



Stage 3 - Set 1 Answers: Gases

1. a) i) $15 + 273 = 288 \text{ K}$
 ii) $117 + 273 = 390 \text{ K}$
 iii) $-105 + 273 = 168 \text{ K}$
- b) i) $298 - 273 = 25^\circ\text{C}$
 ii) $473 - 273 = 200^\circ\text{C}$
 iii) $112 - 273 = -161^\circ\text{C}$

2. a)
- $$n(\text{CO}_2) = \frac{0.450 \times 120.1}{299 \times 8.315} = 2.17 \times 10^{-2} \text{ mol}$$
- b)
- $$n(\text{CH}_4) = \frac{0.889 \times 99.3}{(41 + 273) \times 8.315} = 3.38 \times 10^{-2} \text{ mol}$$
- c)
- $$n(\text{N}_2) = \frac{27.5 \times 145}{(273 + 55) \times 8.315} = 1.46 \text{ mol}$$

3. a)
- $$n = \frac{0.559 \times 105}{(25 + 273) \times 8.315} = 2.37 \times 10^{-2} \text{ mol}$$
- $$M = \frac{2.22}{2.19 \times 10^{-2}} = 93.7 \text{ g mol}^{-1}$$
- b)
- $$n = \frac{1.22 \times 98.5}{(75 + 273) \times 8.315} = 4.15 \times 10^{-2} \text{ mol}$$
- $$M = \frac{0.456}{4.15 \times 10^{-2}} = 11.0 \text{ g mol}^{-1}$$
- c)
- $$n = \frac{3.33 \times 68.4}{(120 + 273) \times 8.315} = 6.97 \times 10^{-2} \text{ mol}$$
- $$M = \frac{6.46}{6.97 \times 10^{-2}} = 92.7 \text{ g mol}^{-1}$$

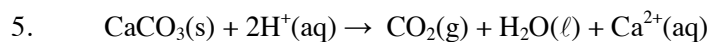
$$4. \quad n = \frac{0.6684 \times 98.0}{(273 + 25) \times 8.315}$$

$$= 2.64 \times 10^{-2} \text{ mol}$$

$$M = \frac{0.761}{2.64 \times 10^{-2}}$$

$$= 28.8 \text{ g mol}^{-1}$$

C_2H_4 (ethene)



$$n(\text{CO}_2) = \frac{0.0255 \times 10^5}{(273 + 25) \times 8.315}$$

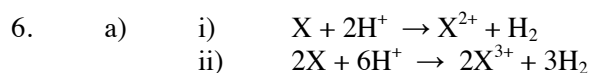
$$= 1.08 \times 10^{-3} \text{ mol}$$

$$n(\text{CaCO}_3) = n(\text{CO}_2)$$

$$= 1.08 \times 10^{-3} \text{ mol}$$

$$m(\text{CaCO}_3) = 1.08 \times 10^{-3} (40.08 + 12.01 + 48.0)$$

$$= 0.108 \text{ g}$$



$$\text{b) } \quad n(\text{H}_2) = \frac{1.34 \times 115}{(32 + 273) \times 8.315}$$

$$= 6.08 \times 10^{-2} \text{ mol}$$

$$\text{i) } \quad n(\text{X}) = 2 \times n(\text{H}_2)$$

$$= 0.122 \text{ mol}$$

$$M(\text{X}) = \frac{2.76}{0.122}$$

$$= 22.7 \text{ g mol}^{-1}$$

$$\text{ii) } \quad n(\text{X}) = n(\text{H}_2)$$

$$= 6.08 \times 10^{-2} \text{ mol}$$

$$M(\text{X}) = \frac{2.76}{6.08 \times 10^{-2}}$$

$$= 45.4 \text{ g mol}^{-1}$$

$$\text{iii) } \quad n(\text{X}) = \frac{2}{3} n(\text{H}_2)$$

$$= 4.05 \times 10^{-2} \text{ mol}$$

$$M(\text{X}) = \frac{2.76}{4.05 \times 10^{-2}}$$

$$= 68.1 \text{ g mol}^{-1}$$

- c) If monovalent $\text{X} = \text{Na}$
 For divalent, no value as close as Na
 For trivalent no viable choice.