PHYSICS 2015

Time: 20 Minutes
Max. Marks: 17

SECTION "A" (MULTIPLE CHOICE QUESTION)

1. Choose the correct answer for each from the given options:

(i) Electron volt is the unit of:
• power • voltage • energy • charge

(ii) Intravenous injection by means of silver syringe was initially used by: • Ibn-e-Sina • Omar Khayyam
• Al-Beruni • Jabir bin Hayyan

(iii) The y-components of vector $|\vec{A}|$ =15 units when it forms an angle of 50° with positive x-axis is:
• 9.6 units • -9.6 units • 11.5 units • -11.5 units

(iv) The rate of change of linear momentum is:
• acceleration • torque • force • velocity

(v) If 'F' be the limiting friction and 'R' the normal reaction. Then co-efficient of static friction 'μ' is:
• $\mu=\frac{F}{R}$ • $\mu=\frac{R}{F}$ • $\mu = FR$ • $\mu=\frac{1}{FR}$

(vi) When a torque acting on a system is zero, this will be constant: • force • angular momentum
• linear momentum • velocity

(vii) The unit of angular velocity is:
• radian/cm • metre/sec • radian/sec • radian/sec^2

(viii) The value of gravitational constant 'G' was determined experimentally by:
• Cavendish • Newton • Joules • Huygen

(ix) Newton's rings illustrate the phenomenon of:
• polarization • diffraction • interference • dispersion

(x) The final image formed by a compound microscope is:
• virtual and diminished • real and diminished
• real and magnified • virtual and magnified

(xi) The dimensions of 'G' are:
• $ML^{-1}T$ • $ML^{-2}T^{3}$ • $M^{-1}L^{3}T^{-2}$ • $ML^{2}T^{-2}$

(xii) In thin film interference, the positions of constructive and destructive interference are interchanged due to:
• Phase coherence • Phase reversal
• Diffraction • Interference

(xiii) The angle between centripetal and tangential acceleration in circular motion is:
• 180° • zero • 90° • 45°

(xiv) The velocity of a wave of wavelength 'λ' and frequency 'v' is given by:
• v/λ • λ/v • $v\lambda$ • $1/v\lambda$

(xv) Polarization of light due to tourmaline crystals takes place because of:
• Reflection • Absorption • Refraction • Collision

(xvi) Two convex lenses of same focal length 'f' are combined together. The focal length of the combines lens is: • $2f$ • $f/2$ • $2+f$ • $2-f$

(xvii) This one of the following is not the unit of power:
• horse power • joule/sec
• kilowatt hour • foot-pound/sec

PHYSICS 2015

Time: 2 Hours 40 Minutes
Marks: 68

SECTION 'B' (SHORT-ANSWER QUESTIONS)(40)

NOTE: Answer any 10 questions from this section.

2.(i) Derive an expression for acceleration of a body moving downward on an inclined plane making angle 'θ' with the horizontal when friction is present.

(ii) At what distance from centre of earth does the gravitational acceleration have one third of the value that it has on the earth's surface?

(iii) A 80 kg man runs up a hill through a height of 3m in 2 sec. What is his average power output?

(iv) A car emitted a note of frequency 490 Hz, if the car approaching towards a stationary Listener at speed of 55 km/h, what frequency will be detected by the listener. Take speed of sound as 334 m/s.

(v) An object moves along a straight line in a force field from (3, 2, –6) to (14, 13, 9) when a uniform force $\bar{F}=4\hat{i}+\hat{j}+3\hat{k}$ acts on it. Find the work done.

(vi) If the tension in a string is increased four times, what will be the effect on the speed of standing waves in the string?

(vii) A boy whose mass is 100 kg when resting on the ground at the equator if the radius of earth 'R' is 6.4 x 10^6m. Calculate the centripetal acceleration & centripetal force

(viii) Why and how is artificial gravity created in a space craft. Derive a formula for spinning frequency of the space craft to provide artificial gravity.

(ix) What are the necessary conditions to observe the interference of light? Differentiate between interference and diffraction.

(x) Prove that $V = r\omega$ or $a = r\alpha$.

(xi) Derive the work-energy equation.

(xii) Two sides of a triangle are formed by vectors $\vec{A}=3\hat{i}+6\hat{j}-2\hat{k}$ and $\vec{B}=4\hat{i}-\hat{j}+3\hat{k}$, determine the area of the triangle.

(xiii) A 100 g bullet is formed from a 10 kg gun with a speed of 1000 m/s. What is speed of recoil of the gun?

(xiv) A body hanging from a spring is set into motion and the period of oscillation is found to be 0.5 sec. After the body has come to rest, it is removed. How much shorter will the spring be when it comes to rest.

(xv) A parallel beam of X-rays is diffracted by rock salt crystal. The 1st order maximum being obtained when the glancing angle of incidence is 6 degree and 5 minutes, the distance between the atomic planes of crystal is 2.81 x 10^{-10}m. Calculate the wavelength of radiation.

SECTION'C' (DETAILED- ANSWER QUESTIONS)

NOTE: Answer any Two questions from this section. Draw diagrams where necessary. (28)

3.(a) Two vectors $\vec{P}$ and $\vec{Q}$ are acting on a point making angles θ_1 and θ_2 with positive x-axis respectively. Find the expressions for the magnitude of the resultant vector and its direction.

(b) What is a simple pendulum? Prove that the motion of a simple pendulum is simple harmonic. Derive the expression for its time period.

4.(a) Define Longitudinal Waves & Transverse waves. Derive the expressions for the frequency of a stretched string vibrating in (i) One loop (ii) two loops (iii) three loops.

(b) An object is thrown upward with initial velocity V_o at the angle 'θ' with the horizontal. Derive the expression for (i) Time required to reach maximum height (ii) Horizontal range.

5.(a) Explain the Young's Double Slits experiment and derive formula for fringe spacing.

(b) Two bodies of unequal masses are attached to the ends of a string which passes over a frictionless pulley. If one body moves vertically downward and the second body moves horizontally on a smooth horizontal surface. Derive the expression for tension in the string and acceleration of the bodies.

OR Define Visual angle and Least distance of distinct vision. With the help of a ray diagram derive the expression for magnifying power of magnifying glass.