

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, JANUARY 2013

(CCSS)

Physics

PHI B01—METHODOLOGY OF SCIENCE AND PHYSICS

Three Hours

Maximum : 30 Weightage

Section A

*Answer all twelve questions.**Each question carries $\frac{1}{4}$ weightage.*

- If speed of light were less than it is, the relativistic phenomena would be :
 - Less Conspicuous than they are now.
 - More Conspicuous than they are now.
 - Same as now.
 - Unpredictable.
- A frame of reference which moves with constant velocity with respect to stationary frame of reference is called :
 - Inertial frame.
 - Non-inertial frame.
 - Rotating frame.
 - Absolute frame.
- Total K.E. of ideal mono atomic gas molecule is :
 - KT.
 - $\frac{1}{2}$ KT.
 - $\frac{3}{2}$ KT.
 - KT.
- The Penetrating power of X-Rays increases with the :
 - Increase in velocity.
 - Increase in frequency.
 - Increase in intensity.
 - Decrease in velocity.
- The Photon of frequency ν has a speed C, its momentum is :
 - $\frac{h\nu}{c^2}$.
 - $\frac{h\nu}{c}$.
 - $\frac{\nu}{c}$.
 - $h\nu$.
- In photoelectric effect, the number of photoelectron emitted is proportional to :
 - Intensity of incident beam.
 - Frequency of incident beam.
 - Velocity incident beam.
 - Work function of photo cathode.

Turn over

7. If E_1 , E_2 , E_3 are respective kinetic energy of an electron, an alpha-particle, a proton, each having same de-Broglie wavelength then :
- (a) $E_1 > E_3 > E_2$. (b) $E_2 > E_3 > E_1$.
 (c) $E_1 > E_2 > E_3$. (d) $E_1 \geq E_3 = E_2$.
8. If N_1 be the population in ground state and N_2 be the population in excited state, during population inversion :
- (a) $N_1 = N_2$. (b) $N_1 > N_2$.
 (c) $N_1 = N_2 = 0$. (d) $N_2 > N_1$.
9. The line integral per unit area along the boundary of a small area around a point in vector field A is called :
- (a) grad A . (b) div A .
 (c) curl A . (d) line integral of A .
10. Which of the following matrices is Hermitian ?
- (a) $\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}$ (b) $\begin{pmatrix} 0 & i \\ -i & 0 \end{pmatrix}$
 (c) $\begin{pmatrix} i & 0 \\ 0 & 1 \end{pmatrix}$ (d) $\begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix}$
11. Scientific theories must not be :
- (a) Correctable. (b) Testable.
 (c) Reliably. (d) Biased.
12. The recipient of First Nobel Prize for physics was :
- (a) Einstein. (b) Planck.
 (c) Rontgen. (d) Newton.

(12 × 1/4 = 3 weight)

Section B*Answer all nine questions.**Each question carries 1 weightage.*

13. What is meant by length contraction ?
14. What is Compton effect ? Mention its significance.

15. List out the main features of continuous X-ray spectrum.
16. What is it that varies in the case of matter waves ?
17. What are the characteristic of black body spectra ?
18. What is meant by metastable state ? Write two materials they possess metastable state.
19. State and explain Green's theorem.
20. What is the significance of peer review ?
21. Mention important steps of scientific method.

(9 × 1 = 9 weightage)

Section C

Answer any **five** questions from seven.

Each question carries 2 weightage.

22. Find out eigen values of $A = \begin{bmatrix} 3 & -1 \\ 4 & -2 \end{bmatrix}$.
23. If H is a Hermitian matrix and U is a Unitary matrix. Prove that $U^{-1} H U$ is Hermitian.
24. Find out the values of a, b, c such that

$$F = (3x - 4y + az)\hat{i} + (cx + 5y - 2z)\hat{j} + (x - by + 7z)\hat{k} \text{ is irrotational.}$$

25. Distinguish between spontaneous and stimulated emission.
26. A space craft is moving relative to earth, an observer on earth find that, according to her clock, 3601 s elapse between 1 p.m. and 2 p.m. on the space craft's clock. What is the space craft's speed relative to earth.
27. Find the shortest wavelength present in radiation from X-ray machine of accelerating potential is 50 kV.
28. Find the de-Broglie wavelength of a 46 g golf ball moving with the a velocity of 10 m/s.

(5 × 2 = 10 weightage)

Section D

Answer any **two** questions from three.

Each question carries 4 weightage.

29. What are de-Broglie waves ? Develop equations for de-Broglie's wavelength (a) In terms of mass and velocity of particle ; (b) In terms of mass and K.E. of particle.
30. Explain the necessity of experimental design.

Turn over

31. Explain about spherical polar co-ordinate :

- (a) Write down equations to connect Cartesian co-ordinate and spherical co-ordinate.
- (b) Express infinitesimal displacement $d\mathbf{l}$ in spherical polar co-ordinate.
- (c) Translate gradient and divergence in spherical polar co-ordinate.

(2 × 4 = 8 weightage)