Chem15, Fall 2016, SJCC, FinalTest 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 = 26+(31x3=)93=119

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 mass (in grams) of 1.56×10^{21} atoms of oxygen (O_2). (6 pts.) 1) 0.0414 g O_2

$$1.56 \times 10^{21} \text{ atoms } O_2 \times \frac{1 \text{ mol } O_2}{(6.022 \times 10^{23})(2) \text{ atoms } O_2} \times \frac{32 \text{ g } O_2}{1 \text{ mol } O_2} = 0.0414 \text{ g } O_2$$

2) Calculate the molarity of a sulfuric acid (H_2SO_4) solution, when 1.178g of the acid is dissolved in water and diluted to a final volume of 25.0 mL. MW of H_2SO_4 = 98.1 g/mol (6 pts.) 2) 0.480 M

$$n_{H_2SO_4} = 1.178 \text{ g } H_2SO_4 \times \frac{1 \text{ mol } H_2SO_4}{98.1 \text{ g } H_2SO_4} = 0.01201 \text{ mol } H_2SO_4$$

$$V = 25.0 \text{ mL} \times \frac{1 \text{ L}}{10^3 \text{ mL}} = 0.025 \text{ L}$$

$$M = \frac{0.01201 \text{ mol}}{0.025 \text{ L}} = 0.4804 \text{ M} \Rightarrow 0.480 \text{ M}$$

3) Use a noble gas core to draw the ground state electron configuration for (4 pts./each; Total = 8 pts.) 3)

(a) Galium (Ga; Z=31): $[Ar]\ 4s^2\ 3d^{10}\ 4p^1$

(b) Strontiume (Sr, Z=38) $[Kr]\ 5s^2$

4) Calculate the pH of a solution where $[OH^-] = 3.0 \times 10^{-6}$ M. (6 pts.) 4) pH = 8.5

$$pOH = -\log(3.0 \times 10^{-6}) = 5.5$$

$$pH + pOH = 14$$

$$pH = 14 - pOH = 14 - 5.5 = \boxed{8.5}$$

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)

5) How many moles of ions are present in a 1-L 0.20 M solution of $MgCl_2(aq)$? 5) A/B

(a) 0.20 moles of ions (c) 0.40 moles of ions

(b) 0.60 moles of ions (d) 0.80 moles of ion

A) B) C) D)

6) How many moles of $AgNO_3$ are needed to prepare 100.0 mL of 0.250 M solution? 6) C

(a) 0.250 moles (c) 0.0250 moles

(b) 0.100 moles (d) 0.0100 moles

$0.100\ \cancel{L} \times \frac{0.250\ mol}{1\ \cancel{L}} = 0.025\ mol$

A) B) C) D)

7) How can one safely draw solutions into a pipette? 7) C

(a) Solutions can be drawn by covering the pipette with your mouth and drawing up the solutions.

(b) Solutions can be drawn by using your hand to cover the opening of the pipette and then drawing up the solutions with your mouth over the hand.

(c) Solutions can be drawn by using a pipette bulb that has been mostly emptied of air and drawing solutions up by pressure differential.

(d) Solutions can be drawn by using a straw attached to the mouth of the pipette and sucking on the straw to draw solutions up.

A) B) C) D)

8) Given the following sets of data for temperature of an unknown solution, determine the average temperature and choose the statement that best describes this set of data. 8) A

Trial	Temperature (°C)
1	15.12
2	15.52
3	14.99

$AVG = \frac{15.12 + 15.52 + 14.99}{3} = 15.21\,^{\circ}C$

(a) Average temperature is 15.21 °C and the set of data is precise because the ranges are small. ↳ reproducibility of results, how close the values are to one another

(b) Average temperature is 15.21 °C and the set of data is imprecise because the ranges are small.

(c) Average temperature is 15.21 °C and the set of data is accurate because the ranges are small.

(d) Average temperature is 15.21 °C and the set of data is inaccurate because the ranges are small.

A) B) C) D)

9) Which of the following represents the largest number of particles? 9) A

(a) 1.0 mol of Na $1\ mol \times \frac{23\ g\ Na}{1\ mol} = 23\ g\ Na$ (b) 1.0 g of Na

(c) 1.0 atom of Na $1\ atom \times \frac{1\ mol}{6.022 \times 10^{23}\ atom} \times \frac{23\ g\ Na}{1\ mol} = 3.82 \times 10^{-23}\ g$ (d) All have the same number of particles

A) B) C) D)

10) How many moles of O are present in 2.0 mol of Na_3PO_4? 10) D

$2\ mol\ Na_3PO_4 \times \frac{4\ mol\ O}{1\ mol\ Na_3PO_4} = 8\ mol\ O$

(a) 1.0 mole (b) 2.0 moles

(c) 4.0 moles (d) 8.0 moles

A) B) C) D)

