1. Brass has a density of 8.40 g/cm^3 and a specific heat of 0.385 J/g°C. A 15.2 cm^3 piece of brass at an initial temperature of 163°C is dropped into an insulated container with water initially at 23°C. If the final temperature of the brass-water mixture is 50°C, what is water mass? (specific heat of water 4.18 J/g°C)

a) 27.22 b) 35.24 c) 49.22 d) 52.52 e) 61.07

Brass → releases → H_2O

$d = \frac{m}{V}$

$m = d \times V$

Brass: $d = 8.40\ g/cm^3$, $c = 0.385\ J/g°C$, $V = 15.2\ cm^3$, $T_i = 163°C$, $T_f = 50°C$, m

H_2O: $T_i = 23°C$, $T_f = 50°C$, $m = ?$, $c = 4.18$

$$q_{brass} = -q_{H_2O}$$

$$m_{brass} \cdot c \cdot \Delta T = -(m \cdot c \cdot \Delta T)$$

$$m_{brass} = d \times V = 8.40 \times 15.2\ cm^3 = 127.68\ g$$

$$127.68 \times 0.385 \times (50 - 163) = -(m \times 4.18 \times (50 - 23))$$

$$5554.7 = m \times 112.86$$

$$m = \frac{5554.7}{112.86} = 49.22\ g$$

2. A 0.288 g sample occupies a volume of 131 mL at 24.8°C and 753 mmHg. What is the molecular weight of this sample?

a) 54.18 b) 63.32 c) 71.09 d) 80.12 e) 45.27

$m = 0.288\ g$

$V = \frac{131}{1000}\ ml = 0.131\ L$

$P = \frac{753}{760}\ mmHg = 0.99\ atm$

$T = 24.8\ ^\circ C + 273 = 297.8\ K$

$M_{wt} = ?$

$R = 0.0821$

$PV = nRT$

$PV = \frac{m}{M_r} RT$

$M_r = \frac{mRT}{PV}$

$= \frac{0.288 \times 0.0821 \times 297.8}{0.99 \times 0.131}$

$M_{wt} = 54.18\ g/mol$

3. Which is false for the neutralization reaction between H_2SO_4 and $Al(OH)_3$?

a) The produced salt is Al_2SO_4. b) H_2SO_4 exhibits acidic properties.

c) $Al(OH)_3$ exhibits basic (alkaline) properties.

d) 6 moles of water are produced in the consumption pf 2 moles $Al(OH)_3$.

e) 3 moles of $Al(OH)_3$ are required for the 2 mol of H_2SO_4 consumption.

reaction between acid and base → products: salt + H_2O

ionic compound

pH = 7

$3H_2SO_4 + 2Al(OH)_3 \longrightarrow Al_2(SO_4)_3 + 6H_2O$

4. What is the stoichiometric ratio of $Ba(OH)_2$ to HCl in an acid-base titration?

a) 0.5 b) 1 c) 1.5 d) 2 e) 2.5

$$Ba(OH)_2 + 2HCl \longrightarrow BaCl_2 + 2H_2O$$

$$\frac{Ba(OH)_2}{HCl} = \frac{1}{2} = 0.5$$

$$\frac{HCl}{Ba(OH)_2} = \frac{2}{1} = 2$$

5. A 1.00 g sample of Ne(g) at 1 atm pressure and 27°C is allowed to expand into an evacuated vessel of 2.50 L volume. Does the gas do work? (Ne: 20.18 g/mol)

a) -275.73 b) -120.45 c) 0 d) 120.45 e) 275.73

$m = 1.00\ g$

$P = 1\ atm$

$T = 27°C$

$V = 2.50\ L$

$w = ?$

$\Delta U = -P_{ext}\,\Delta V$

$w = 0$

$P_2 = 0$

adiabatic expansion

$w = 0$

6. By using the three reaction, find the las t reactions ΔH=?

÷ 2 $2\,CH_3OH(g) + 3\,O_2(g) \longrightarrow 2\,CO_2(g) + 4\,H_2O(g)$ $\Delta H = -1353\,kJ$

reverse $H_2CO(g) + O_2(g) \longrightarrow H_2O(g) + CO_2(g)$ $\Delta H = -520\,kJ$

reverse $2\,H_2(g) + O_2(g) \longrightarrow 2\,H_2O(g)$ $\Delta H = -484\,kJ$

÷ 2 $CH_3OH(g) \longrightarrow H_2CO(g) + H_2(g)$ $\Delta H = ?$

a) – 86 b) 86 c) – 120 d) 235 e) – 235

$CH_3OH + \frac{3}{2}O_2 \rightarrow CO_2 + 2H_2O$ $\Delta H = \frac{-1353}{2}$

$H_2O + CO_2 \rightarrow H_2CO + O_2$ $\Delta H = +520$

$H_2O \rightarrow \frac{1}{2}O_2 + H_2$ $\Delta H = +\frac{484}{2}$

b