

Question 1

Part I

30

 **Underline the Correct answer for items (1-15) .**

1. When the following chemical equation is balanced, what is the correct mole ratio between KClO_3 and O_2 ?



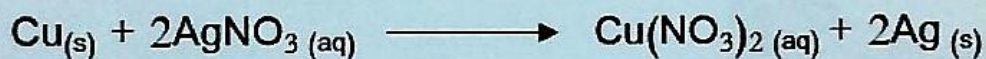
☐ 1:1

☒ 1:2

☐ 1:3

☐ 2:3

2. According to the following equation, how many **moles of Cu** is required to react with **5.8 moles of AgNO_3** ?



☐ 2.9

☐ 3.8

☐ 5.8

☐ 11.6

3. What is the heterogeneous mixture of **intermediate** sized particles called?

☐ Solute

☐ Suspension

☐ Colloid

☐ Solution

4. What is the volume (L) of stock solution **5.0M H_2SO_4** you would need to prepare **100.0 mL solution of 0.25M H_2SO_4** ?

☐ 0.00050

☐ 0.0050

☐ 0.050

☐ 0.50

5. What explains the solvation (solubility) of sucrose in water?

☐ Sucrose molecules are polar and water molecules are polar

☐ Sucrose molecules are polar while water molecules are nonpolar

☐ Sucrose molecules are nonpolar while water molecules are polar

☐ Sucrose molecules are nonpolar and water molecules are nonpolar

6. The solubility of a gas at **10.0 atm** of pressure is **0.75 g/L**. What is the pressure (**atm**) applied on a (**1.0 L**) solution containing **1.5 g** of the gas?

☐ 5

☐ 10

☐ 15

☐ 20

7. A nail has a mass of **25.0 g** made of alloy, absorbs **250 J** of heat as its temperature changes from **25.0 °C** to **78.0 °C**. What is the specific heat (**J/g.°C**) of the alloy?

☐ 0.567

☐ 0.378

☐ 0.189

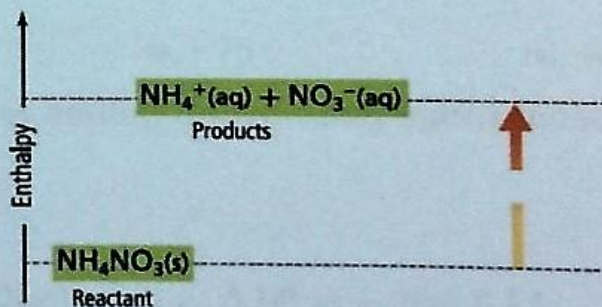
☐ 0.0945

8. A breakfast meal contains **95.0 Cal**. How much is this energy in **Joules**?

(1cal = 4.184J)

☐ 3.97×10^5
☐ 2.27×10^4
☐ 3.97×10^2
☐ 2.27×10^1


9. Which of the following statements is **correct** for the figure below?

☐ $H_{\text{products}} < H_{\text{reactants}}$
☐ $H_{\text{products}} > H_{\text{reactants}}$
☐ $H_{\text{products}} = H_{\text{reactants}}$
☐ The sign of ΔH_{rxn} is negative


10. What is the amount of heat energy required for the vaporization of **4.33 moles** of water at **100°C** ($\Delta H_{\text{vap}}^0 = 40.7 \text{ kJ/mol}$)

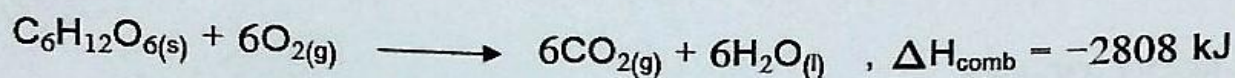
☐ 176 kJ

☐ 142 kJ

☐ 115 kJ

☐ 85.0 kJ

11. According to the following chemical reaction, how much heat is evolved when **0.300 moles** of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) is burned?



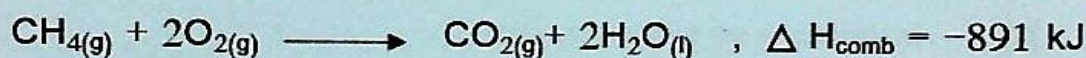
- ☐ 280 kJ
 ☐ 350 kJ
 ☐ 421 kJ
 ☐ 842 kJ

12. Which of the following **does not** shift the equilibrium below to the **right**?



- ☐ Decreasing the concentration of NO_2
☐ Increasing the concentration of N_2O_4
☐ Increasing the pressure
 ☐ Increasing the temperature

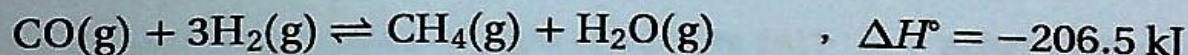
13. Using the reaction below and table data, what is ΔH_f° of methane CH_4 (kJ/mol)?



