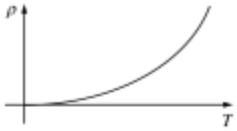
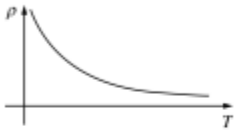
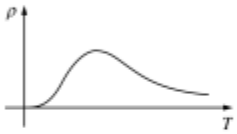
GRE Physics Practice Test 5

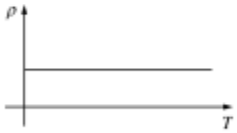
53. Which of the following best represents the temperature dependence of the resistivity of an undoped semiconductor?

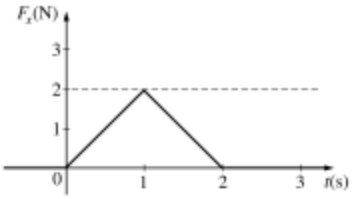
(A) 

(B) 

(C) 

(D) 

(E) 



54. The figure above shows a plot of the time-dependent force $F_x(t)$ acting on a particle in motion along the x-axis. What is the total impulse delivered to the particle?

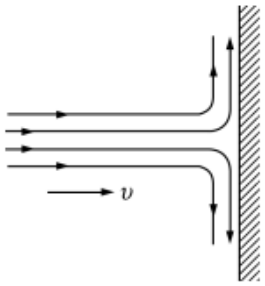
(A) 0
(B) 1 kg·m/s
(C) 2 kg·m/s
(D) 3 kg·m/s
(E) 4 kg·m/s

55. A particle of mass m is moving along the x-axis with speed v when it collides with a particle of mass $2m$ initially at rest. After the collision, the first particle has come to rest, and the second particle has split into two equal-mass pieces that move at equal angles $\theta > 0$ with the x-axis, as shown in the figure above. Which of the following statements correctly describes the speeds of the two pieces?

(A) Each piece moves with speed v.
(B) One of the pieces moves with speed v, the other moves with speed less than v.
(C) Each piece moves with speed $v/2$.
(D) One of the pieces moves with speed $v/2$, the other moves with speed greater than $v/2$.
(E) Each piece moves with speed greater than $v/2$.

56. A balloon is to be filled with helium and used to suspend a mass of 300 kilograms in air. If the mass of the balloon is neglected, which of the following gives the approximate volume of helium required? (The density of air is 1.29 kilograms per cubic meter and the density of helium is 0.18 kilogram per cubic meter.)

(A) $50\ \text{m}^3$
(B) $95\ \text{m}^3$
(C) $135\ \text{m}^3$
(D) $270\ \text{m}^3$
(E) $540\ \text{m}^3$



57. A stream of water of density ρ, cross-sectional area A, and speed v strikes a wall that is perpendicular to the direction of the stream, as shown in the figure above. The water then flows sideways across the wall. The force exerted by the stream on the wall is

(A) $\rho v^2 A$
(B) $\rho v A/2$
(C) $\rho g h A$
(D) $v^2 A/\rho$
(E) $v^2 A/2\rho$

58. A proton moves in the $+z$-direction after being accelerated from rest through a potential difference V. The proton then passes through a region with a uniform electric field E in the $+x$-direction and a uniform magnetic field B in the $+y$-direction, but the proton's trajectory is not affected. If the experiment were repeated using a potential difference of $2V$, the proton would then be

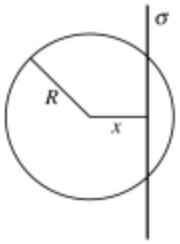
(A) deflected in the $+x$-direction
(B) deflected in the $-x$-direction
(C) deflected in the $+y$-direction
(D) deflected in the $-y$-direction
(E) undeflected

59. For an inductor and capacitor connected in series, the equation describing the motion of charge is

$$L\frac{d^2Q}{dt^2} + \frac{1}{C}Q = 0,$$

where L is the inductance, C is the capacitance, and Q is the charge. An analogous equation can be written for a simple harmonic oscillator with position x, mass m, and spring constant k. Which of the following correctly lists the mechanical analogs of L, C, and Q?

	L	C	Q
(A)	m	k	x
(B)	m	$1/k$	x
(C)	k	x	m
(D)	$1/k$	$1/m$	x
(E)	x	$1/k$	$1/m$



60. An infinite, uniformly charged sheet with surface-charge density σ cuts through a spherical Gaussian surface of radius R at a distance x from its center, as shown in the figure above. The electric flux Φ through the Gaussian surface is

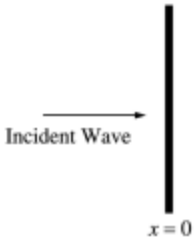
(A) $\frac{\pi R^2 \sigma}{\epsilon_0}$

(B) $\frac{2\pi R^2 \sigma}{\epsilon_0}$

(C) $\frac{\pi (R - x)^2 \sigma}{\epsilon_0}$

(D) $\frac{\pi (R^2 - x^2) \sigma}{\epsilon_0}$

(E) $\frac{2\pi (R^2 - x^2) \sigma}{\epsilon_0}$



61. An electromagnetic plane wave, propagating in vacuum, has an electric field given by $E = E_0 \cos(kx - \omega t)$ and is normally incident on a perfect conductor at $x = 0$, as shown in the figure above. Immediately to the left of the conductor, the total electric field E and the total magnetic field B are given by which of the following?

	E	B
(A)	0	0
(B)	$2E_0 \cos \omega t$	0
(C)	0	$(2E_0/c) \cos \omega t$
(D)	$2E_0 \cos \omega t$	$(2E_0/c) \cos \omega t$
(E)	$2E_0 \cos \omega t$	$(2E_0/c) \sin \omega t$

62. A nonrelativistic particle with a charge twice that of an electron moves through a uniform magnetic field. The field has a strength of $\pi/4$ tesla and is perpendicular to the velocity of the particle. What is the particle's mass if it has a cyclotron frequency of 1,600 hertz?

(A) 2.5×10^{-23} kg
(B) 1.2×10^{-22} kg
(C) 3.3×10^{-22} kg
(D) 5.0×10^{-21} kg
(E) 7.5×10^{-21} kg