SMART EXAM RESOURCES

IGCSE PHYSICS

MOTION FORCES AND ENERGY-IMPORTANT CHANGES [26-28 EXAMS]

1.5.1.6 Describe solid friction as the force between two surfaces

Solid Friction:

Definition: Solid friction is the force between two surfaces that may impede relative motion and produce heating [new for 2026-2028 Exams]

[old syllabus: Described solid friction as the force between two surfaces that may impede motion and produce heating]

Relative is the new word to be included while defining solid friction]

Explanation:

Solid friction, also known as dry friction, is the force that opposes the relative motion or tendency of motion between two solid surfaces in contact. It arises due to irregularities on the surfaces in contact, which interlock and resist sliding past each other. This force exists whether the surfaces are stationary or in motion relative to each other.

Here's a breakdown of solid friction:

- Static Friction: This is the friction that prevents an object from starting to move when a force is applied to it. It occurs between stationary surfaces and can vary in magnitude depending on the applied force. The maximum static friction force that can be applied before motion begins is proportional to the normal force pressing the surfaces together.
- Kinetic Friction: Once an object starts moving, the friction that opposes its motion is called kinetic friction. It's usually slightly less than static friction and remains relatively constant as long as the surfaces are in motion. Kinetic friction arises due to the resistance between the surfaces as they slide past each other.

- 1.5.3.3 Describe, qualitatively, the effect of the position of the centre of gravity and the angle of tilt of a simple object on its stability [new for 2026-2028 Exams]

[Old Syllabus: Describe, qualitatively, the effect of the position of the centre of gravity on the stability of simple Objects]

New syllabus requires ' angle of tilt to be included in explanations]

The stability of an object is influenced by both the position of its center of gravity and the angle of tilt. Here's a qualitative description of how these factors affect stability:

Position of the Center of Gravity (CoG):

- Low CoG: When the center of gravity is low, closer to the base of the object, it enhances stability. This is because the gravitational force acting on the object tends to exert a torque that keeps it upright. Think of a wide-based object like a pyramid; even if it's tilted slightly, the gravitational force tends to bring it back to its stable position.
- High CoG: Conversely, when the center of gravity is high, farther from the base, the object becomes less stable. It's easier for external forces to cause the object to tip over because the torque produced by gravity is stronger. For instance, a tall, narrow object like a pencil is more prone to tipping over than a shorter, wider object like a book.

Angle of Tilt:

- Small Angle: At small angles of tilt, the object is generally more stable. This is because the gravitational force acting on the object produces a restoring torque that opposes the tilt, helping it return to its original position.
- Large Angle: As the angle of tilt increases, stability decreases. At a certain point, the center of gravity may shift beyond the base of support, causing the object to topple over. Imagine a chair leaning on two legs compared to when it's on all four legs; it's much more likely to fall when tilted at a larger angle.

Combining these factors:

- An object with a low center of gravity and a wide base is typically very stable, as it resists tipping even when tilted.
- An object with a high center of gravity and a narrow base is less stable and more prone to tipping over, especially when tilted.

– 1.7.1.2 Describe, qualitatively, how energy is transferred between stores during events and processes, including examples of transfer by forces and motion (mechanical work done), electrical currents (electrical work done), heating, and by electromagnetic, sound and other waves

[old syllabus: Describe how energy is transferred between stores during events and processes, including examples of transfer by forces (mechanical work done), electrical currents (electrical work done), heating, and by electromagnetic, sound and other waves]

[New syllabus requires Description to include explanation forces and motion, both]

Energy transfer between different stores occurs through various processes, each with its own mechanism. Here's a qualitative description of how energy is transferred between different stores:

Mechanical Work Done (Forces and Motion):

- When a force acts on an object and causes it to move, mechanical work is done, transferring energy from one store to another.
- Example: Pushing a car requires applying a force over a distance, doing mechanical work to transfer energy from the muscles (chemical energy store) to the car's kinetic energy store.

Electrical Work Done (Electrical Currents):

- In electrical systems, energy is transferred through the movement of charged particles (usually electrons) in a conductor.
- Example: When you plug in an electrical device, electrical energy from the power source is transferred through the wires to the device's electrical components, such as a motor or a light bulb.

Heating:

- Heat energy is transferred from hotter objects to cooler objects by conduction, convection, or radiation.
- Example: Cooking food on a stove transfers heat energy from the stove's heating element to the pan and then to the food through conduction.

Electromagnetic Waves:

- Energy is transferred through space in the form of electromagnetic waves, such as light, infrared radiation, ultraviolet radiation, etc.
- Example: Sunlight transfers energy to the Earth through electromagnetic waves, providing warmth and enabling photosynthesis in plants.

Sound Waves:

- Vibrations in a medium, such as air, transfer energy as sound waves.
- Example: When you speak, your vocal cords vibrate, transferring energy to the surrounding air molecules, which then propagate as sound waves to the listener's ears.

Other Waves:

- Various types of waves, such as seismic waves (earthquakes), water waves, and waves in strings or springs, transfer energy through the medium they propagate in.
- Example: Wind waves transfer energy from the wind to the surface of the water, causing waves to form and propagate across the ocean.

In each of these examples, energy is transferred between different stores or forms through specific processes or phenomena. Understanding these mechanisms is essential for analyzing energy transformations in various systems and phenomena in the natural world.