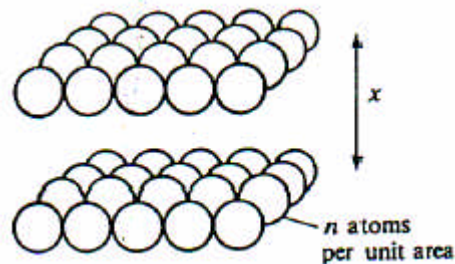


Chapter 5
Multiple choice and quick questions

1. Which one of the following statements **A** to **D** about the structure of solid materials is **FALSE**?
- A** In a crystalline structure particles are packed together in a regular pattern.
- B** Metals usually have a polycrystalline structure.
- C** Tough materials have structures which encourage crack propagation. ✓
- D** The structure of polymers is a series of long chain molecules.

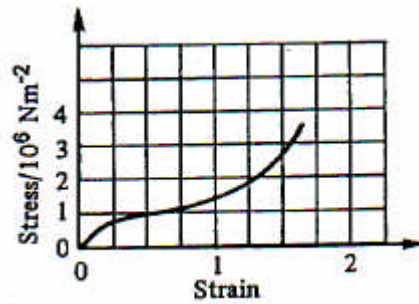
In relating the force required to stretch a wire to the interatomic forces inside the material, it is assumed that the wire can be regarded as made up of layers of atoms, perpendicular to the length of the wire. The separation between successive layers is x . There are n atoms per unit area within each layer. For a single pair of atoms the force required to increase the separation x to $x+\Delta x$ is given by $k\Delta x$.



Here are five combinations of these quantities:

- A** $\Delta x/x$ **B** $nx/\Delta x$ **C** $nk\Delta x$ **D** kx **E** k/x
2. Which one gives the **longitudinal stress** in the wire? (C)
3. Which one gives the **longitudinal strain** of the wire? (A)

4. Below is a stress-strain graph for rubber.

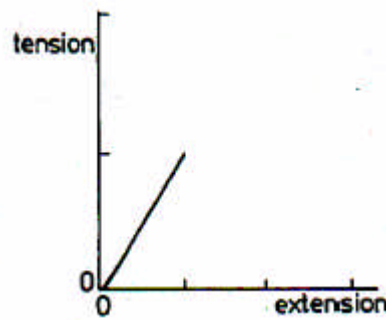


Which of the following facts about rubber is/are helpful in explaining the shape of the curve?

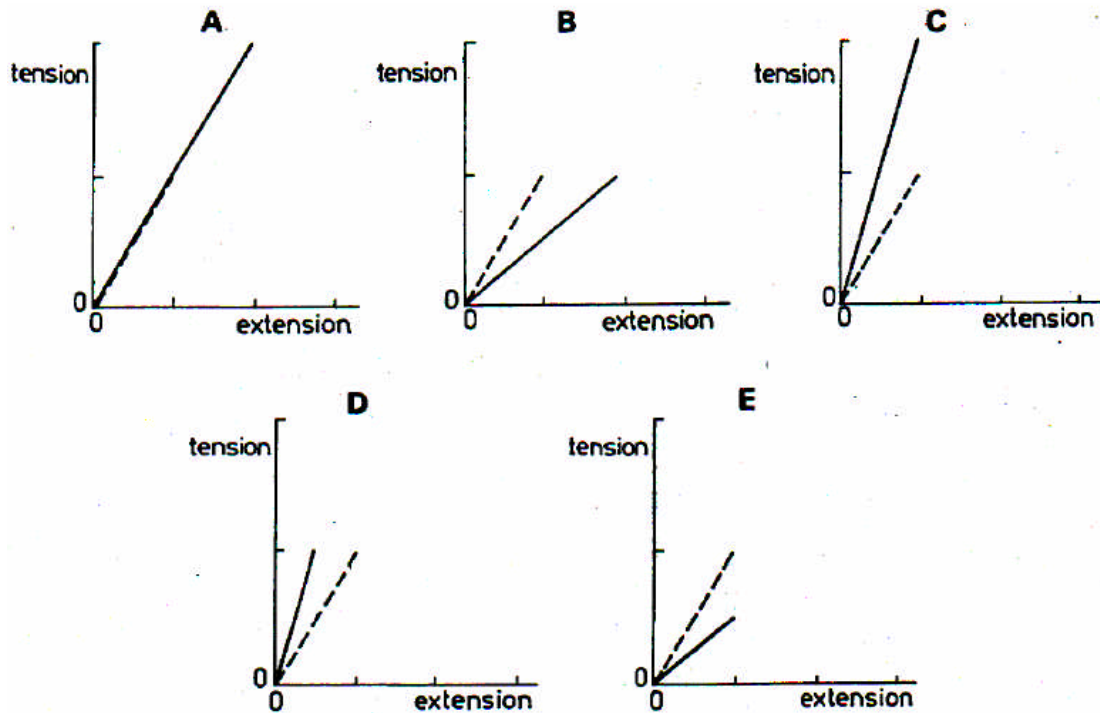
- 1 The rubber molecule is a very long one, with atoms linked in a chain.
- 2 The bonds between atoms in the long chain molecule are very stiff.
- 3 These bonds rotate easily, allowing the long chain to tangle or untangle.

