

Presidency University, Kolkata
Sample Question for Admission to Physics (Honours) Course,

Time: 2 hours

The full question paper must be returned attached with the answer script.

Answer All Questions

GROUP-A will contain MCQ type questions

*Give tick(-V) mark(s) on the question paper to the best answer(s) to each question. **More than one answer may be correct, in such a case the candidate must tick all the correct answers otherwise credit may not be given at all.** There is no negative marking. Calculation, if necessary, can be done on answer script supplied **Scientific calculators may be used.***

An ideal gas is initially at temperature 'T' and volume V. If the temperature is increased by ΔT , pressure remaining unaltered, then $(\Delta V / V \Delta T)$ varies as

- (a) $1/T$ (b) T^2 (c) T (d) T^{-2}

A bomb thrown upwards explodes into fragments at the highest point. The centre of mass of the fragments will be

- a) at rest always (b) initially at rest and then will move in a parabolic path (c) initially at rest and then will move in any direction, (d) initially at rest and then will move vertically downwards.

Imagine yourself sitting within a large air-filled glass sphere completely submerged within clear water and parallel rays of light strike the sphere. What would you see?

- (a) Parallel rays (b) Virtual image of distant object. (c) Rays appearing to come from the apex of a cone. (d) Rays appearing to converge into the apex of a cone.

The distance between the plates of a parallel-plate capacitor is increased in two situations:

- (1) by connecting a battery across them and
(2) after disconnecting the battery.

The energy stored in the capacitor will

- (a) decrease in(1) and increase in (2), (b) increase in (1) and decrease in(2), (c) remains unchanged in both the cases, (d) increases in both the cases

According to Bohr's theory the ratio of the velocity of the electron in the first Bohr orbit of Hydrogen to the velocity of light in vacuum is approximately

- (a) $1/37$ (b) $1/100$ (c) $1/137$ (d) none of these

The ratio of the energy of a Hydrogen atom in the ground state to that of a triply ionized

- Be ($z=4$) atom with the same orbital radii is (a) 1:1 (b) 1:2 (c) 1:4 (d) 4:1

GROUP-B will contain few problems

A body of volume V is completely immersed in a liquid with density ρ . The density of the material of the body is d ($\rho > d$). The body is connected by a string to the bottom of the container. What is the tension in the string? What will be the tension in the string if the container is moved (a) upwards with an acceleration f , (b) downwards with an acceleration f and (c) with a uniform velocity? What will be the shapes of the free surface of the liquid in the above three cases?

A. small object is at rest on the edge of a horizontal table 1 m wide. It is struck in such a way that it falls off the other side of the table after 2 sec. The coefficient of sliding friction between the object and the table is 0.1. Establish, by proper calculation, that the object must have rolled on the table.

150 gm of water at 65°C is mixed with 100 gm of water at the room temperature. The resulting mixture is then converted to steam at 100°C . If this is done using an electric heater of 750 W rating and the time taken is 13 min 45 sec without of any loss of heat, what is the room temperature? [Latent heat of vaporization of water = 540 cal/gm.]

An equi-convex lens is placed on a plane mirror. The axis of the lens is perpendicular to the mirror. The refractive index of the material of the lens is 1.5. The image of a pin placed at a distance of 10 cm from the lens on its axis coincides with the pin. A few drops of a liquid are placed on the mirror and the lens is again placed on the liquid. Now the pin has to be placed at a distance of 15 cm from the lens so that its image coincides with the pin. Find the refractive index of the liquid. Neglect the thickness of the lens.

A pair of parallel conducting wires lies in a plane making an angle with the horizontal plane. The upper end of these wires is connected to a capacitor (of capacitance C). A uniform magnetic field B is applied in the region in a direction normal to the plane of the wires. A conducting filament of mass ' m ' slides down the parallel wires starting from rest. Is it possible for the filament to acquire a steady speed? If YES find the speed. If NO, find the acceleration of the filament. (Ignore frictions and all resistances.)

A diatomic gas molecule consists of two atoms of mass ' m ', separated by a fixed distance ' d ' and rotating about an axis perpendicular to the plane containing the atoms and going through the mid point of the line joining the atoms. Assuming Bohr's quantization method determine the possible angular velocities, and the possible rotational energies. Also draw the energy level diagram.

Two concentric conducting spherical shells of radii r and R ($r < R$) are given charges q and Q respectively. Find their potential difference. What will happen if the spherical shells are joined by a conducting wire?