Paper 1 Problems

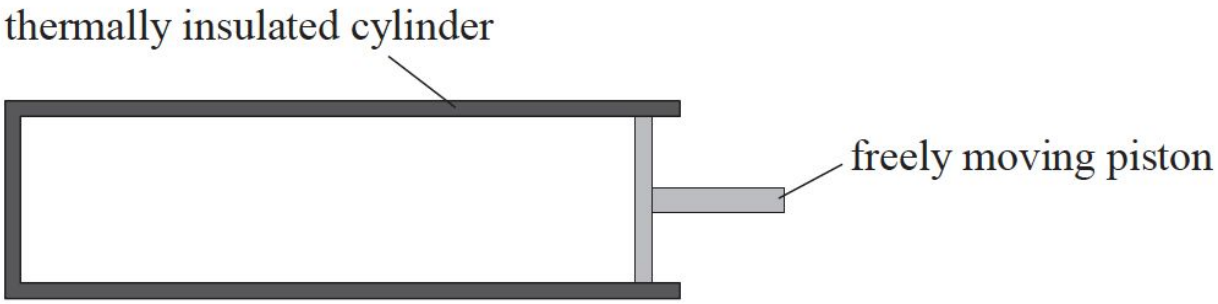
1. In the kinetic model of an ideal gas, which of the following is **not** assumed?

   A. The molecules collide elastically.
   B. The kinetic energy of a given molecule is constant.
   C. The time taken for a molecular collision is much less than the time between collisions.
   D. The intermolecular potential energy of the molecules is zero.

2. What is the definition of the *mole*?

   A. The amount of substance that has the same mass as 6.02 ×× 10^{23} atoms of carbon-12.
   B. The amount of substance that contains as many nuclei as the number of nuclei in 12 g of carbon-12.
   C. The amount of substance that has the same mass as one atom of carbon-12.
   D. The amount of substance that contains as many elementary entities as the number of atoms in 12 g of carbon-12.

3. Which of the following is an assumption of the kinetic model of an ideal gas?
   A. The gas is at high pressure.
   B. There are weak forces of attraction between the particles in the gas.
   C. The collisions between the particles are elastic.
   D. The energy of the particles is proportional to the absolute temperature.



4. The gas is compressed by the piston and as a result the temperature of the gas increases. What is the explanation for the temperature rise?

   A. The rate of collision between the molecules increases.
   B. Energy is transferred to the molecules by the moving piston.
   C. The molecules of the gas are pushed closer together.
   D. The rate of collision between the molecules and the walls of the cylinder increases.

5. The energy of the molecules of an ideal gas is
    A. thermal only.
    B. thermal and potential.
    C. potential and kinetic.
    D. kinetic only.

6. The volume of an ideal gas in a container is increased at constant temperature. Which of the following statements is/are correct about the molecules of the gas?

I. Their average speed remains constant.
II. The frequency of collisions of molecules with unit area of the container wall decreases.
III. The force between them decreases.

A. I only
B. I and II only
C. I and III only
D. II and III only

7. The mole is defined as
    A. 1/12 the mass of an atom of the isotope carbon-12.
    B. the amount of a substance that contains as many elementary entities as the number of atoms in 12 g of the isotope carbon-12.
    C. the mass of one atom of the isotope carbon-12.
    D. the amount of a substance that contains as many nuclei as the number of nuclei in 12 g of the isotope carbon-12.

8. Which of the following is an assumption made in the kinetic model of ideal gases?

A. Molecules have zero mass.
B. Forces between molecules are attractive.
C. Collisions between molecules are elastic.
D. Molecules move at high speed.

Paper 2 Problems

1a. State **two** assumptions of the kinetic model of an ideal gas. [2]

b. Argon behaves as an ideal gas for a large range of temperatures and pressures. One mole of argon is confined in a cylinder by a freely moving piston.

(i) Define what is meant by the term *one mole of argon*.

The temperature of the argon is 300 K. The piston is fixed and the argon is heated at constant volume such that its internal energy increases by 620 J. The temperature of the argon is now 350 K. 1 mole of argon has a mass of 40 grams.

(ii) Determine the specific heat capacity of argon in J kg^{-1} K^{-1} under the condition of constant volume. (The molecular weight of argon is 40) [4]

c.At the temperature of 350 K, the piston in (b) is now freed and the argon expands until its temperature reaches 300 K. Explain, in terms of the molecular model of an ideal gas, why the temperature of argon decreases on expansion. [3]

2. A. Distinguish between internal energy and thermal energy. [3]

B. Describe, with reference to the energy of the molecules, the difference in internal energy of a piece of iron and the internal energy of an ideal gas.[2]

3. An ideal monatomic gas is kept in a container of volume 2.1×10^{-4} $m3$, temperature 310 K and pressure 5.3×10^{5} Pa.

The volume of the gas in (a) is increased to 6.8×10^{-4} m^3 at constant temperature.

a.i. State what is meant by an ideal gas. [1]

a.ii. Calculate the number of atoms in the gas. [1]

a.iiii.Calculate, in J, the internal energy of the gas. [2]

B.i. Calculate, in Pa, the new pressure of the gas. [2]

B.ii.
Explain, in terms of molecular motion, this change in pressure. [1]