Compound	ΔH_f°
$\text{CO}_{2(g)}$	-394 kJ/mol
$\text{H}_2\text{O}_{(l)}$	-286 kJ / mol

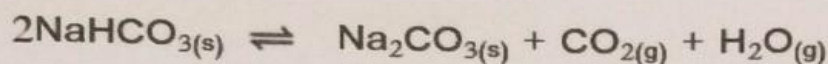
- ☐ -185
 ☐ -135
 ☐ -75
 ☐ -47

14. In the reaction below, **what is the effect of adding dehydrating agent (absorbs water) to the reaction vessel?**



- ☐ The equilibrium shifts to the right
 ☐ K_{eq} decreases in value
☐ The concentration of CH_4 decreases
 ☐ The concentration of H_2 increases

15. What is the equilibrium constant expression for the following reaction?



$$\frac{[\text{NaHCO}_3]^2}{[\text{Na}_2\text{CO}_3][\text{CO}_2][\text{H}_2\text{O}]}$$

$$\frac{[\text{Na}_2\text{CO}_3][\text{CO}_2][\text{H}_2\text{O}]}{[\text{NaHCO}_3]^2}$$

$$[\text{CO}_2][\text{H}_2\text{O}]$$

$$\frac{[\text{Na}_2\text{CO}_3]}{[\text{NaHCO}_3]}$$

Question 2

Part II

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Write the scientific terms for the following definitions between brackets.

16. The study of quantitative relationships between the amounts of reactants used and amounts of products formed by a chemical reaction	(.....)
17. If a stress is applied to a system at equilibrium, the system shifts in the direction that relieves the stress	(.....)
18. A solution that contains the maximum amount of dissolved solute for a given amount of solvent at a specific temperature and pressure	(.....)
19. An insulated device used for measuring the amount of heat absorbed or released during a chemical or physical process	(.....)
20. The energy that is stored in a substance because of its composition	(.....)

21. When a beam of light is shone through two unknown mixtures as shown below.

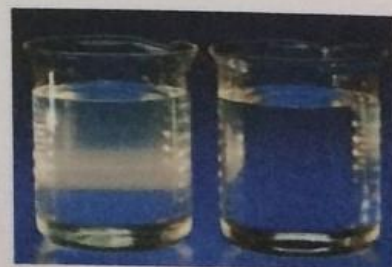
– What happened to the beam of light in mixture (A)?

.....

– What happened to the beam of light in mixture (B)?

.....

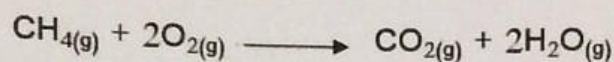
– What do we call this effect?



A

B

22. In the combustion reaction of methane below, show that the law of conservation of mass is observed



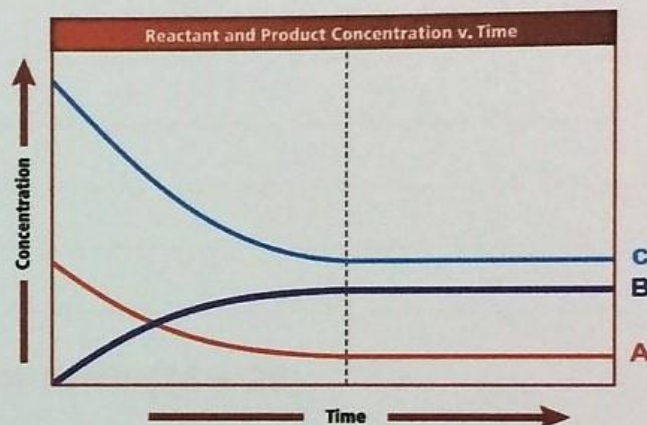
($\text{CH}_4 = 16.04 \text{ g/mol}$, $\text{O}_2 = 32 \text{ g/mol}$, $\text{CO}_2 = 44 \text{ g/mol}$, $\text{H}_2\text{O} = 18.02 \text{ g/mol}$)

