



# ATOMIC ENERGY EDUCATION SOCIETY

Anushaktinagar, Mumbai-400 094

## 2015 – Open Candidates Examination

Post – PGT (Physics)

Date – 27-09-2015

Time – 1 Hour 30 Minutes

Maximum Marks – 50

### Instructions

1. There are 50 Multiple Choice Questions (MCQ) in this paper. Each question carries 1 mark. There will be negative marking of 0.25 per wrong answer.
2. Answer should be darkened/marked in the OMR answer sheet only.
3. Use of any electronic gadget (e.g. calculator, mobile phone, etc.) is not permitted, in the examination hall.
4. In case a candidate has not signed the Attendance Sheet or the OMR Answer Sheet is not signed by the Invigilator, it will be dealt with as a case of unfair means.
5. On completion of the test, the candidates **MUST HAND OVER THE OMR ANSWER SHEET AND QUESTION PAPER TO THE INVIGILATOR** in the room/hall.
6. The candidates should ensure that the OMR answer sheet is not folded or damaged.

### To be filled by the candidate

Name of the Candidate: \_\_\_\_\_

Roll Number: \_\_\_\_\_

OMR Number: \_\_\_\_\_

**2015-Open Candidates- PGT (Physics) – QP**

- Q.1) If a transparent parallel plate of thickness  $t$  and refractive index  $n$  is introduced perpendicularly in the light beam, the optical path is
- (a) increased by  $(n - 1)t$                       (b) decreased by  $nt$   
(c) decreased by  $(n - 1)t$                       (d) increased by  $nt$
- Q.2) Internal energy of an ideal gas decreases by the same amount as the work done by the system.
- (a) the process must be isothermal              (b) the process must be adiabatic  
(c) the process must be isobaric                (d) the temperature of the system must increase
- Q.3) In a resonance column experiment the first 3 resonant lengths are  $l_1$ ,  $l_2$  and  $l_3$  respectively. The  $l_1 : l_2 : l_3$  may be given as
- (a) 1:2:3    (b) 2:3:5  
(c) 1:3:5    (d) 3:4:6
- Q.4) An intrinsic semiconductor at absolute zero of temperature behaves as
- (a) an insulator                                      (b) a metallic conductor  
(c) a superconductor                                (d) a semiconductor
- Q.5) The motion of planets in the solar system is an example of conservation of
- (a) mass    (b) linear momentum  
(c) angular momentum                              (d) kinetic energy
- Q.6) A  $4\mu\text{F}$  capacitor is charged by a 200V supply. The energy stored in the electric field of the capacitor is
- (a)  $8 \times 10^{-2}$  J                                      (b)  $1.6 \times 10^{-9}$  J  
(c)  $8 \times 10^{-4}$  J                                      (d)  $1.6 \times 10^{-1}$  J
- Q.7) A thin concave and a thin convex lens are in contact. The ratio of the magnitude of power of two lenses is  $\frac{2}{3}$  and the focal length of combination is 30 cm. The focal length of the convex lens is
- (a) 10 cm    (b) 12cm  
(c) 15cm    (d) 20cm

Q.8) The relation connecting magnetic susceptibility  $\chi$  and relative permeability  $\mu_r$  is

- (a)  $\chi = (\mu_r + 1)$  (b)  $\chi = (\mu_r - 1)$   
(c)  $\chi = \mu_r^{-1}$  (d)  $\chi = 3(\mu_r + 1)$

Q.9) Taking the significant figures into consideration, the product of 109.832 and 0.6107 should be written as

- (a) 67.0744 (b) 67.1  
(c) 67.07 (d) 67.074402

Q.10) One spring has force constant  $200\text{Nm}^{-1}$ , another has force constant  $500\text{Nm}^{-1}$ . If they are joined in series, the force constant will be nearest to

- (a)  $700\text{Nm}^{-1}$  (b)  $300\text{Nm}^{-1}$   
(c)  $143\text{Nm}^{-1}$  (d)  $100\text{Nm}^{-1}$

Q.11) Two plane mirrors are inclined at an angle of  $60^\circ$  to each other. A point object is placed in between them. The total number of images produced by both the mirrors is

- (a) 2 (b) 4  
(c) 5 (d) 6

Q.12) A 150 m long train is travelling from east to west at a speed of  $20\text{ms}^{-1}$ . A bird is flying from west to east at a speed of  $5\text{ms}^{-1}$ . How long will the bird take to cross the train?

