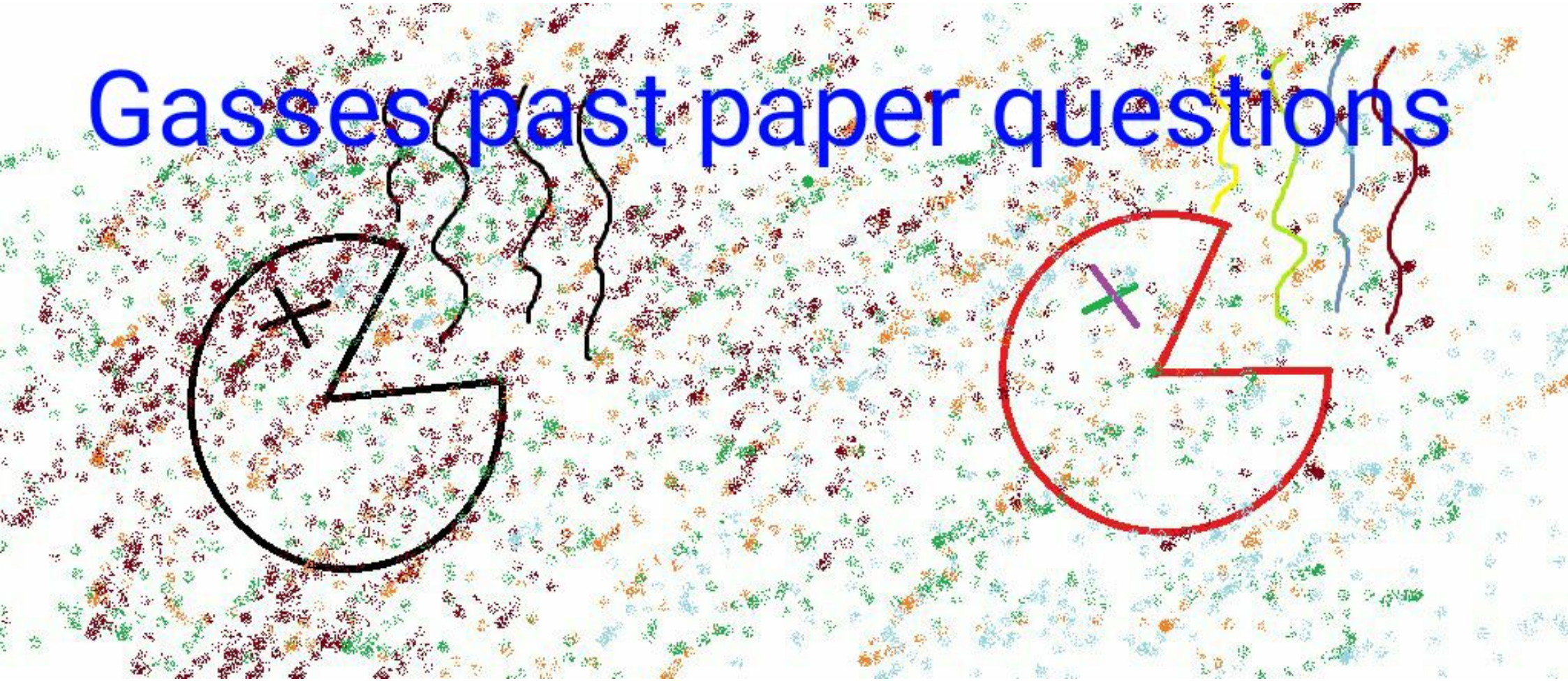
Gasses past paper questions



QUESTION FOUR (GASES) 2023 test 1 [25 marks]

a) Gas laws help us to understand the behaviour of gases under different conditions of temperature, pressure, and volume.

i. State Boyle's Law
[1]

ii. Sketch a graph of pressure against volume for the law in (i) [1]

b) If 22.5 L of nitrogen at 748 mm Hg are compressed to 725 mm Hg at constant temperature.

i. What is the new volume?
[2]

ii. What is the Volume in litres at STP of 50 g of nitrogen (N_2)? [2]

iii. State the gas laws applied in (i) and (ii) above.
[2]

c) A mole of a gas at 450 K has a density of 1.41 g/dm^3 at 2.0 atm. What is the density of the gas at STP?
[4]

d) Dalton, a renowned scientist talked about partial pressures in the atmosphere.

i. State the Dalton's law of partial pressures. [2]

ii. What is the partial pressure in the atmosphere? [2]

e) At -18 °C, a 2L mixture of helium, nitrogen, and neon has a total pressure of 815 mmHg. What mass of neon is present in the mixture if the partial pressure of helium is 201 mmHg and the partial pressure of nitrogen is 351 mmHg? [9]

