# Sample Questions - Physithon

## Subject Fundamental Question

1. In the photoelectric effect, which of the following factors determines the maximum kinetic energy of emitted electrons?

**a) Frequency of incident light**

b) Intensity of incident light

c) Work function of the material

d) Number of photons absorbed

2. When a wave passes from one medium to another with a higher refractive index, which of the following happens to its wavelength?

a) Increases

**b) Decreases**

c) Remains unchanged

d) Depends on the frequency of the wave

3. Which of the following correctly describes the motion of an object in simple harmonic motion?

a) Velocity is zero at equilibrium position.

b) Acceleration is maximum at equilibrium position.

c) Potential energy is maximum at equilibrium position.

**d) Frequency is independent of amplitude.**

4. Which of the following statements about Coulomb's Law is correct?

a) The force between two charges is inversely proportional to the square of the distance between them.

**b) The force between two charges is directly proportional to the product of their magnitudes.**

c) Coulomb's constant depends on the medium between the charges.

d) Coulomb's Law is only valid for point charges.

5. Which of the following best describes the process of nuclear fusion?

**a) Combining two light nuclei to form a heavier nucleus**

b) Splitting a heavy nucleus into two or more lighter nuclei

c) The emission of electrons from a radioactive nucleus

d) The absorption of gamma rays by atomic nuclei

## On-site Learning Question

6. The concept of torque $(\tau)$ is defined as the product of the force $(F)$ applied to an object and the distance $(r)$ from the pivot point to the point where the force is applied:

$$[\tau = F \cdot r]$$

Where:

- $\tau$ = Torque applied to the object
- $F$ = Force applied to the object
- $r$ = Distance from the pivot point to the point where the force is applied"

Which of the following statements accurately describes the effect of increasing the distance from the pivot point on the torque applied to the object?

a) Increasing the distance decreases the torque.

**b) Increasing the distance increases the torque.**

c) Increasing the distance has no effect on the torque.

d) Increasing the distance reverses the direction of the torque.

7. In molecular physics, the concept of Brownian motion describes the random motion of particles suspended in a fluid (gas or liquid) resulting from their collisions with the fast-moving molecules of the fluid. This phenomenon was first observed by the botanist Robert Brown in 1827.

Which of the following factors does NOT influence the magnitude of Brownian motion in a fluid?

a) Temperature of the fluid

b) Size of the suspended particles

**c) Density of the suspended particles**

d) Viscosity of the fluid

8. The phenomenon of total internal reflection occurs when a ray of light traveling from a medium with a higher refractive index to a medium with a lower refractive index strikes the boundary between the two media at an angle greater than the critical angle. As a result, all of the light is reflected back into the higher refractive index medium.

Which of the following conditions must be satisfied for total internal reflection to occur?

a) The incident angle is less than the critical angle.

b) The incident angle is equal to the critical angle.

**c) The incident angle is greater than the critical angle.**

d) The refractive index of the two media is the same.

9. The concept of entropy $(S)$ is a measure of the disorder or randomness of a system. It is defined in terms of the number of microscopic configurations $(\Omega)$ corresponding to a macroscopic state:

$$[S = k \cdot \ln(\Omega)]$$

Where:

- $S$ = Entropy of the system
- $k$ = Boltzmann constant
- $\Omega$ = Number of microscopic configurations"

Based on the provided material, which of the following statements best describes the relationship between entropy and the disorder of a system?

**a) Higher entropy implies higher disorder in the system.**

b) Higher entropy implies lower disorder in the system.

c) Entropy and disorder are unrelated concepts in thermodynamics.

d) Entropy measures the temperature of the system, not its disorder.

10. In the study of waves, the Doppler effect describes the change in the observed frequency of a wave due to the relative motion between the source of the wave and the observer. The observed frequency $(f_o)$ is related to the source frequency $(f_s)$ by the following equation:

$$f_o = f_s\left(\frac{v \pm v_o}{v \mp v_s}\right)$$

Where $v$ is the speed of the wave in the medium, $v_s$ is the speed of the source relative to the medium, and $v_o$ is the speed of the observer relative to the medium. The top sign is used when the source and observer are moving towards each other, and the bottom sign is used when they are moving apart.

A police car with its siren emitting a frequency of 500 Hz is moving towards a stationary observer at a speed of 30 m/s. The speed of sound in air is 340 m/s. What is the frequency heard by the observer?

a) 455.88 Hz

b) 459.46 Hz

c) 543.5 Hz

**d) 548.38 Hz**

## Subject Advanced Question

11. Which of the following phenomena is described by the Biot-Savart law?

a) Magnetic induction due to a moving charge

b) Electric field generated by a changing magnetic field

**c) Magnetic force between two current-carrying wires**

d) Electric potential around a charged conducting sphere

12. In quantum mechanics, which principle states that it's impossible to simultaneously measure both the position and momentum of a particle with arbitrary precision?

**a) Heisenberg uncertainty principle**

b) Pauli exclusion principle

c) Bohr's correspondence principle

d) Planck's principle of quantization

13. Which of the following statements accurately describes the behavior of a ferromagnetic material when placed in an external magnetic field?

a) It exhibits no magnetic properties.

**b) It aligns its magnetic domains parallel to the external field.**

c) It aligns its magnetic domains antiparallel to the external field.

d) It only responds to changes in the magnetic field, not to the field itself.

14. Which of the following phenomena is associated with the phenomenon of superconductivity?

**a) Zero electrical resistance**

b) Infinite electrical resistance

c) Decreased electrical conductivity with temperature

d) Increased electrical conductivity with temperature

15. Which of the following principles is essential for understanding the operation of a laser?

**a) Stimulated emission**

b) Photoelectric effect

c) Compton scattering

d) Hall effect