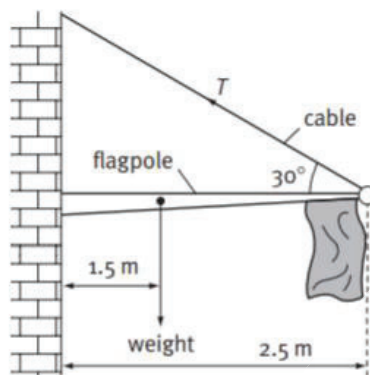


Turning effects of forces

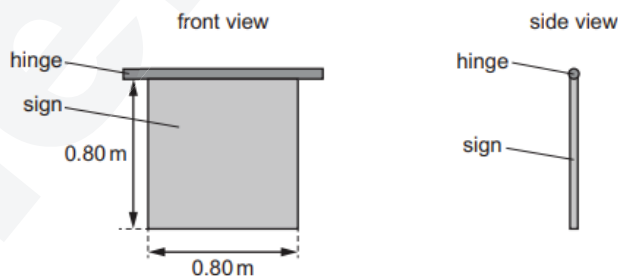
The moment of a force = Force \times Perpendicular distance of the pivot from the line of action of the force

Principle of Moment when it is in equilibrium

- The sum of anticlockwise moment about a point = sum of clockwise moment about the same point when a body is in equilibrium.

Challenging Question:-

- 13 A uniform square sign of weight 40 N is suspended vertically from its top edge by a horizontal hinge, as shown.



The hinge is not frictionless. When the sign is displaced from the vertical by an external force and then released, it does not return to the vertical position.

The maximum torque exerted by the hinge on the sign is 6.0 N m. The sign is displaced by 90° so that it is horizontal and then gradually released.

At which angle to the vertical does the sign hang after release?

- A 11° B 22° C 68° D 79°

Torque of couple

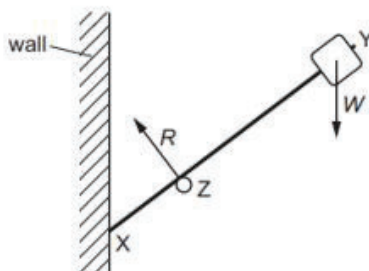
- The pair of forces will cause it to rotate → **the torque of couple**

torque of a couple = one of the forces \times perpendicular distance between the forces

- A couple has turning effect but does not cause an object to accelerate.
 - Conditions:
 - Equal in magnitude
 - Parallel, but opposite direction
 - Separated by a distance d

Exercise:-

- 12 A light rigid rod XY has an object of weight W fixed at one end. The rod is in equilibrium, resting on a roller at Z and a vertical wall at X . The roller exerts a force R on the rod as shown. The diagram shows the directions, but not the magnitudes, of the forces R and W .

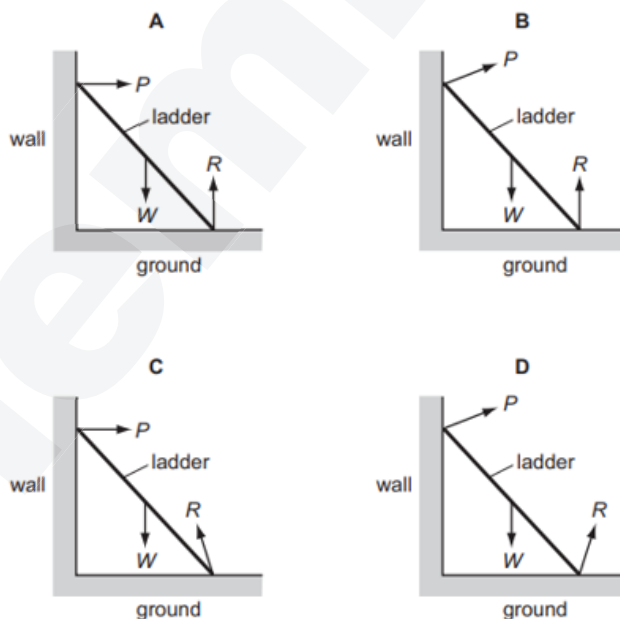


What is the direction of the force on the rod at X ?

