Practice Questions: Mechanics in Physics

Multiple Choice

1. The SI unit of force is:
    * a) Pascal
    * b) Joule
    * c) Newton
    * d) Watt

2. In the absence of an external force, a moving object will:
    * a) Speed up
    * b) Slow down
    * c) Stop immediately
    * d) Continue at a constant velocity

3. A force `F` is applied on an object of mass `m` which produces acceleration `a`. What will be the acceleration if the same force is applied on an object of mass `2m`?
    * a) `2a`
    * b) `a/2`
    * c) `a`
    * d) `4a`

4. In a projectile motion, at the highest point of trajectory, which statement is true?
    * a) Velocity is zero
    * b) Acceleration is zero
    * c) Both velocity and acceleration are zero

* d) None of the above

5. A car moving along a straight path at constant speed, is it under equilibrium?

* a) Yes

* b) No

Open ended

6. Calculate the amount of work done in lifting a 10kg weight to a height of 10m (use `g` = `9.8 m/s^2`).

7. An arrow is shot straight up at a velocity of `50 m/s`. Calculate the time it will take to reach its maximum height.

8. A force of `10 N` is applied to a body of mass `5 kg` at rest. What will be the acceleration of the body?

9. An object is moving with a speed of `60 km/hr` and it is brought to rest in `5 seconds` by applying a force. Find the acceleration produced by the force.

10. A stone is dropped off a bridge into the river below. The bridge is `30 m` above the water. How long does the stone take to fall?

Short answers

11. What is momentum? What is its SI unit?

12. State and explain Newton's three laws of motion.

13. Define kinetic energy. What is its SI Unit?

14. What is potential energy and what factors does it depend on?

15. Define centripetal acceleration and give its formula. Also, what is the significance of centripetal acceleration?

Answer Key

Multiple Choice

1. c. Newton
2. d. Continue at a constant velocity
3. b. `a/2`
4. a. Velocity is zero
5. a. Yes

Open ended

6. Work done = `m*g*h` = `10 kg` * `9.8 m/s^2` * `10 m` = `980 Joule`
7. The arrow will reach its maximum height when its velocity becomes zero. Using `v = u - gt`, where `v = final velocity = 0 m/s`, `u = initial velocity = 50 m/s`, `g = acceleration due to gravity = 9.8 m/s^2` and `t = time`, we solve for t to get `t = u/g = 50/9.8 = ~5.10 s`.

8. `a = F/m` = `10 N / 5 kg` = `2 m/s^2`.

9. Initial speed, `u = 60 km/hr = 60*1000 / 3600  m/s`. As it comes to rest, final velocity, `v = 0 m/s`. So, `a = (v-u) / t` = `(0 - 60*1000/3600) m/s**2 / 5 s` = `-4.44 m/s^2`

10. Using `s = gt^2/2`, where `s = 30 m`, `g = 9.8 m/s^2`, `t = time`, we get `t = sqrt((2s)/g)=sqrt((2*30)/9.8)=~2.47 s`

Short answers

11. Momentum is the product of the mass and velocity of an object, and it is a vector quantity. Its SI unit is `kg m/s`.

12. Newton's First Law: An object at rest or in motion will remain in rest or motion unless acted upon by an external force. Newton's Second Law: The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. Newton's Third Law: Every action has an equal and opposite reaction.

13. Kinetic energy is the energy that a body possesses due to its motion. Its SI unit is Joule.

14. Potential Energy is the stored energy in a body due to its position in a force field or in a system. It depends on the object's mass, height, and the gravitational constant.

15. Centripetal acceleration is the rate of change of tangential velocity and acts towards the center of rotation. The formula is `a = v^2 / r`, where `v` is velocity of the object and `r` is the radius of the path. Significance: It refers to the change in direction of the velocity vector.