

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 = $42 + (27 \times 3) = 81 = 123$

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 magnesium. (6 pts.)

1) _____

$$\frac{1.56 \times 10^{21} \text{ atoms Mg} \quad | \quad 1 \text{ mol Mg} \quad | \quad 24.3 \text{ g Mg}}{6.02 \times 10^{23} \text{ atoms Mg} \quad | \quad 1 \text{ mol Mg}}$$

$$\approx \boxed{0.0630 \text{ g Mg.}} \quad \checkmark$$

2) Calculate how many grams of HNO_3 is produced when 2.0 moles of NO_2 reacts with water in the following reaction: $\text{H}_2\text{O} (\text{l}) + 3 \text{NO}_2 \rightarrow \text{NO} (\text{g}) + 2 \text{HNO}_3 (\text{aq})$ (6 pts.)

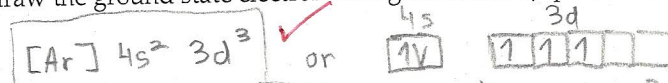
2) _____

$$\frac{2.0 \text{ mole NO}_2 \quad | \quad 2 \text{ mol HNO}_3 \quad | \quad 63.0 \text{ g HNO}_3}{3 \text{ mol NO}_2 \quad | \quad 1 \text{ mol HNO}_3} \approx \boxed{84 \text{ g HNO}_3.} \quad \checkmark$$

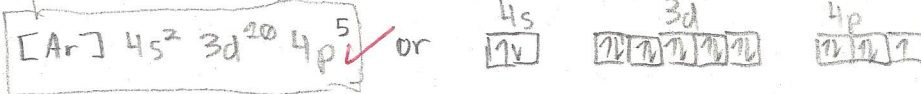
3) Use a noble gas core to draw the ground state electron configuration for (4 pts./each; Total = 8 pts.)

3) _____

(a) Vanadium (V; Z=23):



(b) Bromine (Br, Z=35)



4) Given the following isotope symbol, circle the element it represents in the choices (3 pts.).

4) C



(a) Ge

(b) Cl

(c) P \checkmark

(d) Ag

(e) Xe

5) Circle the best choice among the following elements that has the largest atomic radius (3 pts.).

5) D

- (a) Cl (b) Si (c) Mg (d) Na (e) S

6) A sample of gas in an expandable container is heated from 200 K to 400K while maintaining constant pressure. If the starting volume was 1.0 liter, what is the volume after heating? Circle the best possible choice (4 pts.).

6) B

- (a) 1.0 liters (b) 2.0 liters (c) 0.5 liters
(d) 1.5 liters (e) 2.5 liters

$$P_1 = P_2 ; \quad \frac{nRT_1}{V_1} = \frac{nRT_2}{V_2} ;$$

$$V_2 = \frac{T_2}{T_1} \cdot V_1 = \frac{400K}{200K} \times 1.0L = 2.0L$$

7) Given two 1-L balloons, one containing Argon gas at 1 atm and 25°C and the other Neon gas at 1 atm and 25°C, write T for true statements and F for false statements shown below (4 pts.).

7) _____

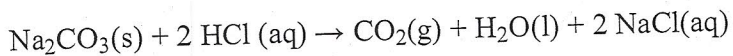
- (a) T The two balloons will have the same number of moles of atoms.
(b) F The balloon with Argon gas would have larger number of atoms.
(c) F The balloon with Neon gas would have larger mass.
(d) F Both balloons would have identical number of atoms and masses.

STP conditions \Rightarrow 1 mol any gas = 22.4L

Same volume \Rightarrow
Same moles

8) How many moles of NaCl (aq) will be produced when 3.5 moles of Na₂CO₃(s) react according to the given balanced chemical reaction? Circle the best possible choice. (4 pts.).

8) C



- (a) 3.5 moles (b) 2.0 moles (c) 7.0 moles
(d) 1.0 mole (e) 1.8 moles

$$\frac{3.5 \text{ mol } Na_2CO_3}{1 \text{ mol } Na_2CO_3} \times \frac{2 \text{ mol } NaCl}{1 \text{ mol } Na_2CO_3} = 7.0 \text{ mol } NaCl$$