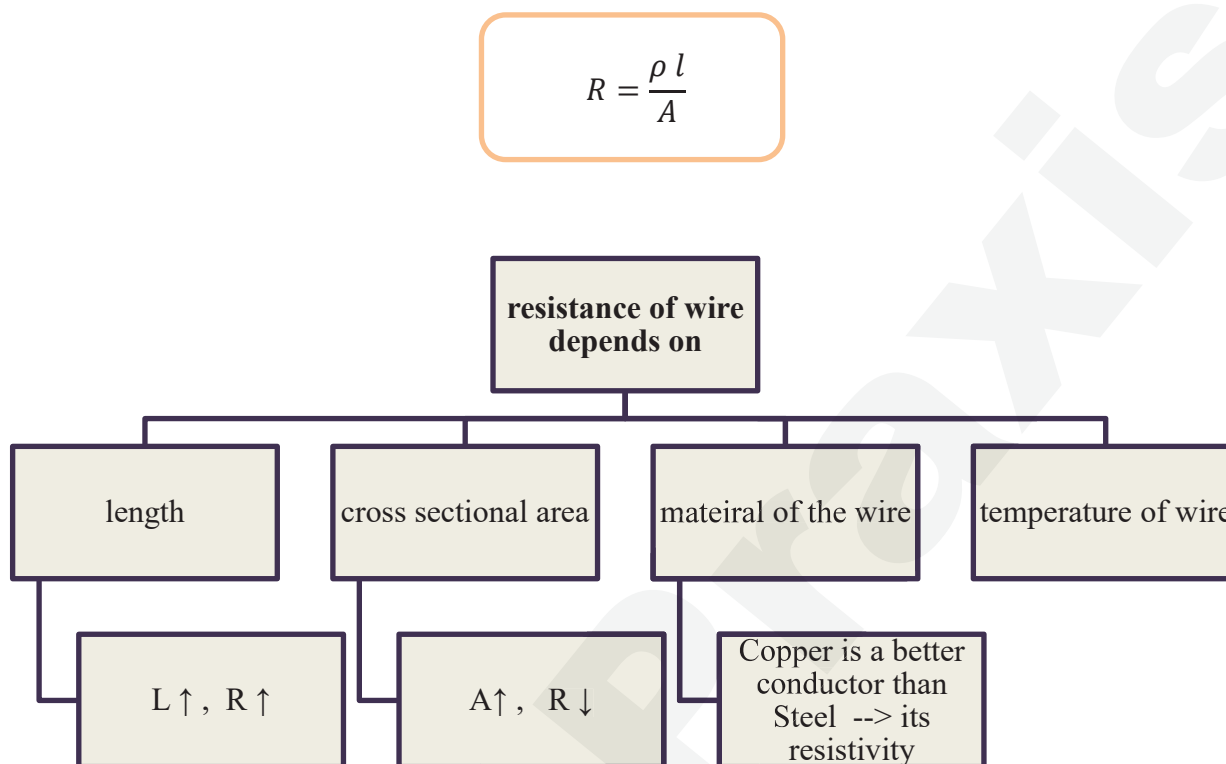


- 14 A ladder is positioned on icy (frictionless) ground and is leant against a rough wall. At the instant of release it begins to slide.

Which diagram correctly shows the directions of the forces P , W and R acting on the ladder as it slides?