11) Determine the answer to the following equation with correct number of significant figures: 11) D

$(17.103 + 2.03) \times 1.02521 =$ _____

$(17.103 + 2.03) = 19.133 = 19.13$

$19.13 \times 1.02521 = 19.61227$

$= 19.61 \approx 19.62$

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

12) Which of the following is NOT a correct name, symbol combination? 12) C

A) manganese, Mn
B) beryllium, Be
C) iron, I
D) silicon, Si
E) magnesium, Mg

13) What is the formula mass of copper(II) fluoride? $CuF_2 \Rightarrow 101.55$ 13) C

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

14) What is the mass percent of chlorine in hydrochloric acid? $HCl = 35.453 + 1.0079 = 36.4609$ 14) D

$\frac{35.453}{36.4609} \times 100 = 97.24\%$

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

15) The elements with the highest electronegativity values tend to be found in the: 15) 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.

16) What is the theoretical yield of waffles if you have 5 cups of flour, 9 eggs and 3 tbs of oil? 16) C
Given: 2 cups flour + 3 eggs + 1 tbs oil → 4 waffles

$2.5 \downarrow \quad 2:3:1:4 \quad 4 \times 2.5 = 10$
$5:9:3:x$

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

17) Which color of the visible spectrum has the longest wavelength (750 nm)? 17) E

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

18) How many subshells are there in the n = 4 principal shell? 18) B

↳ s, p, d, f

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

19) What do the alkali metals all have in common? 19) E

✓ A) They all have similar physical properties.
✓ B) They all undergo similar reactions.
✓ C) They all form +1 ions.
✓ D) They all have the same number of valence electrons.
✓ E) all of the above

20) 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? 20) D

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

$(453.0 - 17.5\ mmHg) = 435.5\ mmHg \times \frac{1\ atm}{760\ mmHg}$

$= 0.573\ atm$

21) When you make ice cubes: 21) D

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

22) 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. 22) A

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

$45\ kJ \times \frac{1\ mol}{40.6\ kJ} \times \frac{18\ g\ H_2O}{1\ mol} = 19.95 \approx 20.0$

$= 20.0$

23) Which statement is TRUE in describing what occurs when a solid melts to a liquid? 23) 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

24) Gas density can be calculated by dividing the mass of gas by its volume. If you took a balloon of gas and then warmed the balloon in a sunny window, what can now be said about the density of the gas in the balloon? 24) A

A) The gas density will decrease.
B) The gas density will increase.
C) The gas density will remain the same.
D) The density of gases is independent of temperature.
E) none of the above

$d = \frac{m}{V}$ $V \propto T$ $m \propto \frac{1}{V}$ $\uparrow T, \uparrow V, \downarrow m$

25) If each of the following gas samples have the same temperature and pressure, which sample has the greatest volume? 25) A/B

A) all have the same volume
B) 1 gram of H_2
C) 1 gram of O_2
D) 1 gram of Ar
E) not enough information

26) When an ionic compound dissolves in water: 26) D

✓ A) the solvent-solute attractive forces overcome the solute-solute attractions.
✓ B) the negative end of water dipoles attract the positive ions.
✓ C) the positive end of water dipoles attract the negative ions.
✓ D) each of the above (A, B, and C) occurs.
E) none of the above (A, B, or C) occurs.

27) A 90.0 g sample of NaOH is dissolved in water and the solution is diluted to give a final volume of 3.00 liters. The molarity of the final solution is _____. 27) C

A) 0.500 M
B) 2.25 M
C) 0.750 M
D) 1.00 M
E) none of the above

$90.0\ g\ NaOH \times \frac{1\ mol\ NaOH}{40\ g\ NaOH} = 2.25\ mol$

$M = \frac{2.25\ mol}{3\ L} = 0.750\ M$

28) Which of the following acids is a diprotic, weak acid? 28) D

X A) sulfuric acid H_2SO_4
X B) hydrobromic acid HBr
X C) phosphoric acid
✓ D) carbonic acid H_2CO_3
E) none of the above

29) Substances that can act both as an acid and as a base are called: 29) C

A) buffers.
B) indicators.
C) amphoteric.
D) neutral.
E) none of these

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

30) One mole of chlorine gas has a mass of 35.45 grams. $Cl_2 = 70.9\ g$ 30) B

31) The conversion factor for pressure is 1 mm Hg = 1 atm. 31) B

32) Salt water is an example of a strong electrolyte solution. 32) A

33) The major component in a solution is called the solute. 33) B

34) A Bronsted-Lowry acid is a proton donor. 34) A

35) H^+ is called the hydronium ion. 35) A/B