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GPT - PHYSICS Handbook 1

You spill a bucket of soapy water on a marble floor accidentally. Would it make it easier or more difficult for you to walk on the floor? Why?

We are able to walk because of the friction present between our feet and the ground. In order to walk, we push the ground in the backward direction with our feet. The force of friction pushes it in the forward direction and allows us to walk. The force of friction between the ground and feet decreases when there is soapy water spilled on the floor. Hence, it becomes difficult to walk on the soapy floor

Iqbal has to push a lighter box and Seema has to push a similar heavier box on the same floor. Who will have to apply a larger force and why?

Force of friction arises because of interlocking of irregularities on the two surfaces in contact. When a heavy object is placed on the floor, the interlocking of irregularities on the surfaces of box and floor become strong.

This is because the two surfaces in contact are pressed harder. Hence, more force is required to overcome the interlocking. Thus, to push the heavier box, Seema has to apply a greater force than Iqbal.

Explain why sliding friction is less than static friction

Friction comes into play when irregularities present in the surfaces of two objects in contact get interlocked with each other. In sliding, the time given for interlocking is very small. Hence, interlocking is not strong. Therefore, less force is required to overcome this interlocking. Because of this reason, sliding friction is less than static friction.

Explain why objects moving in fluids must have special shapes.

When a body moves through a fluid, it experiences an opposing force which tries to oppose its motion through the fluid.

This opposing force is known as the drag force. This frictional force depends on the shape of the body. By giving objects a special shape, the force of friction acting on it can be minimised. Hence, it becomes easier for the body to move through the fluid.

The sound from a mosquito is produced when it vibrates its wings at an average rate of 500 vibrations per second. What is the time period of the vibration?

The time required to complete one oscillation is known as time period. It is given by the inverse of the frequency.

$$\text{Time period} = \frac{1}{\text{Frequency of Oscillation}}$$

$$\text{Frequency of oscillations} = 500 \text{ Hz}$$

$$\text{Time period} = \frac{1}{500} = 0.002 \text{ S}$$

What is the difference between noise and music? Can music become noise sometimes?

The sound that is pleasing to the ear is called music. For example, the sound produced by violins, pianos, flutes, pungs, etc. The sound that is unpleasing to the ear is called noise

Explain in what way noise pollution is harmful to humans

Noise pollution can lead to a number of health-related problems. Some of them are (i) Hearing loss (ii) Insomnia; inability to sleep (iii) Hypertension (iv) Severe headache (v) Stress

Your parents are going to buy a house. They have been offered one on the roadside and another three lanes away from the roadside. Which house would you suggest your parents should buy? Explain your answer

There will be more noise in the house which is along the roadside. This is because noise produced by transportation vehicles may cause trouble to the residents.

The intensity of noise decreases with the distance between the source and the listener. Hence, it is better to take the house that is three lanes away from the roadside

Lightning and thunder take place in the sky at the same time and at the same distance from us. Lightning is seen earlier and thunder is heard later. Can you explain?

The speed of sound is less than the speed of light. Hence, light reaches us before the sound during a lightning, which is accompanied by thundering

Suppose you are in a dark room. Can you see objects in the room? Can you see objects outside the room? Explain.

If we are in a dark room, then it is not possible for us to see objects in the room. However, objects outside the room are visible to us. An object becomes visible when light reaches our eye after being reflected from the object.

If there is no light in the room, then the objects inside the room cannot reflect any light. Hence, we cannot see in a dark room. If there is light present outside the room, then we can see the objects outside the room

Differentiate between regular and diffused reflection. Does diffused reflection mean the failure of the laws of reflection?

Regular reflection takes place from a smooth or a regular surface. In regular reflection, all reflected rays are parallel to each other for parallel incident rays. Irregular or diffused reflection takes place from an irregular surface.

In diffused reflection, the reflected rays are not parallel to each other for parallel incident rays. This happens because of the presence of irregular microscopic surfaces. Hence, parallel incident rays reflect in different directions. However, each ray obeys the laws of reflection. Therefore, laws of reflections are not violated in diffused or irregular reflections

State the laws of reflection.

Laws of reflection:

- (i) The angle of reflection is always equal to the angle of incidence.
- (ii) The incident ray, the reflected ray and the normal to the reflective surface at the point of incidence all lie in the same plane

Describe an activity to show that the incident ray, the reflected ray and the normal at the point of incidence lie in the same plane.

Place a plane mirror on the table. Take a paper sheet and make a small hole in its centre. Make sure that the light in the room is not bright. Hold the sheet normal to

the table. Take another sheet and place it on the table in contact with the vertical mirror. Draw a normal line on the second sheet from the mirror.

Now, light a torch on the mirror through the small hole such that the ray of light falls on the normal at the bottom of the mirror. When the ray from this hole is incident on the mirror, it gets reflected in a certain direction. You can easily observe the incident ray, reflected ray and the normal to the mirror at the point of incidence on the sheet placed on the table. This shows that the incident ray, the reflected ray, and the normal to the surface at the point of incidence all lie in the same plane

Describe the construction of a kaleidoscope

Three rectangular mirror strips of dimensions 15cm x 4cm (l x b) are joined together to form a prism, This prism is fixed into a circular cardboard tube. The circular cardboard tube should be slightly longer than the prism

This circular tube is now closed at one end with a cardboard disc. This disc has a hole in it through which we can see

At the other end of the circular tube, a plane glass plate is fixed. It is important that this glass plate touches the prism mirrors. On this glass plate, several small and broken pieces of coloured glass are placed. This end is now closed by a round glass plate allowing enough space for the coloured glass pieces to move

How many images of a candle will be formed if it is placed between two parallel plane mirrors separated by 40 cm?

Infinite or multiple images of the candle will be formed because of multiple reflections between the mirrors. When two mirrors are placed parallel to each other, then infinite numbers of images are formed

What is a constellation? Name any two constellations

A constellation is a group of stars that form a recognisable pattern in the sky. The two well known constellations are Ursa Major and Orion

Name two objects other than planets which are members of the solar system

(i) Asteroids A collection of a large number of small objects, gases and dust are revolving around the sun. They occupy a large gap between the orbits of Mars and Jupiter. However, these are not planets. These celestial objects are known as asteroids.

(ii) Meteors Meteors are small celestial objects that are seen as bright streaks of light in the sky. They burn out on entering the Earth's atmosphere because of the heat produced by friction. This results in bright streaks in the sky. They are not planets

Do all the stars in the sky move? Explain.

No. The Earth rotates from West to East on its axis. Hence, all stars in the sky (except the Pole star) appear to move from East to West. With reference to the Earth, the Pole star does not appear to move in the sky because it is located above the axis of rotation of the Earth in the north direction. It appears to remain stationary at a point in the sky.

Why is the distance between stars expressed in light years? What do you understand by the statement that a star is eight light years away from the Earth?

The distance of the stars from the Earth and the distance between the stars are very large. It is inconvenient to express these distances in kilometer (km). Thus, these large distances are expressed in light years. One light year is the distance travelled by light in one year. One light year is equal to 9.46×10^{12} km. A star is located eight light years away from the Earth. This means that the distance between the star and the Earth is equivalent to the distance travelled by light in eight years, i.e., a star is located $8 \times (9.46 \times 10^{12}) = 7.6 \times 10^{13}$ km away from the Earth

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