Exam 3

Part I: Multiple Choice (2 points each)

Directions: Please circle the *best* answer for each of the following questions.

Question 1. When it rains or snows, the air temperature seems warmer. Why?

1. When something is falling, friction occurs that release heat.
2. When water vapor condenses or liquid water freezes, heat is released, which warms the air.
3. When it rains or snows, the warm wind always blow from the south.
4. all of the above
5. none of the above

Question 2. Compare the electron-dot formulas of CH4 and H2O. Why do these molecules have similar bond angles, but different names for their shapes? The central atom C has \_\_\_\_\_ than the central atom O.

1. two more bonded atoms
2. the smaller atomic radius
3. the smaller charge
4. is more electronegative
5. has more valence electrons.

Question 3. \_\_\_\_\_\_ has the highest energy.

1. Alpha particles
2. Gamma rays
3. Visible light
4. Beta particles
5. all of the above

Question 4. One symptom of mild radiation sickness is

1. a raised white cell count.
2. a raised red blood cell count.
3. a white cell count of zero.
4. a lowered white cell count.
5. death

Question 5. What is the number of protons in thallium-210, $$?

1. 129
2. 201
3. 81
4. 291
5. 210

Question 6. The pressure exerted by the particles of vapor above a liquid is called the \_\_\_\_ pressure.

1. standard
2. molar
3. atmospheric
4. barometric
5. vapor

Question 7. 1 mole of a gas occupies 22.4 L at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. 100 °C and 1 atm
2. 0 K and 12 kPa
3. 0 °C and 0.50 atm
4. 0 °C and 760 mm Hg
5. 273 K and 15 psi

Question 8. In the kinetic molecular theory of gas behavior, the distance between gas molecules is assumed to be \_\_\_\_ the diameter of the gas molecules.

1. dependent on
2. larger relative to
3. small relative to
4. approximately the same as
5. 22.4 times

Question 9. Which of the following compounds contains a polar covalent bond?

1. O2
2. Br2
3. MgO
4. NaF
5. HCl

Question 10. Which of the following can be used to measure a volume?

1. Graduated cylinder
2. Balance
3. Ruler
4. Test tube
5. Bunsen burner

Part II: Short Answer

Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work.

Question 1. Do the following statements describe (1) an alpha particle, (2) a beta particle, or (3) a gamma ray (4 points)?

1. Least penetration \_\_\_\_\_(1) alpha particle\_\_\_\_\_\_
2. Charge = -1 \_\_\_\_\_(2) beta particle\_\_\_\_\_\_\_
3. Mass = 0 amu \_\_\_\_\_(3) gamma ray\_\_\_\_\_\_\_
4. Fastest particle \_\_\_\_\_\_\_(3) gamma particle\_\_\_\_\_

Question 2. What is fusion (2 points)?

 Fusion is the process of two nuclei merging to form the nucleus of a heavier element.

Question 3. A nurse administered 2.90 mL of a technetium-99m radioactive solution that has an activity of 145 µCi/mL (6 points).

1. What total dose of the radioisotope did the patient receive?

$$2.90 mL×\frac{145 μCi}{1 mL}=420.5 μCi≈421 μCi$$

1. Write the nuclear decay reaction for technetium-99m.

$$\rightarrow +$$

Question 4. Iridium-192 decays by beta emission and has a half-life of 74 days (8 points).

1. Write the nuclear decay reaction of iridium-192.



1. If an iridium-192 sample has an initial activity of 560 distintigrations per minute (dpm), how much time is required for the activity to drop to 35 dpm, given that?

560 dpm 🡪 280 dpm 🡪 140 dpm 🡪 70 dpm 🡪 35 dpm

 

Question 5. For each of the following bonding, indicate the positive δ+ end and the negative δ- end. Draw an arrow to show the dipole moment for each (4 points).

 δ+  δ- δ- δ+ δ+ δ-

* 1. Si-Br
	2. N-H
	3. Se-F

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Question 6. Match the molecule to its shape: linear, bent, trigonal planar, trigonal pyramidal, or tetrahedral (8 points).

1. Ammonia, NH3 \_\_\_\_\_trigonal pyramidal\_\_\_\_\_\_\_\_\_\_
2. Hydrogen sulfide, H2S \_\_\_\_\_bent\_\_\_\_\_\_\_\_\_
3. Carbon tetrachloride, CCl4 \_\_\_\_\_tetrahedral\_\_\_\_\_\_\_\_\_\_
4. Nitrogen, N2 \_\_\_\_\_linear\_\_\_\_\_\_\_\_\_\_
5. Sulfur dioxide, SO2 \_\_\_\_\_bent\_\_\_\_\_\_\_\_\_\_
6. Carbon dioxide, CO2 \_\_\_\_\_linear\_\_\_\_\_\_\_\_\_\_
7. Sulfur trioxide, SO3 \_\_\_\_\_trigonal planar\_\_\_\_\_\_\_\_\_\_
8. Carbon monoxide, CO \_\_\_\_\_linear\_\_\_\_\_\_\_\_\_\_

Question 7. Arrange the molecules H2O, H2, and HBr in order of decreasing boiling point (3 points).