QUESTION THREE (Gases) 2023 SESSIONAL [20 marks]

a) List three properties of an ideal gas. [3]

b) A mole of a gas at 450 K has a density of 1.41 g/dm^3 at 2.0 atm. What is the density of the gas at STP? [4]

c) At 0 °C and 760 mm mercury pressure, a gas occupies a volume of 100 cm^3. The kelvin temperature of the gas is increased by a fifth of the initial, while pressure is increased by one and half times.

i) Calculate the final volume of the gas [6]

ii) Which gas law(s) is being applied in the solution to (i) above? [2]

d) At 25°C, a 4.0 L container is filled with 2.0 g neon and 8.0 g helium. What is the total pressure of the mixture? [5]

QUESTION 4: GASES

2022 test 1

[25 MARKS]

a) State each of the following gas laws:

(i) Avogadro's law [1]

(ii) Charles' law [1]

(iii) Boyle's law [1]

(iv) Graham's law on diffusion of gases [2]

b) Given that one mole of a gas at 450 K has a density of 1.41 gdm^{-3} at 1520 mm Hg. What is the density of the gas at rtp? [3]

c) Determine the molar mass of a gas whose density is 1.50 gdm^{-3} at a temperature of 25°C and pressure of 760 torr. [3]

d) Three gases were added to the same container of volume 20 litres to give a total pressure of 150 kPa at 25°C. If the mixture contained 8.0 g of O_2, 8.0g of CO_2 and an unknown mass of N_2.

(i) Define the term partial pressure [2]

(ii) Calculate the partial pressure of each gas [3]

(iii) Calculate the more fraction of each gas [3]

(iv) Determine the mass of N_2 in the container [3]

e) Give any three postulates of the kinetic theory of gases [3]

(1) **QUESTION 7: GASES** ✓ 2022 sessional **[20 Marks]**

a) The pressure needed to make synthetic diamonds from graphite is 8×10^4 atm. Express this pressure in

i) Pascal ii) Torricelli **[2]**

b) A container of total volume 1.5 dm^3 contains 6.0 g of helium gas at 25°C. Calculate the pressure in atmospheres exerted by helium assuming it behaved as:

i) an ideal gas **[2]**

ii) A van der waals gas with van der waals constants **a** and **b** of values 4.20 $L^2 atm\ mol^{-2}$ and 0.052 $L mol^{-1}$ respectively. **[4]**

2022 sessional

c) Given that the composition of a 100.0 g sample of dry air at sea level is 75.5 g nitrogen, 23.2 g oxygen, and 1.3 g argon, what is the partial pressure of each component at 100 kPa total pressure? [10]

d) State the two special features of an ideal gas. [2]

QUESTION 4: GASES

2021 test 1

[25 MARKS]

a) Write down the mathematical expressions of the following gas laws: [2]

i) Boyle's law
ii) Charles' law

b) Consider a mixture of two gases A and B, confined in a closed vessel. A quantity of a third gas, C, is added to the same vessel at the same temperature. State whether each of the following will increase, decrease, or remain the same. [3]

i) The partial pressure of gas A
ii) The total pressure in the vessel
iii) The mole fraction of gas B

c) A diver releases a bubble of air which rises to the surface of the sea. The volume of the bubble increases from 4.0 cm^3 to 10.0 cm^3 during this process.

i) Why does the bubble expand as it rises? [1]
ii) Just below the surface, the pressure acting on the bubble is 1.0 atm. What is the pressure (in atm) acting on it before it starts to rise? [4]
iii) Which gas law is being applied in your calculation in c(ii) above? [1]

d) An aerosol spray can with a volume of 250 ml contains 2.30 g of propane gas (C_3H_8) as a propellant.

i) If the can is at 23^{0}C, what is the pressure in the can? [5]
ii) What volume would the propane occupy at STP? [4]
iii) The can's label says that exposure to temperatures above 130^{0}F may cause the can to burst. What is the pressure in the can at this temperature? [5]

QUESTION 4: GASES AND CHEMICAL KINETICS [20 MARKS]

a) Which gas law describes the following: [2]

i. The relationship between volume and temperature

ii. The relationship between pressure and volume

b) Under what conditions will the assumptions of the kinetic molecular theory of gases most likely be incorrect? [2]

c) Two flasks are connected with a stopcock. Flask 1 has a volume of 2.5 L and contains oxygen gas at a pressure of 0.70 atm. Flask 2 has a volume of 3.8 L and contains hydrogen gas at a pressure of 1.25 atm. When the stopcock is between the two flasks is opened and the gases are allowed to mix, calculate:

i. The pressure of oxygen [2]

ii. The pressure of hydrogen [2]

iii. The total pressure of the gas mixture [2]

d) Consider the following reaction:

