

(1) Consider the reaction of a solution of silver nitrate with a solution of sodium chloride to form a precipitate of silver chloride and a solution of sodium nitrate. This is a reaction of the following type:

- a) exchange b) combination c) displacement d) decomposition e) none of these.

A because the equation should look like: $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$

(2) What is the coefficient of Fe_2O_3 in the balanced equation for $\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow \text{Fe}_3\text{O}_4 + \text{CO}_2$?

- a) 1 b) 2 c) 3 d) 4 e) none of the previous.

C because the balanced equation is: $3 \text{Fe}_2\text{O}_3 + \text{CO} \rightarrow 2 \text{Fe}_3\text{O}_4 + \text{CO}_2$

(3) Suppose you want to convert grams of CH_4 to molecules of CO_2 in the following reaction:

$\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$, what is the best sequence in the “concept map” for this conversion?

- a) g CH_4 to moles CH_4 to moles CO_2 to grams CO_2 to molecules of CO_2 .
 b) g CH_4 to moles CH_4 to moles H_2O to moles CO_2 to molecules of CO_2 .
 c) g CH_4 to moles CH_4 to grams CO_2 to moles CO_2 to molecules of CO_2 .
 d) g CH_4 to moles CH_4 to moles CO_2 to molecules of CO_2 .
 e) none of the above.

D: because that is the best one (B is not the best but it is possible). Note: you need to go from moles CO_2 to molecules CO_2

(4) How many moles of oxygen atoms are in 3.5 micrograms of oxalic acid, ($\text{H}_2\text{C}_2\text{O}_4$, 90.g/mol)?

- a) 3.9×10^{-8} b) 1.6×10^{-7} c) 6.02×10^{23} d) 7.5×10^{-2} e) none of the previous.

B because: # moles O = $3.5 \times 10^{-6} \text{g H}_2\text{C}_2\text{O}_4 (1 \text{mol H}_2\text{C}_2\text{O}_4 / 90. \text{g H}_2\text{C}_2\text{O}_4) (4 \text{ mol O} / 1 \text{ mol H}_2\text{C}_2\text{O}_4) = 1.6 \times 10^{-7}$

(5) How many atoms of carbon are in 2.00 milligrams of methane (CH_4 , 16.0 g/mole) ?

- a) 0.000125 b) 7.52×10^{19} c) 6.02×10^{23} d) 7.5×10^{22} e) none of the previous.

B: #atoms C = $2 \times 10^{-3} \text{g CH}_4 (1 \text{mol CH}_4 / 16.0 \text{g CH}_4) (1 \text{mol C} / 1 \text{mol CH}_4) (6.02 \times 10^{23} \text{ atoms C} / \text{mol C}) = 7.5 \times 10^{19}$

(6) Based on the balanced equation: $\text{O}_3 + 3\text{NO} \rightarrow 3\text{NO}_2$, how many grams of NO_2 do you expect to get if you react 1.5 grams of O_3 completely?

- a) 1.5 g NO_2 b) 1.0 g NO_2 c) 2.25 g NO_2 d) 4.3 g NO_2 e) none of the previous.

D : #g $\text{NO}_2 = 1.5 \text{g O}_3 (1 \text{mol O}_3 / 48.0 \text{g O}_3) (3 \text{ mol NO}_2 / \text{mol O}_3) (46 \text{g NO}_2 / \text{mol NO}_2) = 4.3 \text{g NO}_2$

(7) How many grams of ammonia, NH_3 , will form if you let 3.0 g of hydrogen gas react with excess nitrogen gas assuming that the % yield is 50%? (Hint: write the balanced equation first).

- a) 8.5 g b) 4.3 g c) 17 g d) 12.8 g e) none of the previous.

A: balanced equation: $\text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3$;

#g $\text{NH}_3 = 3.0 \text{g H}_2 (1 \text{mol H}_2 / 2.0 \text{g H}_2) (2 \text{ mol NH}_3 / 3 \text{ mol H}_2) (17.0 \text{g NH}_3 / \text{mol NH}_3) (0.50) = 8.5 \text{g NH}_3$

(8) Suppose that the empirical formula of a compound is CH_2O . Which of the following compounds could it possibly be?

- a) glycerol, $\text{C}_3\text{H}_8\text{O}_3$ b) acetic acid, $\text{CH}_3\text{CH}_2\text{OH}$ c) sucrose, $\text{C}_{12}\text{H}_{22}\text{O}_{12}$ d) oxalate, $\text{C}_2\text{O}_4^{2-}$
 e) fructose, $\text{C}_6\text{H}_{12}\text{O}_6$.

E: Only this one has the empirical formula being asked for.

(9) Suppose that in the following equation, $2 \text{CH}_4 \rightarrow \text{C}_2\text{H}_6 + \text{H}_2$, the reactants have an energy of 50. kJ and the products have an energy of 35 kJ. The top of the energy of activation “hill” is 71 kJ.

Choose the correct statement about this reaction:

a) The reaction is endothermic, b) $\Delta E_{\text{rxn}} = + 15 \text{ kJ}$, c) $E_a = 36 \text{ kJ}$, d) $E_a = -21 \text{ kJ}$ e) none of these.

E: None of these is correct.

(10) According to Collision Theory, which of the following factors does not affect the frequency of collision among gas molecules but still leads to increased reaction rates?

a) Temperature, b) concentration c) orientation d) higher activation energy
e) pressure

C: only orientation is not related to frequency of collision.

(11) Consider the equilibrium equation: $\text{CH}_4(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons \text{CH}_2\text{O}(\text{l}) + \text{H}_2\text{O}(\text{l}) + \text{heat}$.

If initially the system is in an airtight container at equilibrium, what will happen if the container is then compressed? a) More CH_4 will form b) CH_2O will decrease c) heat will be evolved

d) There will be no change e) none of the previous.

C: According to LeChatelier's principle, the system will try to ease the pressure by favoring the forward direction. Only C corresponds to an increase in the forward direction.