 H2O > HBr > H2

Question 8. Answer the following questions about CHCH (7 points):

1. Draw the Lewis Structure H-C≡C-H
2. Identify the electron pair geometry around the carbon atoms: linear
3. Identify the molecular geometry around the carbon atoms: linear
4. What is the H-C-C bond angle? 180°
5. What type of hydrocarbon is ethyne, HCCH? Alkyne

Question 9. If the heat of fusion of water is 334 joules/g, how many kilojoules are needed to melt 45.0 g of ice at 0 °C (5 points)?

$$q=m∆H=45.0 g ×334\frac{J}{g}×\frac{1 kJ}{1000 J}=15.0 kJ$$

Question 10. State whether the following list of properties is most descriptive of an ionic, a molecular, or a metallic solid (3 points).

1. wide melting point range, malleable, ductile, conductor of electricity.

Metallic solid

1. high melting point, hard, soluble in water, conductor of electricity when melted.

Ionic solid

1. low melting point, generally insoluble in water, nonconductor of electricity

Molecular solid

Question 11. If a package of potato chips contains 0.132 L of air on the ground where the atmospheric pressure is 760 torr, what is the pressure in the airplane if the volume increases to 0.243 L after takeoff (5 points)?

V1 = 0.132 L

P1 = 760 torr

V2 = 0.243 L

$$P\_{1}V\_{1}=P\_{2}V\_{2}⇒P\_{2}=P\_{1}\frac{V\_{1}}{V\_{2}}=\left(760 torr\right)\left(\frac{0.132 L}{0.243 L}\right)=413 torr$$

Question 12. Zinc metal, Zn, was allowed to react with hydrochloric acid, HCl, to produce hydrogen gas, H2, and aqueous zinc chloride, ZnCl2, and gave a total of 555 mL of gas collected over water at 20 °C and a pressure of 747 mm Hg (6 points).

1. What type of reaction is being conducted? \_\_\_\_\_Single Replacement or Oxidation-Reduction Reaction\_\_\_\_\_\_\_\_
2. What is the pressure of the dry hydrogen gas in atm, if the vapor pressure of water at 20 °C is 18 mm Hg?

$$P\_{total}=P\_{H\_{2}}+P\_{H\_{2}O}⇒P\_{H\_{2}}=P\_{total}-P\_{H\_{2}O}$$

$$P\_{H\_{2}}=747 mm Hg-18 mm Hg=729 mm Hg×\frac{1 atm}{760 mm Hg}=0.959 atm$$

Question 13. A volume of 18.0 L contains a mixture of 0.250 moles N2, 0.250 mole O2, and an unknown quantity of He. The temperature of the mixture is 0 °C, and the total pressure is 1.00 atm. How many grams of helium are present in the gas mixture (10 points)?

V = 18.0 L

nnitrogen = 0.250 mol

noxygen = 0.250 mol

T = 0 °C +273 = 273 K

P = 1.00 atm

$$PV=nRT⇒n=\frac{PV}{RT}=\frac{(1.00 atm)(18.0 L)}{(0.0821 \frac{L atm}{mol K})(273 K)}=0.803 mol$$

$$m\_{helium}=0.803 mol-0.250 mol-0.250 mol=0.303 mol He×\frac{4.00 g He}{1 mol He}=1.21 g He$$

Question 14. Butane gas is used in many lighters available. The butane, C4H10, evaporates and reacts with oxygen gas according to the unbalanced equation below (4 points):

2 C4H10 (g) + 13 O2 (g) 🡪 8 CO2 (g) + 10 H2O (l)

 How many L of carbon dioxide would result from the reaction of 12.0 L of butane with excess oxygen gas at a temperature of 65 °C and a pressure of 1.359 atm?

$$12.0 L C\_{4}H\_{10}×\frac{8 L CO\_{2}}{2 L C\_{4}H\_{10}}=48.0 L CO\_{2}$$

Question 15. Are the following statements about gases true or false (5 points)?

1. Gas law calculations normally require the use of the Kelvin temperature scale. \_\_True
2. The volume of 1 mole of any gas at STP is 22.4 L. \_\_\_\_\_True\_\_\_\_\_
3. STP stands for 25 °C and 760 mm Hg. \_\_\_\_\_False\_\_\_\_\_
4. Charles’ law states that the volume of a gas is inversely proportional to moles. \_False
5. If the volume of a gas and the Kelvin temperature are reduced by one-half there is no change. \_\_\_\_\_True\_\_\_\_\_