QUESTION 2: GASES [20 Marks]

a) (i) What is pressure? [1]

(ii) What is the atmospheric pressure when the height of the mercury column in a barometer is 756 mm? [1]

b) (i) The kinetic Molecular Theory of a gas is based on four assumptions. State any two of these assumptions [2]

(ii) What is the difference between a real gas and an ideal gas [1]

c) State the following gas laws mathematically (using formulas)

(i) Charles' law [1]

(ii) Boyle `s law [1]

(ii) Gay-Lussac`s law [1]

d) (i) A gas at 110 KPa and 30.0°C fills a flexible container with an initial volume of 2.00L. If the temperature is raised to 80.0°C and the pressure increased to 440KPa, what is the new volume of the gas? [2]

(ii) What volume will 1.07g of carbon dioxide (CO_2) gas occupy at 48°C and 740mmHg? [3]

(iii) The mass of a definite volume of a gas is referred to as the density of the gas. What is the density of C_2H_2 gas at STP? [1]

e) (i) John Dalton, the English chemist who proposed the atomic theory, also made an important contribution to the study of mixtures of gases. He stated the law of partial pressures. What is partial pressure? [1]

(ii) A mixture of 50.0g of oxygen gas and 50.0 g of methane, CH_4, gas is placed in a container under a pressure of 600 mmHg. What is the partial pressure of the oxygen gas in the mixture? [2]

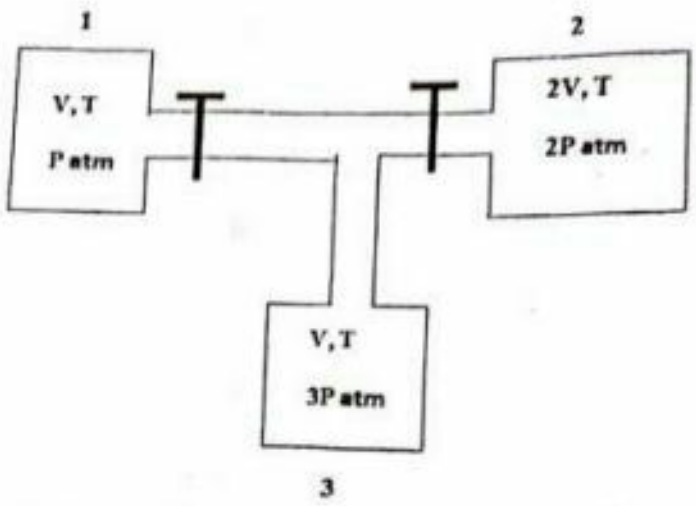
f) (i) Thomas Graham, a Scottish chemist carried out a series of experiments on the rate of effusion of gases. His observation is now known as Graham`s law of effusion. State Graham's law of effusion [1]

(ii) Compare the rate of effusion of hydrogen and oxygen at the same temperature and pressure [2]

2018 test 2

QUESTION 1: GASES

a) When we open the valves given in the picture below, state whether the pressure of the gas will increase, decrease, or remain constant in each container. [5]



b) State whether each of the following statements is true or false. [4]

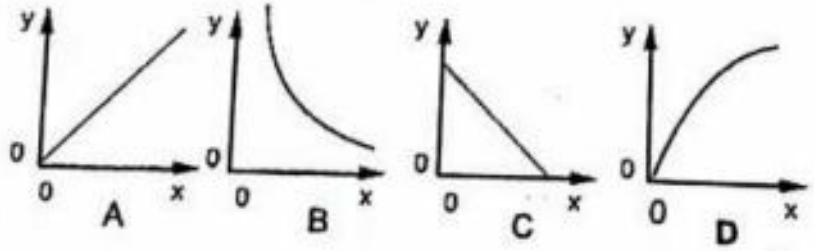
(i) According to Charles Law, if you have a balloon inside a car at noon during a hot summer day the balloon molecules inside will increase in pressure.

(ii) A good example of Charles Law is when a piece of metal expands in the heat.

(iii) You drove continuously from Kitwe to Lusaka and you observed that the pressure in your tires increased. This is because of the increased temperature outside the tire caused by friction.

(iv) Charles' law is involved when a balloon bursts when you sit on it.

c) Answer the following questions based on the graphs below: [3]



2018 test 2

(i) Which graph shows the variation in **volume** (y) of a fixed mass of ideal gas at constant pressure with **absolute temperature** (x)?

