Gases Quiz #2 **Gases** Name: Answers.

$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$ PV = nRT $R = \frac{8.31\ kPa \cdot L}{Mol \cdot K}$ ____/12

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1. A large flask is hooked to a vacuum pump and the air is pumped out. The mass of this evacuated flask is 101.22 g. When the flask is filled with helium gas the mass of the flask (with the helium inside) is 101.28 g.
Finally when the flask is filled with another gas the mass of the flask (with this other gas inside) is found to be 101.70g.
Could this last gas be one of these substances? hydrogen nitrogen [✓ oxygen] argon carbon dioxide
Show calculations to support your choice.

$$\begin{array}{r} 101.28\,g \\ -101.22\,g \\ \hline 0.06\,g\ He \end{array}$$

$$\text{unknown}\quad \begin{array}{r} 101.70\,g \\ -101.22\,g \\ \hline 0.48\,g \end{array}$$

$$\frac{1\,mol\ He}{x} = \frac{4.00\,g}{0.06\,g}$$

$$x = 0.015\ mol\ He$$

$$\frac{1\,mol}{0.015} = \frac{x}{0.48} \qquad x = 32\,g/mol$$

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2. One can heat potassium chlorate ($KClO_3$) to produce oxygen gas and potassium chloride.

$$2KClO_3 \rightarrow 3O_2 + 2KCl$$

a) What mass of potassium chlorate would you need in order to produce enough oxygen to fill a 75 litre box to a pressure of 60 KPa and at a temperature of -40 °C? $-40 + 273$

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{(60)(75)}{(8.31)(233)} = 2.3241\ mol\ O_2$$

$$\frac{3\,mol\ O_2}{2.3241} = \frac{2\,mol\ KClO_3}{x}$$

$$x = 1.5494\ mol\ KClO_3$$

$$\frac{1\,mol\ KClO_3}{1.5494\,mol} = \frac{122.55\,g}{x}$$

$$x = 189.879\,g\ KClO_3$$

$$\boxed{1.9 \times 10^2\,g\ KClO_3}$$

b) If 25.0 grams of potassium chlorate were decomposed in order to make oxygen, would this give off enough oxygen at 15°C and 120 kPa to fill a 3.5 litre balloon? Show your work.

$$\frac{1\,mol\ KClO_3}{x} = \frac{122.55\,g}{25.0\,g}$$

$$x = 0.203998\ mol\ KClO_3$$

$$\frac{2\,mol\ KClO_3}{0.203998} = \frac{3\,mol\ O_2}{x}$$

$$x = 0.305998\ mol\ O_2$$

$$V = \frac{nRT}{P} = \frac{(0.305998)(8.31)(288K)}{120}$$

$$V = 6.10L$$

$$V = 6.1L$$

Yes plenty.

$$n = \frac{PV}{RT} = \frac{(120)(3.5)}{(8.31)(288)}$$

or

$n = 0.17544$

moles O_2

3:2 0.1170 mol $KClO_3$

$$\frac{1\,mol}{.1170} = \frac{122.55\,g}{x}$$

$x = 19.33g$ needed.

3. A 8.00 ml bubble of marsh gas rising from the bottom of a bog where the pressure is 176 kPa and the temperature is -3°C rises to the surface where the pressure is 95 kPa and the temperature is 17 °C. **What is the volume of the gas bubble as it breaks the surface?**

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{(176)(8.00)}{270} = \frac{(95)V_2}{290}$$

$$V_2 = 15.9189$$

$$V_2 = 16\,mL$$

or

$$1.6 \times 10^{-2}\,L$$

Gases Quiz #2 **Gases** v2 2019 Name: Answers

$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$ PV = nRT $R = \frac{8.31\ \text{kPa} \cdot \text{L}}{\text{Mol} \cdot \text{K}}$ ____/16

1. A large flask is hooked to a vacuum pump and the air is pumped out. The mass of this evacuated flask is 101.55 g. When the flask is filled with nitrogen gas the mass of the flask (with the nitrogen inside) is 101.62 g.
Finally when the flask is emptied again and filled with another gas the mass of the flask is found to be 101.71g.
Could this gas be one of these substances? $\overset{28}{\text{nitrogen}}$ $\overset{32}{\text{oxygen}}$ $\overset{39}{\text{argon}}$ [✓ $\overset{64}{\text{sulphur dioxide}}$]
Show calculations to support your choice.

$$\begin{array}{r} 101.62 \\ -101.55 \\ \hline 0.07\text{g} \end{array} \qquad \begin{array}{r} 101.71 \\ -101.55 \\ \hline 0.16\text{g} \end{array}$$

$N_2 \rightarrow$ 0.07g

$$\frac{1\text{mol } N_2}{x} = \frac{28.02}{0.07}$$

$$x = 2.4982 \times 10^{-3} \text{ mol}$$

$$\frac{2.4982 \times 10^{-3} \text{ mol}}{1 \text{ mol}} = \frac{0.16\text{g unk}}{x}$$

$$x = 64 \text{ g/mol}$$

2. One can heat potassium chlorate ($KClO_3$) to produce oxygen gas and potassium chloride.

a) What mass of potassium chlorate would you need in order to produce enough oxygen to fill a 75 litre box to a pressure of 60 KPa and at a temperature of -40 °C?

