

1. Which of the following values has 3 significant figures?

- (1) 0.032
- (2) 700
- (3) 50.
- (4) 0.000430
- (5) .004

2. 57mL of 0.50 M solution of sodium hydroxide is needed to neutralize 22mL of hydrobromic acid of unknown concentration during a titration. Write out the reaction formula then find the unknown concentration of the acid.

3. Compound Z has two stable isotopes: Z-45 and Z-44. Z-45 has a mass of 44. 9757 amu and Z-44 has a mass of 43.899 amu. If the atomic mass of Z is 44.3026 amu, then what is the abundance of isotope Z-44?

- (1) 37.5%
- (2) 62.5%
- (3) 78.3%
- (4) 23.3%
- (5) 13.5%

4. Determine the net ionic equation of the reaction between sodium phosphate and calcium nitrate.

5. Complete combustion of a hydrocarbon yielded 3.2 g of  $\text{H}_2\text{O}$  and 4.5 g of  $\text{CO}_2$ . If the sample was found to have a mass of 124.3 g/mol, how many carbons are in the molecular formula of the hydrocarbon?

- (1) 2
- (2) 4
- (3) 5
- (4) 6
- (5) 8

6. What is the percent mass of hydrogen in the molecular formula of the hydrocarbon determined in the previous question?

- (1) 22.7%
- (2) 32.1%
- (3) 87.3%
- (4) 11.2%
- (5) 32.5%

7. 10.2 mL of 0.30 M ammonium carbonate and 14.2 mL of 0.45 M of magnesium sulfate solutions undergo a double displacement reaction, what is the concentration of the insoluble product?

- (1) 0.225 M
- (2) 0.500 M
- (3) 0.750 M
- (4) 0.125 M
- (5) 0.450 M

8. What is the mass of the excess reactant in the previous problem?

- (1) 0.500 g
- (2) 0.401 g
- (3) 0.223 g
- (4) 0.445 g
- (5) 0.695 g

9. Which of the following pairs have the higher boiling point?

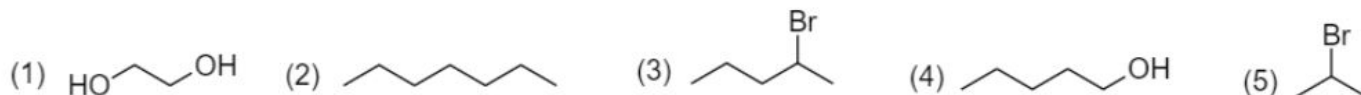
**A:  $\text{CH}_3\text{CH}_2\text{OH}$  vs.  $\text{CH}_3\text{CH}_2\text{Br}$**

**B:  $\text{H}_2\text{O}$  vs.  $\text{H}_2\text{S}$**

**C: Propane ( $\text{C}_3\text{H}_8$ ) vs. Decane ( $\text{C}_{10}\text{H}_{22}$ )**

- (1)  $\text{CH}_3\text{CH}_2\text{OH}$ ,  $\text{H}_2\text{S}$ , Propane
- (2)  $\text{CH}_3\text{CH}_2\text{OH}$ ,  $\text{H}_2\text{O}$ , Decane
- (3)  $\text{CH}_3\text{CH}_2\text{Br}$ ,  $\text{H}_2\text{S}$ , Decane
- (4)  $\text{CH}_3\text{CH}_2\text{Br}$ ,  $\text{H}_2\text{O}$ , Propane

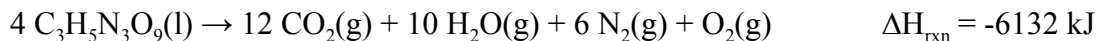
10. Which of the following would you expect to have the highest vapor pressure at a given temperature?



11. Consider a solution that is 43% (m/m) bromoform ( $\text{CHBr}_3$ ) in acetone ( $\text{C}_3\text{H}_6\text{O}$ ). What volume of bromoform would be needed to prepare 400 mL of this solution?

- (1) 55.6 mL
- (2) 20.3 mL
- (3) 68.5 mL
- (4) 90.3 mL
- (5) 32.1 mL

12. The explosive nitroglycerin ( $\text{C}_3\text{H}_5\text{N}_3\text{O}_9$ ) decomposes rapidly upon ignition according to the following equation:



Calculate the standard enthalpy of formation ( $\Delta H_f$ ) for nitroglycerin. For  $\text{CO}_2(\text{g})$ ,  $\Delta H_{\text{rxn}} = -393.5$  kJ/mol. For  $\text{H}_2\text{O}(\text{g})$ ,  $\Delta H_{\text{rxn}} = -241.82$  kJ/mol.

- (1) -252.05 kJ/mol
- (2) -1008 kJ/mol
- (3) 458.8 kJ/mol
- (4) 569.7 kJ/mol
- (5) -392.1 kJ/mol

13. Which specie is isoelectronic with Ar?

- (1) Ne
- (2)  $\text{F}^-$
- (3)  $\text{O}^{2-}$
- (4)  $\text{Ca}^{2+}$
- (5)  $\text{Mg}^{2+}$

14. What are the correct molecular geometries for  $\text{XeF}_4$ ,  $\text{SOCl}_2$ ,  $\text{SF}_6$ ,  $\text{ClF}_5$ ,  $\text{H}_2\text{O}$  respectively?

15. In a coffee-cup calorimeter, 2.45 g of  $\text{KNO}_3$  is dissolved in enough water to make 25.0 mL of solution. The initial temperature is  $26.5^\circ\text{C}$  and the final temperature is  $21.3^\circ\text{C}$ . Calculate the change in enthalpy for the dissolution of  $\text{KNO}_3$  in kJ/mol. (Assuming 1.0 g/mL as the density of the solution).

- (1) 11.2 kJ/mol
- (2) 4.22 kJ/mol
- (3) 22.4 kJ/mol
- (4) 72.5 kJ/mol
- (5) 34.9 kJ/mol

16. The laser emits photons with  $\lambda = 640 \text{ nm}$ . How many photons from this laser would be required to heat 13.5 g of pure solid lead (specific heat capacity =  $0.127 \text{ J/}^\circ\text{C}\cdot\text{g}$ ) from  $25^\circ\text{C}$  to its melting point ( $327^\circ\text{C}$ )?

- (1)  $2.31 \times 10^{23}$
- (2)  $6.77 \times 10^{20}$
- (3)  $4.04 \times 10^{18}$
- (4)  $2.03 \times 10^{18}$
- (5)  $1.67 \times 10^{18}$

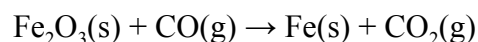
17. What atom has the electron configuration:  $[\text{Xe}] 6s^1 4f^{14} 5d^{10}$ ; Next, what is the electron configuration of Tungsten (W) using the noble gas abbreviation?

18. How many atoms of sulfur are in a 4.0 g sample of  $\text{S}_7\text{O}_2$ ?

- (1)  $5.44 \times 10^{23}$
- (2)  $6.87 \times 10^{22}$
- (3)  $2.12 \times 10^{22}$
- (4)  $6.57 \times 10^{22}$
- (5)  $9.33 \times 10^{23}$

19. Identify the conjugate acid and base when hydrobromic acid reacts with water.

20. The following reaction is used to obtain iron from iron ore:



The reaction of 88.32 g  $\text{Fe}_2\text{O}_3$  with 102.3 g CO produces 43.5 g  $\text{CO}_2$ . Determine the percent yield. (Don't forget to check if the reaction is balanced)

- (1) 69.3%
- (2) 93.2%
- (3) 11.2%
- (4) 43.6%
- (5) 59.6%