(ii) Which graph shows the variation in volume (y) of a fixed mass of ideal gas at constant temperature with pressure (x)?

(iii) Which gas law is being shown graphically in (ii) above? [1]

d) (i) What is an ideal gas? [1]

(ii) State one reason why ammonia gas deviates from an ideal behavior. [1]

(iii) State one condition under which the deviation of ammonia from ideal behavior will be more pronounced. [1]

e) A small quantity of the volatile organic solvent propanone (C_3H_6O) evaporates at room temperature and pressure. Assuming that propanone is an ideal gas, calculate the volume, in litres, of propanone vapour formed when 0.29 g of liquid propanone evaporates taking room temperature as 20^0C and room pressure as 101kPa. [4]

f) Carbon dioxide gas (1.00 mol) at 373 K occupies 536 mL at 50.0 atmosphere pressure. What is the calculated value of the pressure using:

(i) Ideal gas equation [2]

(ii) Van der Waals equation? [3]

(iii) Give one reason why the two values are different [1]

[Data: Van der Waals constants for carbon dioxide: a = 3.61 L^2 atm mol^{-2}; b = 0.0428 $Lmol^{-1}$; R = 8.314J.$K^{-1}mol^{-1}$ or 0.08206 L.atm.$mol^{-1}.K^{-1}$]

QUESTION 7: GASES 2018 sessional [20 MARKS]

(a) The pressure of a gas is measured as 49 torr. Represent this pressure in both atmospheres and pascals. [4]

(b) State the two gas laws below, give each law's mathematical representation and sketch a graphical plot of the mathematical relation that you give for each law. [6]

(i) Boyle's Law (ii) Avogadro's Law

(c) Quicklime (CaO) is produced by thermal decomposition of calcium carbonate ($CaCO_3$). Calculate the volume of carbon dioxide (CO_2) at STP produced from the decomposition of 152 g of $CaCO_3$. [6].

(d) Answer the following questions on Dalton's Law.

(i) The partial pressure of oxygen was observed to be 156 torr in air with a total atmospheric pressure of 743 torr. Calculate mole fraction of O_2 present. [2]

(ii) The mole fraction of nitrogen in the air is 0.7808. Calculate the partial pressure of N_2 in air when the atmospheric pressure is 760 torr. [2]

The Periodic Table

1	2											3	4	5	6	7	0
1 **H** 1.01				Atomic Number **Element** Atomic Mass													2 **He** 4.00
3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.90	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.71	29 **Cu** 63.55	30 **Zn** 65.37	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** 98.91	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.40	49 **In** 114.82	50 **Sn** 118.69	51 **Sb** 121.75	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.30
55 **Cs** 132.91	56 **Ba** 137.34	57 † **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.21	76 **Os** 190.21	77 **Ir** 192.22	78 **Pt** 195.09	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.37	82 **Pb** 207.19	83 **Bi** 208.98	84 **Po** (210)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 ‡ **Ac** (227)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (266)	107 **Bh** (264)	108 **Hs** (277)	109 **Mt** (268)	110 **Ds** (281)	111 **Rg** (272)	112 **Cn** (285)	113 **Uut** (284)	114 **Fl** (289)	115 **Uup** (288)	116 **Lv** (291)	117 **Uus** (Unknown)	118 **Uuo** (294)

58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.36	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97
90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)

TABLE OF FUNDAMENTAL CONSTANTS

Quantity	symbol	Value	Power of ten	Units
Speed of light	c	2.9979	10^{8}	m s^{-1}
Elementary charge	e	1.602	10^{-19}	C
Faraday's constant	$F=N_Ae$	9.6485	10^{4}	C mol^{-1}
Boltzmann's constant	k	1.380 65	10^{-23}	J K^{-1}
Gas constant	$R=N_Ak$	8.314 47 8.314 47 8.205 74 6.236 37	 10^{-2} 10^{-2} 10	J K^{-1} mol^{-1} L bar K^{-1} mol^{-1} L atm K^{-1} mol^{-1} L Torr K^{-1} mol^{-1}
Planck's constant	h	6.626 08	10^{-34}	Js
Avogadro's constant	N_A	6.022 14	10^{23}	mol^{-1}
Atomic mass unit	m_u	1.660 54	10^{-27}	Kg
Mass				
Electron	m_e	9.109 38	10^{-31}	Kg
Proton	m_p	1.672 62	10^{-27}	Kg
neutron	m_n	1.674 93	10^{-27}	kg
Rydeberg constant	R_H	1.097 37	10^{7}	m^{-1}
1 atm = 760 mmHg = 760 Torr = 1.01325 x 10^5 Nm^{-2} = 1.01325 x10^5 Pa= 1.01325 bar				