

Mock 2020ans

Part A. 17 Multiple choice questions (2 marks each). Darken the letter that corresponds to the best answer on the answer sheet, found on the last page of this booklet.

1 Which of the following statements concerning the kinetic molecular theory is true?

- A) At the same temperature and pressure, two samples of gas with different molar masses will have the same average kinetic energy. ✓ (same average KE not temp)
- B) Temperature has no effect on the velocity of gas molecules ✗
- C) Molecules move more slowly in the gaseous phase than in a liquid. ✗
- D) At the same temperature, the molecules of different gases move at the same velocity ✗

2 What will be the volume of 32.0 grams of helium gas (He) at 155 kPa and 27.0°C?

- A) 44.8 Litres
- B) 100 Litres
- C) 129 Litres
- D) 25 Litres

$$PV = nRT$$

$$V = \frac{nRT}{P} = \frac{(8)(8.31)(300K)}{155} = 129L$$

$$\frac{32g}{4} = 8mol$$

3 Saturn's moon Titan has an average surface temperature of 90 K. Its atmospheric pressure is 146.7 kPa. This dense atmosphere consists of Nitrogen (N₂) with a partial pressure of 144.3 kPa and methane (CH₄) with a partial pressure of 1.9 kPa. The rest of the atmosphere consists of hydrocarbons. What is the partial pressure of the hydrocarbons in the atmosphere?

- A) 101.3 kPa
- B) 1.9 kPa
- C) 0.04 kPa
- D) 0.50 kPa

$$P_T = P_{CH_4} + P_{N_2} + P_{rest}$$

$$146.7 = 1.9 + 144.3 + P_{rest}$$

$$P_{rest} = 0.5 kPa$$

4 What happens to the volume of a gas if we double the pressure, halve the number of gas molecules, and quadruple the temperature?

- A) It remains the same.
- B) It is reduced by half.
- C) It doubles.
- D) It quadruples

$$\frac{PV}{nT} = \frac{PV}{nT}$$

$$1V_1 = \frac{(2)V_2}{0.5(4)}$$

$$V_1 = V_2$$

5 One winter morning, a driver checked the tires of his car and found the pressure to be 302 kPa at a temperature of -21°C.

In the middle of the afternoon he rechecked the tires and found that they were over inflated and that the pressure was now 320 kPa.

Disregarding any change in the volume of the tire, what was the temperature when he rechecked the tires?

- A) -6°C
- B) -11°C
- C) -15°C
- D) -20°C

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$\frac{302}{252} = \frac{320}{x}$$

$$267 - 273 = -5.98$$

6. Two identical rigid containers each hold a gas at the same temperature and pressure. One contains oxygen gas, O_2 , and the other contains nitrogen gas, N_2 . The mass of the oxygen gas is 48.00 g.

Same # of moles. $\frac{48.00}{32.00} = 1.5 \text{ mol } O_2$

What is the mass of the nitrogen gas?

- A) 18.68 g
 B) 21.02 g
 C) 42.03 g
 D) 48.00 g

$$\frac{1 \text{ mol } N_2 = 28.02}{1.5 \text{ mol}} = 42.03 \text{ g}$$

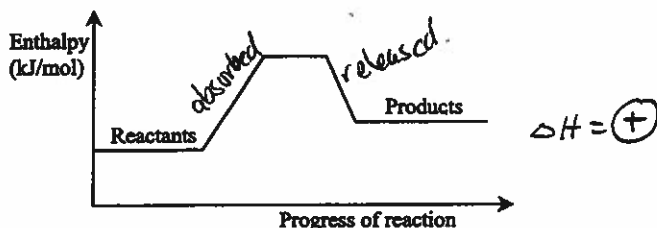
- 7] A molecule of fluorine gas has an average velocity of 25.2 m/s at a given temperature and pressure. What is the average speed of helium atoms at the same conditions?

- A) 8.18 m/s
 B) 11.6 m/s
 C) 54.9 m/s
 D) 77.7 m/s

$$\frac{v_1}{v_2} = \frac{\sqrt{M_2}}{\sqrt{M_1}} \quad \frac{25.2}{x} = \frac{\sqrt{4}}{\sqrt{38}}$$

$$\frac{v_{F_2}}{v_{He}} = \frac{\sqrt{M_{He}}}{\sqrt{M_{F_2}}} \quad x = 77.7$$

- 8] The following diagram shows the change in enthalpy of the substances involved in a chemical reaction.



Given this diagram, which of the following statements is true?

- A) During this reaction, more energy is absorbed than released. ✓
 B) This reaction takes place spontaneously. ✗
 C) The ΔH for this reaction is negative. ✗
 D) This reaction is exothermic. ✗

- 9] Which of the following involves an endothermic change?

- A) Clothing drying on a clothes line evaporation $l \rightarrow g$ endo.
 B) Snow crystals forming in the atmosphere $l \rightarrow s$ exo
 C) A lake freezing over $l \rightarrow s$ exo
 D) The combustion of fuel in a vehicle releases E exo

- 10] A styrofoam cup contains some water at $22^\circ C$. When 420 g of water at $13^\circ C$ is added to the cup, the final temperature of the mixture is $16^\circ C$.

If there is no heat loss, what was the mass of the water in the styrofoam cup?

- A) 280 g
 B) 210 g
 C) 140 g
 D) 84 g

$$Q = -Q$$

$$m \Delta T = -m \Delta T$$

$$m(16-22) = -(420)(16-13)$$

$$-6m = -1260$$

$$m = 210.$$

- 11] What is the molar heat of dissolution of $(AgNO_3)$ if 34 g of this substance, when dissolved in water, causes the temperature of 200 g of water to drop from $20^\circ C$ to $14.5^\circ C$?

- A) +0.14 kJ/mol $\frac{34g}{169.88} = 0.2 \text{ mol}$
 B) +0.78 kJ/mol 169.88
 C) +4.6 kJ/mol
 D) +23 kJ/mol

$$Q = m \Delta T$$

$$= 200(4.19)(14.5 - 20)$$

$$= -4609 \text{ J}$$

$$\frac{+4609 \text{ J}}{0.2 \text{ mol}} = 23 \text{ kJ}$$