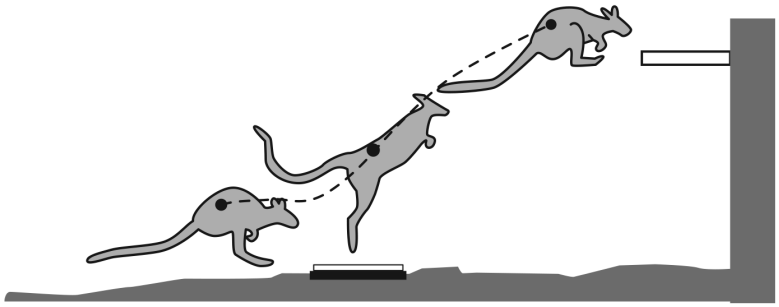
TIMSS Advanced 2015

APPENDIX C

Example Physics Items



A kangaroo hops along and then jumps from a flat plate on the ground up to a ledge, as shown above. When a jumping kangaroo is in contact with the plate, its feet exert a force on the plate in the vertical direction, and the plate exerts a force on the kangaroo's feet in the vertical direction. Which statement BEST describes the magnitudes of these forces?

Ⓐ Both forces equal the mass of the kangaroo.

Ⓑ Both forces equal half the mass of the kangaroo.

● They vary in size but stay equal to each other.

Ⓓ The force from the plate becomes larger than the force from the feet.

PA23110

PA23082

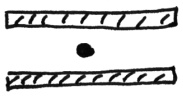
The sand on a beach is very hot on a warm and sunny day and is cold at night. As a contrast, the temperature of the sea varies very little between day and night. What does this observation tell you about the specific heat capacity of sand compared to that of water?

The sand has a wider temperature range than the water, so the water retains more heat. The specific heat capacity of sand is much lower than the specific heat of water

A small charged plastic foam ball is held at rest by the electric field between two large horizontal oppositely charged plates.

If the charge on the ball is 5.7 μC and its mass is 1.4×10^{-4} kg, what is the magnitude of the electric field strength? Show your work.

PA13024



$F_g = mg$

$E = F/q$

$F = qE$

$F_g = F$

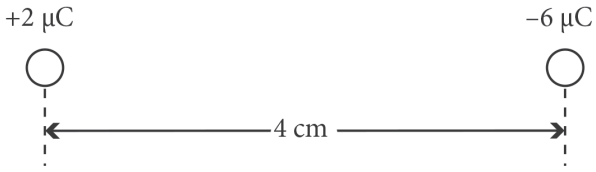
$mg = qE$

$E = mg/q$

$= \frac{(9.8)(1.4 \times 10^{-4})\text{N}}{5.7 \times 10^{-6}\text{C}}$

$= 240\ \text{N/C}$

Two small charges of +2 μC (microcoulombs) and –6 μC respectively are placed 4 cm apart as shown.



Where should a third charge –8 μC be placed so that there is no net force on the –6 μC charge?

Ⓐ 4 cm left of the –6 μC charge

Ⓑ 16 cm left of the –6 μC charge

Ⓒ 16 cm right of the –6 μC charge

● 8 cm left of the –6 μC charge

Ⓔ 8 cm right of the –6 μC charge

PA13006

PA23113

Laser Radiation
Caution: Do not stare into the beam.
Class II Laser Product

Suzanne has a red laser pointer of wavelength 630-680 nm and maximum output of less than 1 mW. The label on Suzanne's laser pointer is shown above. Which statement explains how laser light can damage Suzanne's eyes?

Ⓐ The energy of a photon of red light is large enough to damage the light sensitive cells in her eyes.

Ⓑ Red light from a laser has higher photon energy than red light from an incandescent light globe.

Ⓒ The laser pointer produces more photons per second than a 100 W incandescent light globe.

● Red light photons in the laser pointer beam are spread over a smaller area than photons from a light globe.

The speed of waves on the water surface is 0.32 ms^{-1} in deep water and 0.20 ms^{-1} in shallow water.

If the wavelength in deep water is 0.016 m, what is the wavelength in shallow water?

$$f_1 = \frac{v_1}{\lambda_1}, \quad f_2 = \frac{v_2}{\lambda_2}, \quad f_1 = f_2$$

$$\lambda_2 = \left(\frac{v_2}{v_1}\right)\lambda_1$$

$$= \left(\frac{.20}{.32}\right)(.016)\ m$$

$$\lambda_2 = .010\ m$$

PA13023