Assessment Question Set 1

For the following questions give answers to 2d.p unless otherwise stated, and assume;

- *The volume of a sphere is* $\frac{4}{3}\pi r^3$
- *The volume of a cylinder is* $\pi r^2 h$
- *The molar gas constant = 8.31Jmol^{-1}K^{-1}*
- *Avogadro's number = 6.022×10^{23}*
- *0℃ = 273K*

1. By stating T for true and F for false only, identify the correct statements from the following.

A. Boyle's Law tells us that the pressure of a gas is inversely proportional to volume when the gas is held at constant temperature T

B. Boyle's Law tells us that the pressure of a gas is inversely proportional to temperature when the gas is held at constant volume F

C. A plot of pressure vs. volume for a gas held at constant temperature yields a straight line through the origin F

D. A change in a system whilst the temperature of the system remains constant is known as an isothermal change T

2. Identify the correct statement from the following.

According to Boyle's Law……

A. Increasing the pressure on a volume of gas wall cause the volume to increase

B. The change in the volume of a gas in a sealed container is inversely proportional to changes in pressure

C. The volume of gas in a closed container does not change when pressure is changed

D. The change in the volume of a gas in a closed container is directly proportional to changes in pressure

3. Given a large balloon of oxygen gas has an initial volume of 0.1m^3 at pressure of 40 Pa, calculate the volume of the balloon if the pressure is increased to 200 Pa and the temperature remains constant. 0.02m^3

4. An elastic container of air at constant pressure occupies a volume of $0.15m^3$ at 20°C. If the container is placed in liquid nitrogen and rapidly cooled to a temperature of -120°C, calculate the new volume of the container. Give your answer in m^3 to 3d.p $0.078m^3$

5. A sealed cylinder contains a gas at 150kPa. The cylinder and gas are in thermal equilibrium at a temperature of -5°C. If the temperature of the cylinder and gas system is raised to 160°C, calculate the new pressure to the nearest kPa assuming that the volume of the cylinder remains constant. 242kPa

6. Calculate the mass in kg of 8mol of Chlorine gas given that the molar mass of Chlorine is $0.071kgmol^{-1}$. Give your answer to 3d.p. 0.568kg

7. 11mol of steam condenses to form 0.4kg of water. Assuming no steam was lost, calculate the molar mass of steam. Give your answer in appropriate units to 3.d.p $0.036kgmol^{-1}$

8. A cylindrical container of radius 2cm and height 10cm contains an ideal gas. The container has a valve designed to release some gas if the pressure exceeds 130kPa. Calculate the maximum number of moles that can be contained by this vessel at

(a) 30°C $649\times10^{-3}mol$

(b) 80°C $557\times10^{-3}mol$

9. A gas is held within a cylinder of volume $0.08m^3$ at a pressure of 150kPa and a temperature of 293K. A piston then reduces the cylindrical volume to $0.04m^3$. If the pressure of the compressed gas is now 350kPa, use the combined gas laws to calculate the final temperature of the gas in Kelvin. 341.83K

10. Identify the correct statements from the following;

An ideal gas……..

