9th Physics

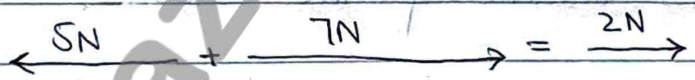
Chapter 4 Turning Effect of Forces

Conceptual Questions

1. Two forces of 7N and 5N are added, how will they give resultant of 12N and 2N?

(i). If two forces of 7N and 5N have same direction and parallel to each other then their resultant will be 12N.

(ii). If two forces of 7N and 5N have opposite direction and parallel to each other then their resultant will be 2N



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2. Why long spanner is used to open or tight nuts of vehicle's tyre? While tightening a small nut, extra-long wrench is not suitable. Why?

(ii). $\tau = Fl \Rightarrow \frac{\tau}{F} = l \Rightarrow l = \frac{\tau}{F}$ $\begin{cases} l \propto \tau \\ l \propto \frac{1}{F} \end{cases}$

(i). Long spanner helps to increase the torque which in turn makes it easy to open or tight the nut of vehicle's tyre.

$l \propto \tau$

If moment arm (length of Spanner) is greater then Small force is required to open or tight the nut.

$$l \propto \frac{1}{F}$$

moment arm

(ii). While tightening a Small nut, extra-long wrench is not Suitable because a large torque will produce which may damage or break the nut.
Secondly Small nut requires less torque which can easily be achieved by Small Spanner.

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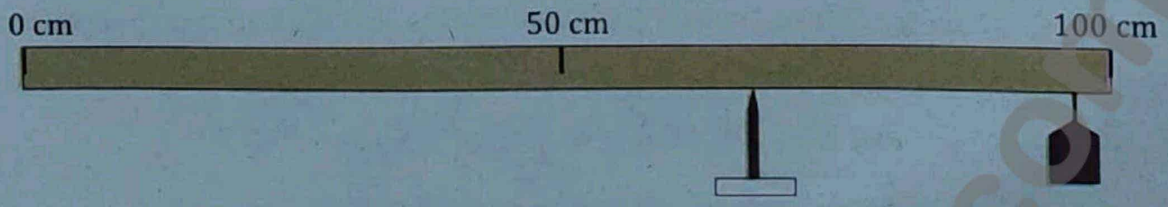
3. Why door Knobs are fixed at the edge of door? what will happen if the door Knob is at the middle of the door?

Door Knobs are fixed at the edge of door to increase the moment arm (l) which in turn makes it easy to open or close the door because less force is required

$$l \propto \frac{1}{F}$$

If the door knob is at the middle of the door, the moment arm will be reduced to half which means greater force is required to open the door.

4. A uniform metre rod is balanced on the sharp edge of a knife. A mass is hanging on its right side. Why is it not falling on right side?



The metre rod is balanced on the edge of a knife and it is not falling on right side because clockwise torque produced on the right side due to mass hanging is equal to the anti-clockwise torque produced on the left side due to mass of rod. These two torques are equal so the uniform metre rod is balanced on the sharp edge of a knife.

5. How does this toy remain balanced on finger, even disturbed slightly?

The toy (bird) remains balanced on finger even disturbed slightly because of the way that the balancing bird is spreading its wings, it is able to distribute its weight in such a way that it creates a centre of gravity right below the beak and it is its lowest possible height. So having the center of gravity below the beak allows the bird to be balanced on a finger.

→ The Center of gravity is the point where whole weight of the body appears to act.

6. A Small boy is thrown Straight up by his father. At the top of his path, he comes to rest for a moment. Will he be in equilibrium at this point?

A Small boy is thrown Straight up by his father. At the top of his path, he comes to rest for a moment but he is not in equilibrium because net force on the body is not zero. For a body to be in equilibrium, Sum of all the forces acting on the body must be equal to zero. A body is not in equilibrium due to a force (gravitational force) acting on it.

7. A fan is rotating uniformly, is it in equilibrium?

Yes, the fan is in equilibrium.

Reason:

The fan is in equilibrium because it is rotating with uniform velocity and when velocity is uniform, acceleration is zero. And a body is said to be in equilibrium if acceleration is zero.

8. Can a body be in equilibrium under the action of Single force or Single torque?

→ No, a body Cannot be in equilibrium under the action of Single force or Single torque.

→ For a body to be in Complete equilibrium, the Sum of all the forces or torques acting on the body must be equal to zero.

→ Due to Single force or Single torque, a body is not balanced and acceleration is produced. Therefore in the presence of a Single force body Can not be in equilibrium.

9. Give an example of a body, which Satisfies first Condition of equilibrium but it is not in equilibrium?

In Case of Couple, two equal and opposite forces are acting on a Same body but the body has a tendency to rotate and the body rotates. In this Case resultant force is zero but resultant torque is not zero.

Example:

While turning a Car, the resultant forces applied on the Steering wheel by hands is zero but rotation is produced in the Steering wheel i.e torque is not zero.

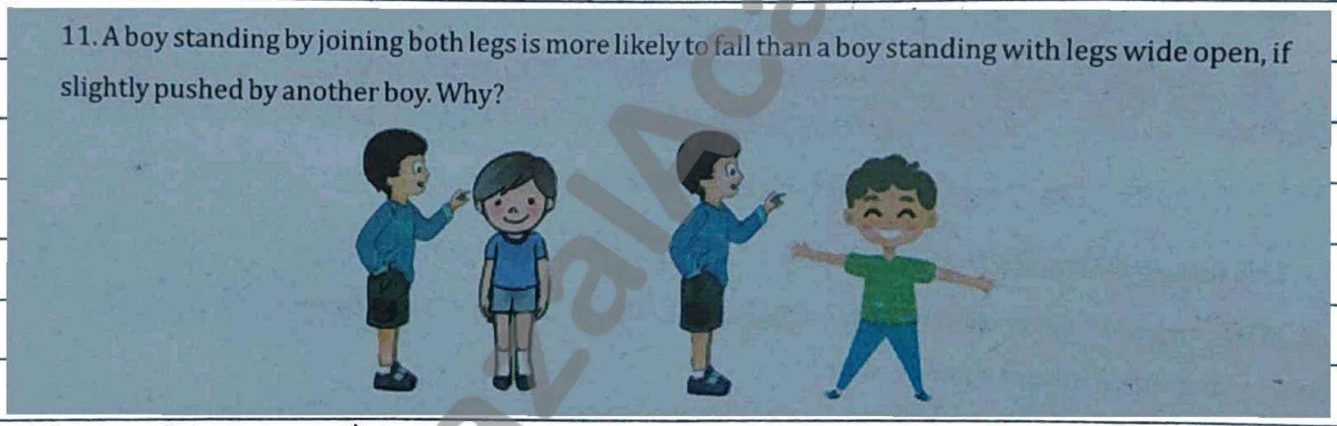
10. Why Heavy Transport Vehicles (HTV) are made heavy at their bottom?

Heavy Transport Vehicles (HTV) are made heavy at their bottom

(i). to increase their stability,

(ii) to keep its Centre of gravity as low as possible. A lower Centre of gravity helps to keep Heavy Transport vehicles stable.

(iii). If their bottom are not made heavy, the body topples over while taking a turn and does not remain stable.



A boy standing with legs wide open is more stable than a ~~body~~ boy standing by joining his legs because when his legs are joined, the Centre of gravity of the body is in its highest position which decrease its stability and the boy who is standing with open legs have Centre of gravity at lowest position which increase its stability, if slightly pushed by another boy, he can maintain its position.

The wide base area increase stability