

QUAID - I - AZAM UNIVERSITY

Department of Physics

Sample M.Sc Admission Test

- *Answer all questions. Each question carries equal marks. Calculators not allowed.*
- *Circle only the correct answer. Circling more than one will be considered wrong.*
- *Marks will be deducted for wrong answers.*
- *Total allowed time : 60 minutes.*

Q.1 A stone tied to a string of length L is whirled around at angular speed ω . Suppose the string has tension T . How much work will be done when the stone makes one complete revolution?

- a) zero
- b) $\omega^2 L$
- c) $\omega^2 L^2$
- d) $T L$
- e) T^2 / L

Q.2 The spring of a toy gun with spring constant k is compressed to a distance d from its relaxed position. A ball of mass m is put in the barrel of the toy gun. When the spring is released, the ball comes out with velocity:

- a) $\sqrt{k/m}$
- b) $\sqrt{kd^2/m}$
- c) $\sqrt{k/md^2}$
- d) $\sqrt{2k/md}$
- e) $\sqrt{kd/2m}$

Q.3 A bucket filled with water is rotated vertically in a circle of radius R . If the acceleration due to gravity is g and water is not to fall from the bucket even when it is at its highest point, the velocity v of the bucket must be at least:

a) $\sqrt{2g/R}$

b) \sqrt{gR}

c) gR^2

d) $2gR$

e) none of the above

Q.4 Balls A and B are made of the same material and have the same mass. A is completely solid while B is partially hollow. They are rolled down the same inclined plane and the time taken to reach the bottom is noted.

a) A will reach first because it is solid and has less inertia.

b) A will reach first because it will have less rotational energy than B.

c) B will reach first because it has lower density and can roll more easily.

d) B will reach first because the moment of inertia is smaller.

e) A and B will reach the bottom at the same time.

Q.5 The magnetic field at distance r inside a long straight wire with a uniformly distributed current over the crosssectional radius R is proportional to:

a) $\frac{1}{r}$

b) $\frac{r}{R^2}$

c) 0

d) ∞

e) $\log r$

Q.6 A particle oscillates in the x direction according to $x = A \sin \omega t$ and in the y direction according to $y = A \cos \omega t$. What path will you see the particle following?

- a) A simple oscillation in the x direction.
- b) A simple oscillation in the y direction.
- c) A circular path.
- d) An ellipsoidal path.
- e) none of the above.

Q.7 An electron of charge q enters with speed v into a uniform magnetic field B that is perpendicular to the velocity. Find the frequency with which the electron goes around in a circle.

- a) $\frac{mv^2}{r}$
- b) 0
- c) $\frac{|B|^2}{8\pi}$
- d) $\frac{qB}{m}$
- e) $\frac{qB}{2m}$

Q.8 A stone is dropped into a lake and the waves spread out uniformly. How does the power in the wave decrease as a function of distance from the centre? [Note that this is a 2-dimensional situation!]

- a) $P \propto \frac{1}{r^2}$
- b) $P \propto \frac{1}{r}$
- c) $P \propto \frac{1}{r^{1/2}}$
- d) $P \propto \frac{1}{\log r}$
- e) $P \propto \log r$

Q.9 For an ideal gas, the specific heat at constant pressure C_p is greater than the specific heat at constant volume C_v because:

- a) Pressure of the gas remains constant when temperature is kept constant.
- b) More energy is needed at constant pressure than at constant volume because the molecules have to move faster.
- c) The gas does work on its environment while its temperature is increased.
- d) Increase in the internal energy of the gas is greater when its pressure is kept constant than when its volume is kept constant.
- e) None of the above.

Q.10 A wooden bowl has one eighth of the radioactivity of ^{14}C observed in a bowl of the same wood made from a freshly cut tree. Estimate its age using whatever approximate techniques you know. (Half-life of $^{14}\text{C} = 5670$ years, $e \approx 2.7$).

- a) 100 years
- b) 1000 years
- c) 10000 years
- d) 17000 years
- e) 20000 years