

# Thermal starter

1. What does the constant  $n$  represent in the equation of state for an ideal gas  $pV = nRT$ ?

- A. The number of atoms in the gas
- B. The number of moles of the gas
- C. The number of molecules of the gas
- D. The number of particles in the gas

2. An ideal gas has a volume of 15 ml, a temperature of 20 °C and a pressure of 100 kPa. The volume of the gas is reduced to 5 ml and the temperature is raised to 40 °C. What is the new pressure of the gas?

- A. 600 kPa
- B. 320 kPa
- C. 200 kPa
- D. 35 kPa

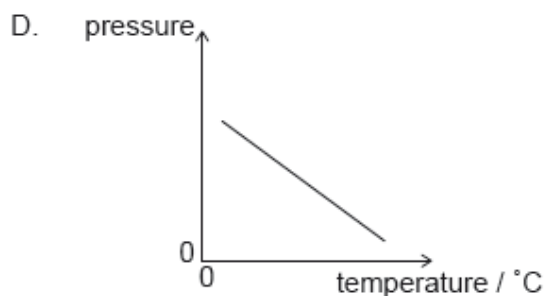
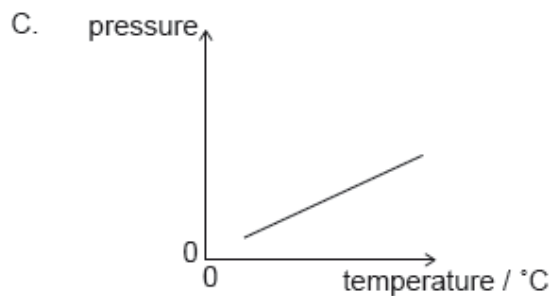
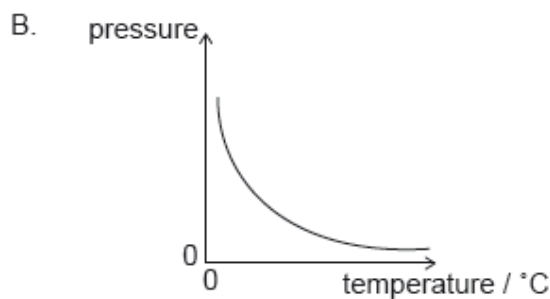
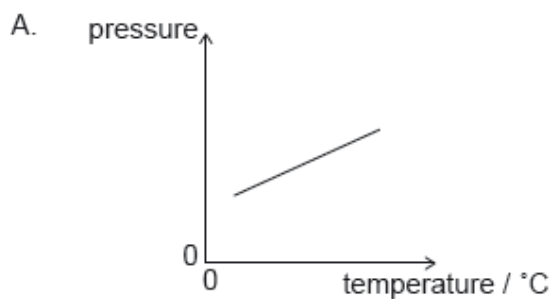
3. The volume of an ideal gas in a container is increased at constant temperature. Which of the following statements is/are correct about the molecules of the gas?

- 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

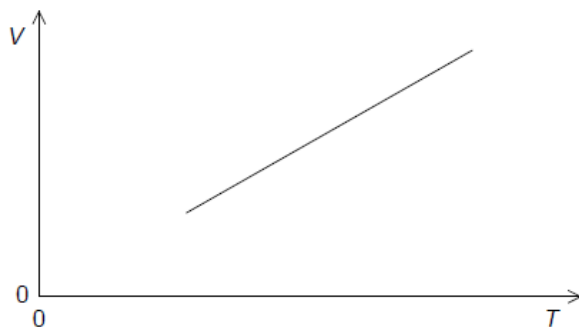
4. The energy of the molecules of an ideal gas is

- 1. thermal only.
- 2. thermal and potential.
- 3. potential and kinetic.
- 4. kinetic only.

5. A fixed mass of an ideal gas is trapped in a cylinder of constant volume and its temperature is varied. Which graph shows the variation of the pressure of the gas with temperature in degrees Celsius?



6. An ideal gas of  $N$  molecules is maintained at a constant pressure  $p$ . The graph shows how the volume  $V$  of the gas varies with absolute temperature  $T$ .



What is the gradient of the graph?

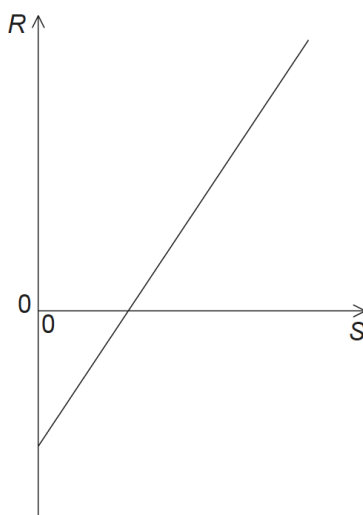
A.  $\frac{N}{p}$

B.  $\frac{NR}{p}$

C.  $\frac{Nk_B}{p}$

D.  $\frac{N}{Rp}$

7. A fixed mass of an ideal gas has a constant volume. Two quantities,  $R$  and  $S$ , of the gas vary as shown by the graph below.



What quantities do  $R$  and  $S$  represent?

8a. An ideal monatomic gas is kept in a container of volume  $2.1 \times 10^{-4} \text{ m}^3$ , temperature 310 K and pressure  $5.3 \times 10^5 \text{ Pa}$ .

State what is meant by an ideal gas.

[1 mark]

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8b. Calculate the number of atoms in the gas.

[1 mark]

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**8c.** Calculate, in J, the internal energy of the gas.

[2 marks]

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**8d.** The volume of the gas in (a) is increased to  $6.8 \times 10^{-4} \text{ m}^3$  at constant temperature.

Calculate, in Pa, the new pressure of the gas.

[1 mark]

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**8e.** Explain, in terms of molecular motion, this change in pressure.

[2 marks]

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