

D 32465

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Name.....

Reg. No.....

**FIRST SEMESTER B.Sc. DEGREE EXAMINATION, JANUARY 2013**

(CCSS)

Physics

**PHI B01—METHODOLOGY OF SCIENCE AND PHYSICS**

Time : Three Hours

Maximum : 30 Weightage

**Section A**

*Answer all twelve questions.*

*Each question carries  $\frac{1}{4}$  weightage.*

1. If speed of light were less than it is, the relativistic phenomena would be :
  - (a) Less Conspicuous than they are now.
  - (b) More Conspicuous than they are now.
  - (c) Same as now.
  - (d) Unpredictable.
2. A frame of reference which moves with constant velocity with respect to stationary frame of reference is called :
  - (a) Inertial frame.
  - (b) Non-inertial frame.
  - (c) Rotating frame.
  - (d) Absolute frame.
3. Total K.E. of ideal mono atomic gas molecule is :
  - (a)  $KT$ .
  - (b)  $\frac{1}{2} KT$ .
  - (c)  $\frac{3}{2} KT$ .
  - (d)  $KT$ .
4. The Penetrating power of X-Rays increases with the :
  - (a) Increase in velocity.
  - (b) Increase in frequency.
  - (c) Increase in intensity.
  - (d) Decrease in velocity.
5. The Photon of frequency  $\nu$  has a speed  $C$ , its momentum is :
  - (a)  $\frac{h\nu}{c^2}$ .
  - (b)  $\frac{h\nu}{c}$ .
  - (c)  $\frac{\nu}{c}$ .
  - (d)  $h\nu$ .
6. In photoelectric effect, the number of photoelectron emitted is proportional to :
  - (a) Intensity of incident beam.
  - (b) Frequency of incident beam.
  - (c) Velocity incident beam.
  - (d) 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  $N$  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  $\times$   $\frac{1}{4}$  = 3 weightage)

### 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  

$$F = (3x - 4y + az)\hat{i} + (cx + 5y - 2z)\hat{j} + (x - by + 7z)\hat{k}$$
 is irrotational.
25. Distinguish between spontaneous and stimulated emission.
26. A space craft is moving relative to earth, an observer on earth finds 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)