- (a) 6 s (b) 8 s  
(c) 10 s (d) 12 s

Q.13) The masses of two particles having same kinetic energy are in the ratio of 2:1. Their de Broglie wavelengths are in the ratio

- (a) 2 : 1 (b) 1 : 2  
(c)  $\sqrt{2}$  : 1 (d) 1 :  $\sqrt{2}$

Q.14) A ball of mass  $m$  collides with a wall with speed  $v$  and rebounds on the same line with the same speed. If the mass of the wall is taken as infinite, the work done by the ball on the wall is

- (a)  $2mv$  (b)  $2mv^2$   
(c)  $mv^2$  (d) zero

Q.15) The mean kinetic energy of molecules in 1 mole of a monatomic ideal gas is equal to (k is Boltzmann constant)

- (a)  $\frac{1}{2} kT$  (b)  $kT$   
(c)  $\frac{3}{2} kT$  (d)  $3kT$

Q.16) The equation  $y = 0.02 \sin(500\pi t) \cos(4.5t)$  represents

- (a) progressive wave of frequency 250 Hz along x-axis  
(b) a standing wave of wavelength 1.4m  
(c) a transverse progressive wave of amplitude 0.02m  
(d) progressive wave of speed approximately  $350\text{ms}^{-1}$

Q.17) If  $v_o$  be the orbital velocity of a satellite in a circular orbit close to earth's surface and  $v_e$  is the escape velocity for the earth, the relation between the two is

- (a)  $v_e = \sqrt{2} v_o$  (b)  $v_e = \sqrt{3} v_o$   
(c)  $v_o = v_e$  (d)  $v_e = 2v_o$

Q.18) The refractive index  $\mu$  of a material varies with wavelength  $\lambda$  in the following manner (a and b are constants)?

- (a)  $\mu = a + \lambda b$  (b)  $\mu = a + \frac{b}{\lambda}$   
(c)  $\mu = a + \frac{b}{\lambda^2}$  (d)  $\mu = a + b\lambda^2$

Q.19) If vectors  $\vec{a}$  and  $\vec{b}$  are given as

$$\vec{a} = 5\vec{i} + 6\vec{j} + 3\vec{k}$$

$$\vec{b} = 6\vec{i} - 2\vec{j} - 6\vec{k},$$

which of the following statements is correct?

- (a)  $\vec{a}$  and  $\vec{b}$  are mutually perpendicular (b)  $\vec{a} \times \vec{b}$  is same as  $\vec{b} \times \vec{a}$   
(c)  $|\vec{a} + \vec{b}| = a + b$  (d)  $|\vec{a} \times \vec{b}|^2 = a^2 + b^2 + \vec{a} \cdot \vec{b}$

Q.20) Two photons are emitted in opposite directions by a source.