A. Is a gas that obeys some of the pressure laws

B. Is only theoretical

C. Is one for which the molecules of the gas are perfectly elastic and obeys all three pressure laws

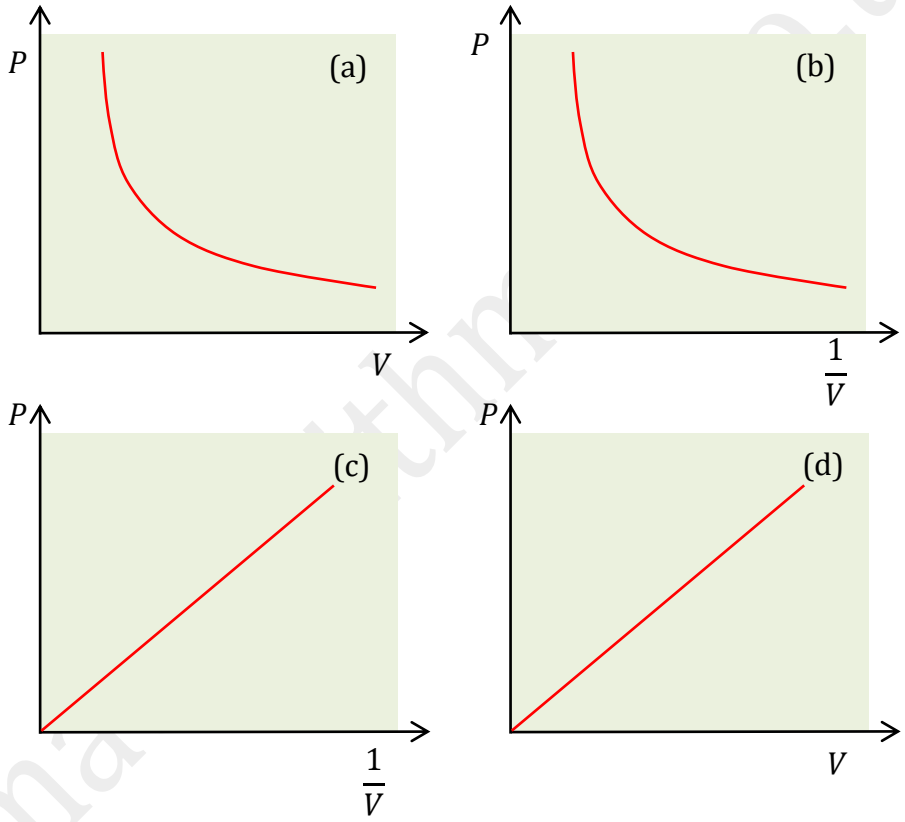
D. Is only a valid model of a real gas at extreme temperature and pressure

Assessment Question Set 2

For the following questions give answers to 2d.p unless otherwise stated, and assume;

- *The volume of a sphere is* $\frac{4}{3}\pi r^3$
- *The volume of a cylinder is* $\pi r^2 h$
- *The molar gas constant = 8.31Jmol^{-1}K^{-1}*
- *Avogadro's number = 6.022×10^{23}*
- *0℃ = 273K*

1. A student has a fixed mass of gas at constant pressure in a piston / cylinder arrangement. He varies the volume of the cylinder and records volume. He plots his results. Which two graphs might he obtain if his treatment of the data is correct? (a) and (c)



2. A container of helium gas has an initial volume of 400 litres and pressure of 20 Pa.

Use Boyle's Law to calculate the pressure if the volume is changed to 50 litres.

160Pa

3. Select the two correct statements from the following;

If the air inside a balloon is heated the volume of the balloon will……..

A. Increase

B. Decrease

C. Remain constant

This is an example of……..

D. Charles' Law

E. Boyle's Law

F. The Pressure Law

4. A spherical weather balloon of helium at 20°C has a radius of 10cm. If the pressure remains constant, at what temperature (in °C) would the balloons radius be exactly 12cm? Give your answer in Celsius to the nearest degree. 148°C

5. A pressure cooker at 50°C holds steam at a pressure of 180kPa. The valve on the pressure cooker is set to release if the pressure exceeds 200kPa. What is the maximum temperature to the nearest degree Celsius the pressure cooker can reach without the valve releasing any of the steam? 86°C

6. Air has a mean molar mass of 0.029kgmol^{-1}. If an air mattress when inflated contains 6 moles, calculate the mass of air in the mattress in kg, and the number of air molecules N. m = 0.17kg, 3.61×10^{24}

7. Butane gas has a molar mass of 0.06kgmol. A gas cylinder when empty has a mass of 0.2kg and when full, 0.9 kg. Calculate the number of moles of gas and the number of butane gas molecules in the cylinder before use. 11.6mol

8. A sealed metal container holds 3 moles of an ideal gas at a temperature of 250°K and a pressure of 98kPa. Calculate the volume of the container. The container is then heated to a temperature of 450°K. The expansion of the metal container at this temperature is negligible. Calculate the pressure of the ideal gas assuming it is in thermal equilibrium with the container. V=0.064m^3 P=176.4kPa

9. A hot air balloon has an initial volume of 2800m^3 when filled with air at 20°C and at a pressure of 101kPa. In order to take off, the pilot heats the air to an average temperature of 105°C. If the volume of the balloon only increases by 20m^3 (through stretching of the balloon material), use the combined pressure law to calculate the take off pressure in the balloon to the nearest whole kPa. 128kPa

10. State the equation of state for an ideal gas and then rearrange it to find the units of the molar gas constant *R*. *Hint; pressure is a force per unit area and the product of force and distance is work done (energy).* PV=nRT and $Jmol^{-1}K^{-1}$