the periodic table.
B) center of the periodic table.
C) lower right-side of the periodic table.
D) lower left-side of the periodic table.
E) upper right-side of the periodic table.

18) Which molecule listed below is a nonpolar molecule? 18) D

A) CO_2 O=C=O
B) CCl_4 –C–
C) BH_3 –B–
D) all of the compounds
E) none of the compounds

19) What is the molecular geometry if you have 4 single bonds around the central atom? 19) D

A) linear
B) trigonal pyramidal
C) bent
D) tetrahedral
E) not enough information

20) Considering the following precipitation reaction: 20) D

$Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$

What is the correct net ionic equation?

A) $Pb^{2+} + I_2^- \rightarrow PbI_2(s)$
B) $Pb^{2+} + 2NO_3^- + 2K^+ + 2I^- \rightarrow PbI_2(s) + 2K^+ + 2NO_3^-$
C) $2NO_3^- + 2K^+ \rightarrow 2KNO_3$
D) $Pb^{2+} + 2I^- \rightarrow PbI_2(s)$
E) none of the above

21) What is the theoretical yield of waffles if you have 5 cups of flour, 9 eggs and 3 tbs of oil? 21) C

Given: 2 cups flour + 3 eggs + 1 tbs oil → 4 waffles

A) 6 5 9 3
B) 4 10 12 12
C) 10
D) 12
E) not enough information

22) Which color of the visible spectrum has photons with the most energy? 22) E

A) green B) red C) yellow D) orange E) violet

23) The n = _____ principal shell is the lowest that may contain a d-subshell. 23) D

A) 4
B) 1
C) 2
D) 3
E) not enough information

24) What is the electron configuration for P? [Ne] $3s^2 3p^3$ 24) D

A) $[Ar]3s^23p^3$
B) $[Ne]1s^21p^62s^22p^3$
C) $[Ar]3s^23p^64s^23d^{10}4p^3$
D) $[Ne]3s^23p^3$
E) none of the above

25) Which of the following elements has the electron configuration of $3s^23p^4$ in its outermost shell? 25) A

A) S
B) Si
C) Al
D) Cl
E) none of the above

χ 0 Hg = 1atm
874

26) A 3.76 g sample of a noble gas is stored in a 2.00 L vessel at 874 torr and 25°C. What is the noble gas? 26) C

(R= 0.0821 L atm/ mol K)

$PV = nRT$

$\frac{(1.15)(2)}{(0.0821)(298.15)} = 0.094$

A) He
B) Ne
C) Ar
D) Kr
E) not enough information

$n = \frac{m}{m}$ $m = \frac{m}{n}$

27) The vapor pressure of water at 20.0°C is 17.5 mm Hg. If the pressure of a gas collected over water was measured to be 453.0 mm Hg. What is the pressure of the pure gas? 27) D

A) 0.0230 atm
B) 0.596 atm
C) 0.619 atm
D) 0.573 atm
E) none of the above

28) When you make ice cubes: 28) D

A) the heat of vaporization must be removed.
B) the process is referred to scientifically as sublimation.
C) it is an endothermic process.
D) it is an exothermic process.
E) none of the above

$n = \frac{m}{m}$

29) A 250 gram sample of water at the boiling point had 45.0 kJ of heat added. How many grams of water were vaporized? Heat of vaporization for water is 40.6 kJ/mole. 29) A

A) 20.0
B) 1.11
C) 0.902
D) 16.2
E) none of the above

$H_2O(l) \rightarrow H_2O(g)$ $\Delta H = 40.6$ kJ/mol

$\Delta H = \frac{H}{n}$

30) Which statement is TRUE in describing what occurs when a solid melts to a liquid? 30) C

A) The process is exothermic and the heat of fusion is positive.
B) The process is endothermic and the heat of fusion is negative.
C) The process is endothermic and the heat of fusion is positive.
D) The process is exothermic and the heat of fusion is negative.
E) not enough information

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

31) Zeros located after a number and after a decimal point are significant. 31) A

32) Protons and neutrons have similar masses and similar electrical charges. 32) B

33) Molecular elements do not exist in nature. 33) B

34) One mole of chlorine gas has a mass of 35.45 grams. $n = \frac{m}{m}$ 34) B

35) Li^+, Na^+, K^+ and NH_4^+ compounds are soluble. $m = n m$ 35) A