The velocity of one photon relative to the other is

- (a)  $c$  (b)  $2c$   
(c)  $\sqrt{2} c$  (d) zero

- Q.21) In Young's double slit experiment, the fringe width with light of wavelength  $\lambda = 600 \text{ nm}$  is 3 mm. The fringe width, when the  $\lambda$  of light is changed to 400 nm is
- (a) 4 mm (b) 3 mm  
(c) 2 mm (d) 1mm
- Q.22) An electric field does not exist in the region.
- (a) between the nucleus and the electron in an atom  
(b) inside a current carrying conductor  
(c) inside a plate of insulator held between the plates of a charged parallel plate capacitor  
(d) inside a cavity of a charged conductor.
- Q.23) A Table-Tennis ball floating on the top of a vertical water jet is a consequence of
- (a) Stokes' Law (b) Bernoulli's principle  
(c) Pascal's Law (d) the phenomenon of surface tension
- Q.24) Balmer series in the spectrum of H – atom lies in
- (a) Near Infrared region (b) Far Infrared region  
(c) Visible region (d) UV region.
- Q.25) The surface tension of soap solution is S. What is the work done in blowing a small bubble of radius r?
- (a)  $\pi r^2 S$  (b)  $2\pi r^2 S$   
(c)  $4\pi r^2 S$  (d)  $8\pi r^2 S$
- Q.26) The average power dissipated in a pure capacitor in one complete cycle of AC is (V is the rms value of the AC voltage)
- (a) zero (b) CV  
(c)  $\frac{1}{2} CV^2$  (d)  $\frac{1}{4} CV^2$
- Q.27) Velocity of sound in a gas at a given temperature is  $340 \text{ ms}^{-1}$ .  
If the pressure of gas is doubled isothermally, the speed of sound in this case is
- (a)  $170 \text{ ms}^{-1}$  (b)  $340 \text{ ms}^{-1}$   
(c)  $680 \text{ ms}^{-1}$  (d)  $1360 \text{ ms}^{-1}$

Q.28) An enclosure maintained at 1000K radiates the most at the wavelength  $\lambda_m$ . If temperature is raised to 2000K, the maximum emission of radiation will occur at the following wavelength

- (a)  $\frac{\lambda_m}{2}$  (b)  $2\lambda_m$   
(c)  $16\lambda_m$  (d)  $\frac{\lambda_m}{16}$

Q.29) In a charged parallel plate capacitor, the plates carry charges  $\pm\sigma A$ , where A= area of each plate. The oppositely charged parallel plates attract each other by a force F equal to

- (a)  $\frac{\sigma^2 A}{\epsilon_0}$  (b)  $\frac{\sigma^2 A}{2\epsilon_0}$   
(c)  $\frac{(\sigma A)^2}{\epsilon_0}$  (d)  $\frac{(\sigma A)^2}{4\pi\epsilon_0}$

Q.30) In a series LCR circuit, the rms voltage across R, L and C is 10V each. The rms value of applied emf is

- (a) 10 V (b)  $10\sqrt{2}$  V  
(c)  $10\sqrt{3}$  V (d) 20 V

Q.31) Magnifying power of an astronomical telescope for normal vision (in usual notations) is

- (a)  $-f_e / f_o$  (b)  $-f_o / f_e$   
(c)  $-f_o \times f_e$  (d)  $f_o + f_e$

Q.32) The maximum and minimum values of Poisson's ratio for a metal lie in the following limits

- (a) -1 to +1 (b) -1 to 0  
(c) 0 to 1 (d) 0 to 0.5

Q.33) A projectile projected at  $30^\circ$  with the horizontal achieves a horizontal range R. It can achieve the same horizontal range R if projected (with the same initial velocity) at the following angle  $\alpha$  with the vertical

- (a)  $15^\circ$  (b)  $22.5^\circ$   
(c)  $30^\circ$  (d) It cannot achieve the same horizontal range for any angle  $\alpha < 60^\circ$  with the vertical.

Q.34) In an electromagnetic wave the  $\vec{E}$  and  $\vec{B}$  vectors at any instant of time have

- (a) the same phase (b) same amplitude  
(c) phase difference  $\pi$  (d) phase difference  $\frac{\pi}{2}$

Q.35) A simple pendulum is attached to the ceiling of a lift. Its time period of oscillation when the lift is stationary is  $T$ . Its frequency of oscillations, when the lift falls freely is

- (a)  $T$  (b)  $\frac{1}{T}$   
(c) zero (d)  $\infty$

Q.36) A star converts all of its Helium into Oxygen nucleus. Find the amount of energy released per nucleus of oxygen. The masses of two Nuclei are as follows:

$m(\text{He}) = 4.0026 \text{ u}$ ,  $m(\text{O}) = 15.9994 \text{ u}$ .