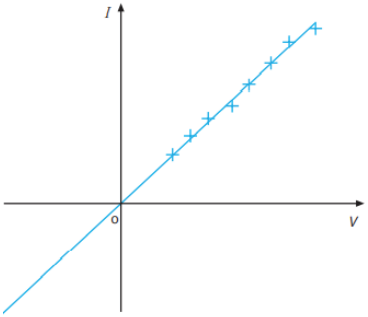
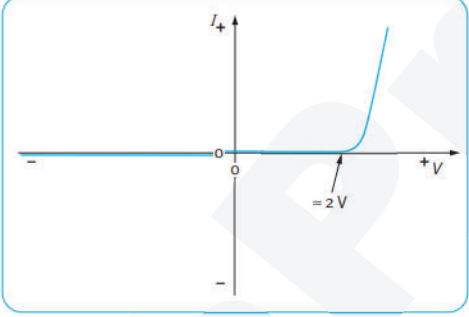
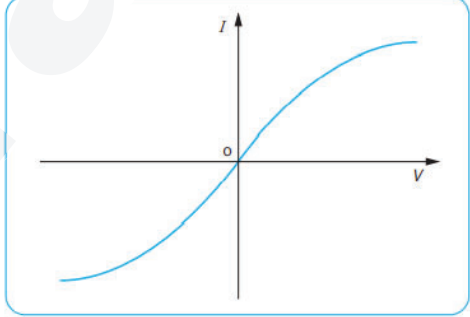
Resistance and resistivity (Popular in paper 2 for ratio questions)



- Definition of Ohm = Volt per ampere.
- The resistance of wire depends on
 - Length
 - Cross Sectional Area
 - Material Of the Wire
 - If is impure metal, different sizes of atoms occur → hence disrupts the free flow of electrons.
 - Temperature Of Wire
 - At low temperature → the electrons can move easily past the positive ions
 - High temperature → ions vibrate with larger amplitude. Hence electrons collide more frequently with the vibrating ions = decreasing the drift velocity.

Ohm's Law

- Definition: For a metallic conductor at constant temperature, the current in the conductor is directly proportional to the potential difference across its ends.
 - Meaning, it will only be directly proportional if the temperature does not change.
 - Temperature will affect the resistance. So when it obeys Ohm's Law, it means that the resistance is independent.

Metallic conductor at constant temperature	Semiconductor diode	Filament lamp
		
<p>The graph passing through origin shows that the resistance of the conductor remains constant.</p> <p>Double the current, double the voltage</p>	<p>This component only allows electric current to flow in one direction.</p> <p>Most of the diode made of semiconductor materials.</p> <p>Meaning if the current flow as the direction of diode, very low resistance.</p>	<p>The line still passes through the origin shows you an ohmic component.</p> <p>As voltage increase, the current started lesser than expected like Ohm's Law.</p> <p>The resistance depends on the temperature of its filament.</p>

Questions:-

- 7 (a) Define the *ohm*.

.....[1]

- (b) Wires are used to connect a battery of negligible internal resistance to a lamp, as shown in Fig. 7.1.

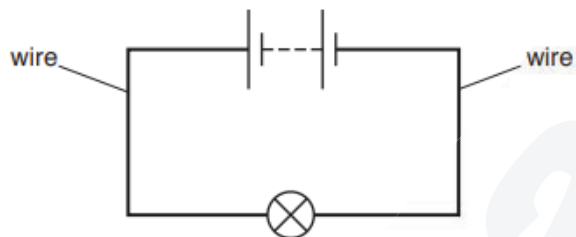


Fig. 7.1

The lamp is at its normal operating temperature. Some data for the filament wire of the lamp and for the connecting wires of the circuit are shown in Fig. 7.2.

	filament wire	connecting wires
diameter	d	$14d$
total length	L	$7.0L$
resistivity of metal (at normal operating temperature)	ρ	0.028ρ

Fig. 7.2

- (i) Show that

$$\frac{\text{resistance of filament wire}}{\text{total resistance of connecting wires}} = 1000.$$

[2]

- (ii) Use the information in (i) to explain qualitatively why the power dissipated in the filament wire of the lamp is greater than the total power dissipated in the connecting wires.

.....
.....
..... [1]

- (iii) The lamp is rated as 12V, 6.0W. Use the information in (i) to determine the total resistance of the connecting wires.

total resistance of connecting wires = Ω [3]

- (iv) The diameter of the connecting wires is decreased. The total length of the connecting wires and the resistivity of the metal of the connecting wires remain the same.

State and explain the change, if any, that occurs to the resistance of the filament wire of the lamp.

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.....
.....
..... [3]

[Total: 10]