23. The figure below shows the changes in the concentrations of the reactants and the products in a chemical reaction.

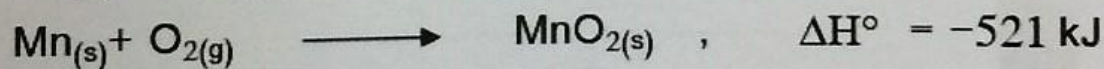
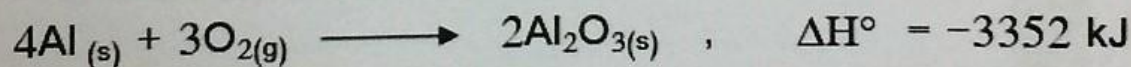
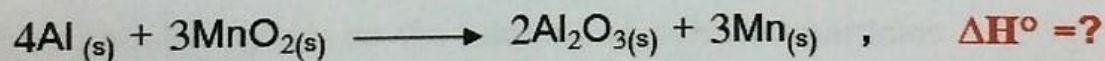
- What are the **reactants**?

- What is the **product**?

- What happens to the concentrations of the reactants and the products at equilibrium?



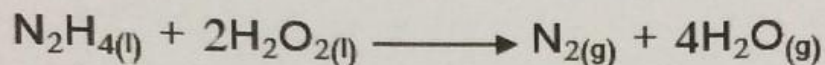
24. Use Hess's law and the following two reactions to determine ΔH°_f for the next reaction.



Question 3

25. Solve the following.

Liquid hydrazine (N_2H_4) reacts with liquid hydrogen peroxide (H_2O_2) in rocket fuel. Nitrogen gas and water are produced according to the following equation.



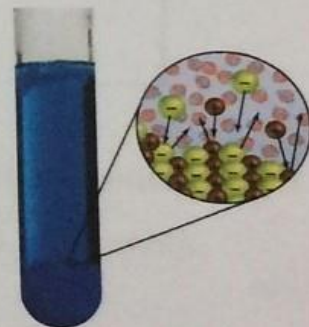
What is the mass of hydrazine (N_2H_4) in grams is required to produce 280.2 g of N_2 ?

($\text{N}_2\text{H}_4 = 32.06 \text{ g/mol}$, $\text{H}_2\text{O}_2 = 34.02 \text{ g/mol}$, $\text{N}_2 = 28.02 \text{ g/mol}$, $\text{H}_2\text{O} = 18.02 \text{ g/mol}$)

 Give an appropriate scientific explanation for items (26 – 29)

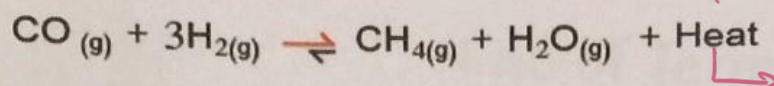
26. Brownian motion takes place in liquid colloids.

27. In the opposite figure, as the number of solvated particles increases the crystallization takes place.



28. Chemists are usually more interested in changes in energy during reactions than in the absolute amounts of energy contained in the reactants and products.

29. In the reaction below, K_{eq} increases in value when the temperature is lowered.

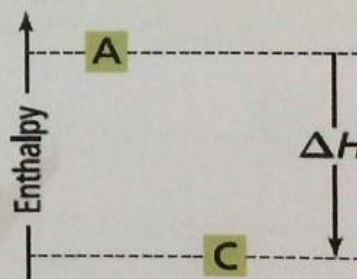


30. What is the molarity of 250.0 mL aqueous solution containing 20.0 g of CaCO_3 ?
($\text{CaCO}_3 = 100\text{g} / \text{mol}$)

31. What is the molality of a solution containing 19.23 g of naphthalene (C_{10}H_8) dissolved in 500.0 g of toluene? ($\text{C}_{10}\text{H}_8 = 128.2\text{g} / \text{mol}$)

32. The reaction $\text{A} \longrightarrow \text{C}$ is shown in the enthalpy diagram below.
Is the reaction exothermic or endothermic?

Explain your answer.



33. Calculate K_{eq} for the following equilibrium, if the concentration at equilibrium are

$$[\text{N}_2] = 0.20\text{ mol/L}, [\text{O}_2] = 0.15\text{ mol/L}, [\text{NO}] = 0.0035\text{ mol/L}$$

