P8-72) Two snowy peaks are at heights $H = 850$ m and $h = 750$ m above the valley between them. A ski run extends between the peaks, with a total length of 3.2 km and an average slope of $\theta = 30^\circ$ (Fig. 8-59). (a) A skier starts from rest at the top of the higher peak. At what speed will he arrive at the top of the lower peak if he coasts without using ski poles? Ignore friction. (b) Approximately what coefficient of kinetic friction between snow and skis would make him stop just at the top of the lower peak?

![Ski Run Diagram](image)

P9-51) In Fig. 9-58a, a 3.50 g bullet is fired horizontally at two blocks at rest on a frictionless table. The bullet passes through block 1 (mass 1.20 kg) and embeds itself in block 2 (mass 1.80 kg). The blocks end up with speeds $v_1 = 0.630$ m/s and $v_2 = 1.40$ m/s (Fig. 9-58b). Neglecting the material removed from block 1 by the bullet, find the speed of the bullet as it (a) leaves and (b) enters block 1.

![Bullet and Blocks Diagram](image)

P16-54) Two sinusoidal waves with the same amplitude and wavelength travel through each other along a string that is stretched along an $x$ axis. Their resultant wave is shown twice in Fig. 16-40, as the antinode $A$ travels from an extreme upward displacement to an extreme downward displacement in 6.0 ms. The tick marks along the axis are separated by 10 cm; height $H$ is 1.80 cm. Let the equation for one of the two waves be of the form $y(x, t) = y_m \sin(kx + \omega t)$. In the equation for the other wave, what are (a) $y_m$, (b) $k$, (c) $\omega$, and (d) the sign in front of $\omega$?

![Waves Diagram](image)
P19-8) Compute (a) the number of moles and (b) the number of molecules in 1.00 cm$^3$ of an ideal gas at a pressure of 100 Pa and a temperature of 220 K.

P22-84) In Fig. 22-63, a uniform, upward electric field $\vec{E}$ of magnitude $2.00 \times 10^3$ N/C has been set up between two horizontal plates by charging the lower plate positively and the upper plate negatively. The plates have length $L = 10.0$ cm and separation $d = 2.00$ cm. An electron is then shot between the plates from the left edge of the lower plate. The initial velocity of the electron makes an angle $\theta = 45.0^\circ$ with the lower plate and has a magnitude of $6.00 \times 10^6$ m/s. (a) Will the electron strike one of the plates? (b) If so, which plate and how far horizontally from the left edge will the electron strike?

P24-50) In Fig. 24-49, how much work must we do to bring a particle, of charge $Q = +16e$ and initially at rest, along the dashed line from infinity to the indicated point near two fixed particles of charges $q_1 = +4e$ and $q_2 = -q_1/2$? Distance $d = 1.40$ cm, $\theta_1 = 43^\circ$, and $\theta_2 = 60^\circ$.

P28-72) A beam of electrons whose kinetic energy is $K$ emerges from a thin-foil “window” at the end of an accelerator tube. A metal plate at distance $d$ from this window is perpendicular to the direction of the emerging beam (Fig. 28-52). (a) Show that we can prevent the beam from hitting the plate if we apply a uniform magnetic field such that

$$B \geq \sqrt{\frac{2mK}{e^2d^2}}$$

in which $m$ and $e$ are the electron mass and charge. (b) How should $\vec{B}$ be oriented?

P29-53) A long solenoid has 100 turns/cm and carries current $i$. An electron moves within the solenoid in a circle of radius 2.30 cm perpendicular to the solenoid axis. The speed of the electron is $0.0460c$ ($c =$ speed of light). Find the current $i$ in the solenoid.
P33-79) (a) Prove that a ray of light incident on the surface of a sheet of plate glass of thickness $t$ emerges from the opposite face parallel to its initial direction but displaced sideways, as in Fig. 33-69. (b) Show that, for small angles of incidence $\theta$, this displacement is given by

$$x = t\theta \frac{n-1}{n}$$

where $n$ is the index of refraction of the glass and $\theta$ is measured in radians.

P35-21) In a double-slit experiment, the distance between slits is 5.0 mm and the slits are 1.0 m from the screen. Two interference patterns can be seen on the screen: one due to light of wavelength 480 nm, and the other due to light of wavelength 600 nm. What is the separation on the screen between the third-order ($m = 3$) bright fringes of the two interference patterns?