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{(60)(75)}{(8.31)(233)} = 2.3241 \text{ mol } O_2$$

$$\frac{3\text{mol } O_2}{2.3241 \text{ mol}} = \frac{2 \text{ mol } KClO_3}{x}$$

$$x = 1.5494 \text{ mol } KClO_3$$

$$\frac{1\text{mol } KClO_3}{1.5494 \text{ mol}} = \frac{122.55\text{g}}{x}$$

$$x = 189.879\text{g}$$

$$\boxed{1.9 \times 10^2 \text{g } KClO_3}$$

b) What volume of oxygen gas would be produced if 15.0 grams of potassium chlorate were decomposed in order to make oxygen, at 15°C and 120 kPa? Show your work.

$$\frac{1\text{mol } KClO_3}{x} = \frac{122.55\text{g}}{15.0\text{g}}$$

$$x = 0.12240 \text{ mol } KClO_3$$

$$\frac{2\text{mol } KClO_3}{0.12240 \text{ mol}} = \frac{3 \text{ mol } O_2}{x}$$

$$x = 0.18360 \text{ mol } O_2$$

$$V = \frac{nRT}{P} = \frac{(0.18360)(8.31)(288)}{120}$$

$$V = 3.6617 \text{ L}$$

$$\boxed{V = 3.66 \text{ L}}$$

3. A 8.00 ml bubble of marsh gas rising from the bottom of a bog where the pressure is 170 kPa and the temperature is -3°C rises to the surface where the pressure is 95 kPa and the temperature is 15 °C. **What is the volume of the gas bubble as it breaks the surface?**

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{(170)(8.00)}{270} = \frac{(95)V_2}{288}$$

$$V_2 = 15.270 \text{ mL}$$

$$\boxed{V_2 = 15 \text{mL}}$$

Gases Quiz #2 **Gases** v3 2019 Name: Answers

$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$ PV = nRT R = $\frac{8.31\ \text{kPa} \cdot \text{L}}{\text{Mol} \cdot \text{K}}$ ____/16

1. A large flask is hooked to a vacuum pump and the air is pumped out. The mass of this evacuated flask is 101.55 g. When the flask is filled with nitrogen gas the mass of the flask (with the nitrogen inside) is 102.25 g.
Finally when the flask is emptied again and filled with another gas the mass of the flask is found to be 101.60g.

2g/mol 32 40 64

Could this gas be one of these substances? [✓ hydrogen] oxygen argon sulphur dioxide
Show calculations to support your choice.

unknown

$$\begin{array}{r} 102.25 \\ -101.55 \\ \hline 0.70\text{g } N_2 \end{array} \qquad \begin{array}{r} 101.60 \\ -101.55 \\ \hline 0.05\text{g} \end{array}$$

$$\frac{0.02498\text{mol}}{1\text{mol}} = \frac{0.05\text{g}}{x} \qquad x = 2.00\text{g/mol}$$

$\boxed{H_2}$

$$\frac{1\text{mol } N_2}{x} = \frac{28.02\text{g}}{0.70\text{g}} \qquad 0.02498 \text{ mol } N_2$$

2. One can heat potassium chlorate ($KClO_3$) to produce oxygen gas and potassium chloride.

a) What mass of potassium chlorate would you need in order to produce enough oxygen to fill a 75 litre box to a pressure of 60 KPa and at a temperature of -40 °C? $-40 + 273 = 233$

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{(60)(75)}{(8.31)(233)} = 2.3241 \text{ mol } O_2$$

$$x = 189.879\text{g}$$

$$\frac{3\text{mol } O_2}{2.3241} = \frac{2\text{mol } KClO_3}{x}$$

$$x = 1.5494 \text{ mol } KClO_3$$

$$\frac{1\text{mol } KClO_3}{1.5494} = \frac{122.55\text{g}}{x}$$

$$\boxed{1.9 \times 10^2\text{g } KClO_3}$$

b) What volume of oxygen gas would be produced if 20.5 grams of potassium chlorate were decomposed in order to make oxygen, at 15°C and 120 kPa? Show your work.

$$\frac{1\text{mol } KClO_3}{x} = \frac{122.55\text{g}}{20.5\text{g}}$$

$$x = 0.16729 \text{ mol } KClO_3$$

$$\frac{2\text{mol } KClO_3}{0.16729} = \frac{3\text{ mol } O_2}{x}$$

$$x = 0.250918 \text{mol } O_2$$

$$V = \frac{nRT}{P} = \frac{(0.250918)(8.31)(288)}{120}$$

$$V = 5.00431\text{L}$$

$$\boxed{V = 5.00\text{ L}}$$

3. A 7.00 ml bubble of marsh gas rising from the bottom of a bog where the pressure is 176 kPa and the temperature is -3°C rises to the surface where the pressure is 95 kPa and the temperature is 15 °C. **What is the volume of the gas bubble as it breaks the surface?**

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{(176)(7.00)}{270} = \frac{(95)V_2}{288}$$

$$V_2 = 13.8330\text{mL}$$

$\boxed{14\text{mL}}$