Force and Friction

I Word Focus

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1. Difference between Contact and Non-contact force

Aspect	Contact Forces	Non-Contact Forces
Definition	Forces that act when two objects are physically in contact.	Forces that act at a distance without physical contact.
Examples	Friction, tension, normal force, applied force, air resistance.	Gravitational force, electrostatic force, magnetic force.
Source of Force	Result from the interaction of objects at the point of contact.	Result from the fields around objects (gravitational, magnetic, etc.).
Effect	Can change the object's motion, shape, or direction based on the contact.	Can change an object's motion or position at a distance.

Example in Real Life	Walking (friction), lifting a box (applied force), bending (tension).	Earth's gravity (objects fall), magnets attracting (magnetic force).

2. If you were tasked with designing a vehicle that moves on both land and water, how would you adjust the design to minimize friction on land and maximize friction on water? Explain your reasoning.

To **minimize friction on land**, the vehicle should have:

- **Smooth, round wheels** or **tires** to reduce the surface contact area. This reduces rolling friction, allowing for smooth movement.
- A **lightweight design** to reduce the force pressing the vehicle against the ground.

To **maximize friction on water**, the vehicle should have:

- A **flat or wide base** to increase surface contact with the water, allowing for more resistance to slipping or sliding.
- **Specialized paddles or fins** could be added to help propel the vehicle forward and create more friction with the water's surface.

3. Why is it harder to push a stationary box than a moving one?

Static Friction is the friction that resists the start of motion. It is usually **stronger** because the surfaces in contact are not yet sliding, so the microscopic asperities (roughness) of the surfaces interlock more tightly. This requires a larger force to break the interlocking.
Kinetic Friction occurs once the object is in motion. As the surfaces are sliding against each other, the interlocking of microscopic asperities is lessened, making it easier for the object to keep moving. Thus, less force is needed to overcome kinetic friction.

4. If you were designing a running shoe, how would you make sure it has good grip on a track but lasts longer without wearing out quickly

To maximize **grip** on a track, the shoe should:

- Have a **rubber sole with a textured surface** (like treads or spikes) to increase the friction between the shoe and the track, preventing slipping.
- Use **soft but durable materials** that offer good traction without being too abrasive.

To minimize **wear on the sole**, the shoe should:

- Use **a hard rubber compound** or a **long-lasting synthetic material** in areas of the sole that are subject to the most wear.

- Design the shoe with **reinforced high-wear zones** like the heel and toe, which experience the most friction during running.

5. What is force and write it's effects.

Force is a push or pull that can cause an object to move, stop, or change its direction. It can also cause an object to change its shape. Force is measured in **Newtons (N)**.

(a) Force can make a stationary object move or make a moving object move faster.
(b) Force can slow down or completely stop a moving object
(c) Force can change the direction of a moving object
(d) Force can change the speed of an object
(e) Force can change the shape or size of an object