- (a) 5.12 Mev (b) 7 Mev  
(c) 7.26 Mev (d) 10.24 Mev

Q.37) Two satellites of masses  $3M$  and  $M$  orbit the earth in the circular orbits of radii  $r$  and  $3r$  respectively. The ratio of their orbital velocities is

- (a) 1 : 1 (b)  $\sqrt{3} : 1$   
(c) 3 : 1 (d) 9 : 1

Q.38) The moment of inertia of a uniform disc about an axis perpendicular to the disc at its centre is  $\frac{MR^2}{2}$ , where  $M$  is the mass and  $R$  the radius of the disc. If the disc is rolling on the edge without slipping, on a straight line path, the ratio of rotational kinetic energy to the translational kinetic energy is

- (a) 1 (b)  $\frac{1}{2}$   
(c)  $\frac{1}{4}$  (d)  $\frac{1}{8}$

Q.39) Wavelength  $K_{\alpha}$  line of X-ray spectra varies with atomic number ( $Z$ ) as

- (a)  $\lambda \propto Z$  (b)  $\lambda \propto \sqrt{Z}$   
(c)  $\lambda \propto \frac{1}{Z^2}$  (d)  $\lambda \propto \frac{1}{\sqrt{Z}}$

Q.40) The excess pressure inside a small soap bubble of radius  $r$  is proportional to

- (a)  $r$  (b)  $\frac{1}{r}$   
(c)  $\frac{1}{r^2}$  (d)  $r^2$

- Q.41) An electron is travelling along X- direction. It encounters a magnetic field in the Y- direction. Its subsequent motion will be
- (a) a circle in the XZ- plane
  - (b) a circle in the YZ- plane
  - (c) a circle in the XY-plane
  - (d) a straight line along X- direction.
- Q.42) A particle moving along a circular path with uniform speed has a
- (a) radial velocity and radial acceleration
  - (b) radial velocity and transverse acceleration
  - (c) transverse velocity and radial acceleration
  - (d) transverse velocity and transverse acceleration.
- Q.43) In a region of space the electric field is given as  $\vec{E} = 8\vec{i} + 4\vec{j} + 3\vec{k}$ . The electric flux through a surface area of 100 units in XY- plane is
- (a) 300 units
  - (b) 400 units
  - (c) 800 units
  - (d) 1200 units
- Q.44) Which of the following pair of physical quantities does not have the same dimensions?
- (a) Electric flux, Electric dipole moment
  - (b) Pressure, Young's modulus
  - (c) Electromotive force, Potential difference
  - (d) Heat, Potential energy.
- Q.45) When a magnetic material is subjected to an external magnetizing field, its ability to get magnetized is represented by
- (a) magnetic permeability
  - (b) magnetic susceptibility
  - (c) magnetic viscosity
  - (d) magnetic resonance
- Q.46) Which of the following represents an adiabatic process in an ideal gas( the symbol  $\gamma$  has its usual significance)
- (a)  $pV = \text{constant}$
  - (b)  $TV^\gamma = \text{constant}$
  - (c)  $pV^{\gamma-1} = \text{constant}$
  - (d)  $TV^{\gamma-1} = \text{constant}$







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**PGT (PHYSICS)**

**ANSWERS KEY**

- |       |       |
|-------|-------|
| 1. A  | 26. A |
| 2. B  | 27. B |
| 3. C  | 28. A |
| 4. A  | 29. B |
| 5. C  | 30. A |
| 6. A  | 31. B |
| 7. A  | 32. D |
| 8. B  | 33. C |
| 9. C  | 34. A |
| 10. C | 35. C |
| 11. C | 36. D |
| 12. A | 37. B |
| 13. D | 38. B |
| 14. D | 39. C |
| 15. C | 40. B |
| 16. B | 41. A |
| 17. A | 42. C |
| 18. C | 43. A |
| 19. A | 44. A |
| 20. A | 45. B |
| 21. C | 46. D |
| 22. D | 47. A |
| 23. B | 48. B |
| 24. C | 49. A |
| 25. D | 50. B |

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