- A** 1 only **B** 2 only **C** 1 and 3 only **D** 2 and 3 only
E 1, 2 and 3 ✓

5. A certain wire is stretched to its breaking point. The graph below shows the tension in the wire plotted against its extension.



Which one of the graphs **A** to **E** on the next page is obtained if a wire of the same material and same length but double the cross-sectional area is stretched until it breaks? (The original graph is shown as a broken line for comparison.) (C)



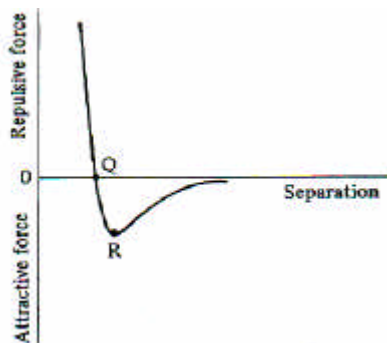
6. A wire which obeys Hooke's law stretches 6 mm under a load of 60 N.

A 2 mm B 3 mm C 6 mm D 9 mm E 12 mm

Which of A to E is the extension of a wire of the same material having twice the diameter and twice the original length with the same load under Hooke's law conditions? (B)

7. What will be the extension of a wire of the same material having half the diameter and half the original length with the same load under Hooke's law conditions? (E)

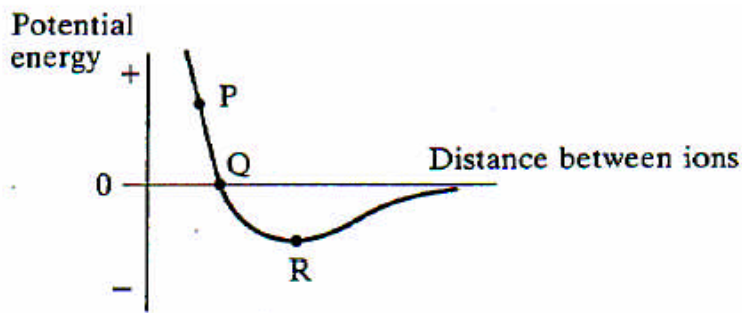
Questions 8 and 9 refer to the diagram below, which shows the force-separation graph for a pair of atoms in a crystal.



Five features of the graph are given below.

- A the gradient of the line at R
- B the gradient of the line at Q
- C the value of the force at R
- D the value of the force at Q
- E the value of the separation at Q

8. Which feature is most closely related to the stiffness of the crystal? (B)
9. Which feature is most closely related to the breaking stress of the crystal? (C)
10. The graph below shows how the potential energy of a pair of ions varies with the distance between them.



Which of the following arguments about the points P, Q and R marked on the graph is/are correct?

- 1 From P to Q the potential energy falls with distance, so here the net force between the ions must be pushing them apart.
- 2 At Q, the potential energy is zero, so here any repulsive force between the ions must be zero.
- 3 At R the potential energy curve is a minimum, so a supply of energy is needed either to increase or decrease the distance between ions.

- A 1 only B 2 only C 1 and 3 only ✓ D 2 and 3 only
- E 1, 2 and 3