

Sample Exam Items for Phys 1011
(Prepared by Mesfin T., Department of Physics, AAU. Meskerem 2, 2014 EC)

Linear Momentum (impulse, momentum, conservation of momentum, collisions)

Multiple choice

An object at rest suddenly breaks into two fragments by an explosion. If fragment 1 has twice the mass of fragment 2, then fragment 1 will have

- A. twice the velocity of fragment 2.
- B. twice the speed of fragment 2 in the opposite direction.
- C. the same linear momentum as fragment 2.
- D. half the speed of fragment 2 in the opposite direction.

Short answer

A large fish of mass M swims at speed v toward a smaller fish and swallows it. If the smaller fish was at rest and has a mass m , what is the speed of the larger fish immediately after it finishes lunch? _____.

A tennis ball of mass m that is moving along negative x -axis strikes a wall perpendicularly with a speed v and bounces back with the same speed. The impulse imparted to the ball is _____.

Workout problem

A 2.00-kg ball moves at 3.00 m/s toward the right. It collides elastically with a 4.00-kg ball that is initially at rest. Determine the final velocities of the balls after the collision.

Heat and Thermodynamics (*The Concept of Temperature: Zeroth Law of Thermodynamics, The Concept of Heat and Energy, Energy Conservation: First Law of Thermodynamics*)

Multiple choice

Which equation gives the work done in an isothermal process?

- A. $W = P_i \ell n(V_f - V_i)$
- B. $W = P_i V_i \ell n\left(\frac{P_f}{P_i}\right)$
- C. $W = P_i V_i \ell n\left(\frac{V_f}{V_i}\right)$
- D. $W = n R P_i \ell n\left(\frac{V_f}{V_i}\right)$

Short answer

A thermodynamic process is represented by a vertical line on a PV diagram. The work done in this process is _____.

Workout problem

A monatomic ideal gas of volume 1000cm³, initially at 0°C and 1atm, is compressed to half of its volume. Taking $\gamma = 1.67$, find the work done if the compression is

- a. adiabatic;
- b. isothermal.

[R=8.314J/mole-K, 1atm = 1.013 × 10⁵Pa, 1mole at STP = 22.4litre]

Oscillations (*mass-spring system, simple pendulum*)

Multiple choice

The maximum acceleration of a particle in SHM is doubled while the maximum speed is kept constant. This is possible when

- A. amplitude is doubled while frequency remains constant
- B. amplitude is doubled while frequency is halved
- C. frequency is doubled while amplitude is halved
- D. frequency is doubled while amplitude remains constant

Short answer

What would the phase constant ϕ if an oscillating object has $x = x_0$ and $v = v_0$ at $t = 0$? _____

Workout problem

A 0.5kg mass attached to a spring of force constant 8N/m vibrates with SHM with amplitude of 10cm. Calculate:

- a) the maximum value of its speed and acceleration,
- b) the speed and the acceleration when the mass is at $x = 6\text{cm}$ from the equilibrium position, and
- c) the time takes it takes the mass to move from $x = 0$ to $x = 8\text{cm}$.

A horizontal spring has a mass of 460 g attached to it. The position as a function of time for the oscillation of the mass is $x(t) = (8.2 \text{ cm}) \cos((2.6/\text{s})t)$.

- a. What is the period of the oscillation?
- b. What is the spring constant of the spring?
- c. What is the maximum velocity of the mass?
- d. Write down the equation of the velocity as a function of time for the oscillating mass.

Electrostatics (*Coulomb's Law and Electric Fields, Electric Potential, Current, Resistance and Ohm's Law*)

Multiple choice

If Q_1 and Q_2 repel each other and Q_3 and Q_4 attract each other, the sign of the charges should be:

	Q_1	Q_2	Q_3	Q_4
A.	–	–	–	+
B.	–	+	+	–
C.	+	+	–	–
D.	+	–	–	+
E.	–	+	–	+

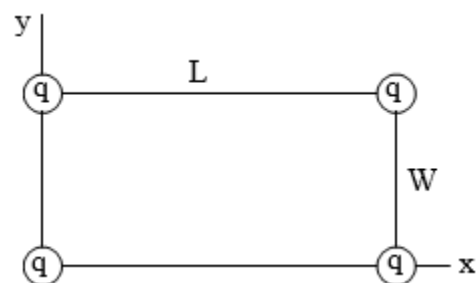
Short answer

Consider the point mid-way between two equal positive charges separated by a distance d . The electric field strength at the midpoint is _____ and the electric potential is _____.

Workout problem

Four identical point charges ($q = +10\mu\text{C}$) are located on the corners of a rectangle, as shown in the figure. The dimensions of the rectangle are $L = 80\text{ cm}$ and $W = 60\text{ cm}$.

- Calculate the magnitude and direction of the net electrostatic force exerted on the charge at the lower right corner of the rectangle by the other three charges.
- What is the electric field strength at the center of the rectangle produced by all charges?
- How much work should be done to bring the charge at the lower left corner to the center of the rectangle?

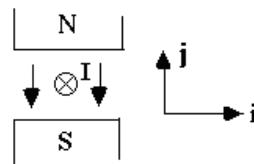


Magnetic Field and Magnetic Flux (Electromagnetic Induction)

Multiple choice

Determine the direction of the force on the current I placed between the N and S poles.

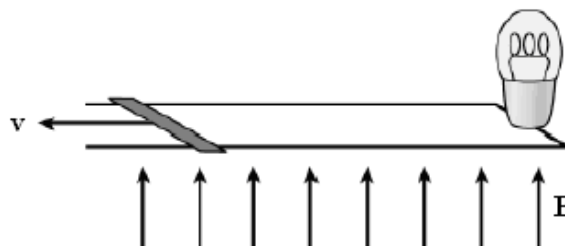
- A. $+i$
- B. $-i$
- C. $+j$
- D. $-j$



Short answer

A conducting bar slides along conducting rails in a constant magnetic field, as shown. The bar is pulled to the left at constant speed; if this speed is doubled, the brightness of the bulb will _____.

(Assume the bulb has a constant resistance and consider its power.)



Workout problem

In the diagram below, the wire on the left carries a current of $I_1 = 12.5\text{A}$ directed into the paper while the right has current $I_2 = 8.5\text{A}$ directed out of the paper. Both wires are $R = 0.45\text{m}$ from point A and the $\theta = 90^\circ$. What is the direction and magnitude of the magnetic field at A?

- A. $6.72 \times 10^{-6}\text{ T}$, down
- B. $6.72 \times 10^{-6}\text{ T}$, up
- C. $67.2 \times 10^{-6}\text{ T}$, left
- D. $67.2 \times 10^{-6}\text{ T}$, right

