परीक्षा दिनांक - 2 मार्च, 2017

A

2014

CODE : A

प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

प्रश्नपुस्तिका
चाळणी परीक्षा
भौतिकशास्त्र

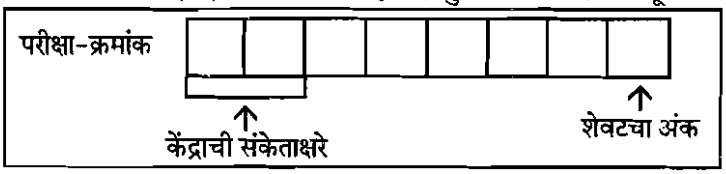
वेळ : 3 (तीन) तास

एकूण प्रश्न : 80
एकूण गुण : 200

सूचना

(1) सदर प्रश्नपुस्तिकेत 80 अनिवार्य प्रश्न आहेत. उमेदवारांनी प्रश्नांची उत्तरे लिहिण्यास सुरुवात करण्यापूर्वी या प्रश्नपुस्तिकेत सर्व प्रश्न आहेत किंवा नाहीत याची खात्री करून घ्यावी. असा तसेच अन्य काही दोष आढळल्यास ही प्रश्नपुस्तिका समवेक्षकांकडून लगेच बदलून घ्यावी.

(2) आपला परीक्षा-क्रमांक ह्या चौकोनांत **न विसरता बॉलपेनने** लिहावा.



(3) वर छापलेला प्रश्नपुस्तिका क्रमांक तुमच्या उत्तरपत्रिकेवर विशिष्ट जागी उत्तरपत्रिकेवरील सूचनेप्रमाणे **न विसरता नमूद करावा.**

(4) या प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाला 4 पर्यायी उत्तरे सुचविली असून त्यांना 1, 2, 3 आणि 4 असे क्रमांक दिलेले आहेत. त्या चार उत्तरांपैकी सर्वात योग्य उत्तराचा क्रमांक उत्तरपत्रिकेवरील सूचनेप्रमाणे तुमच्या उत्तरपत्रिकेवर नमूद करावा. अशा प्रकारे उत्तरपत्रिकेवर उत्तरक्रमांक नमूद करताना तो संबंधित प्रश्नक्रमांकासमोर छायांकित करून दर्शविला जाईल याची काळजी घ्यावी. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

(5) सर्व प्रश्नांना समान गुण आहेत. यास्तव सर्व प्रश्नांची उत्तरे द्यावीत. घाईमुळे चुका होणार नाहीत याची दक्षता घेऊनच शक्य तितक्या वेगाने प्रश्न सोडवावेत. क्रमाने प्रश्न सोडविणे श्रेयस्कर आहे पण **एखादा प्रश्न कठीण वाटल्यास त्यावर वेळ न घालविता पुढील प्रश्नाकडे वळावे.** अशा प्रकारे शेवटच्या प्रश्नापर्यंत पोहोचल्यानंतर वेळ शिल्लक राहिल्यास कठीण म्हणून वगळलेल्या प्रश्नांकडे परतणे सोईस्कर ठरेल.

(6) उत्तरपत्रिकेत एकदा नमूद केलेले उत्तर खोडता येणार नाही. नमूद केलेले उत्तर खोडून नव्याने उत्तर दिल्यास ते तपासले जाणार नाही.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच ''उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची दिलेल्या चार पर्यायांपैकी सर्वात योग्य उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चार चुकीच्या उत्तरांसाठी एका प्रश्नाचे गुण वजा करण्यात येतील''.**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

ताकीद

ह्या प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपेपर्यंत ही प्रश्नपुस्तिका आयोगाची मालमत्ता असून ती परीक्षाकक्षात उमेदवाराला परीक्षेसाठी वापरण्यास देण्यात येत आहे. ही वेळ संपेपर्यंत सदर प्रश्नपुस्तिकेची प्रत/प्रती, किंवा सदर प्रश्नपुस्तिकेतील काही आशय कोणत्याही स्वरूपात प्रत्यक्ष वा अप्रत्यक्षपणे कोणत्याही व्यक्तीस पुरविणे, तसेच प्रसिद्ध करणे हा गुन्हा असून अशी कृती करणाऱ्या व्यक्तीवर शासनाने जारी केलेल्या ''परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचा अधिनियम-82'' यातील तरतुदीनुसार तसेच प्रचलित कायद्याच्या तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

तसेच ह्या प्रश्नपत्रिकेसाठी विहित केलेली वेळ संपण्याआधी ही प्रश्नपुस्तिका अनधिकृतपणे बाळगणे हा सुद्धा गुन्हा असून तसे करणारी व्यक्ती आयोगाच्या कर्मचारीवृंदापैकी, तसेच परीक्षेच्या पर्यवेक्षकीयवृंदापैकी असली तरीही अशा व्यक्तीविरूद्ध उक्त अधिनियमानुसार कारवाई करण्यात येईल व दोषी व्यक्ती शिक्षेस पात्र होईल.

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

Note :

Assume suitable data as necessary.

- Mass of an electron = 9.1×10^{-31} kg; Charge of an electron $= 1.6 \times 10^{-19}$ C
- Planck's constant $h = 6.62 \times 10^{-34}$ J–s; Avagadro's number $N = 6.023 \times 10^{26}$/kg mole
- Velocity of light $c = 3 \times 10^{8}$ m/s; Boltzmann's constant $K = 1.38 \times 10^{-23}$ J/K
- Permittivity of free space $\epsilon_o = 8.85 \times 10^{-12}$ F/m; Permeability of free space $\mu_o = 4\pi \times 10^{-7}$ H/m

---

1. An electron is bound in a 1 D-potential well of width 2 Au but of infinite height. Find its energy value in the ground state :

(1) 1.5×10^{-18} eV (2) 9.43 eV

(3) 9.43×10^{4} eV (4) None of the above

---

2. The relation between one Bohr magneton and one nuclear magneton is :

(1) $\mu_B = \frac{e\hbar}{2m_e} \mu_N$ (2) $\mu_B = 1836\ \mu_N$

(3) $\mu_B = 1386\ \mu_N$ (4) $\mu_B = \frac{1}{10} \mu_N$

---

3. The complementary function of $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x$ is given by :

(1) $C_1 x e^x$ (2) $(C_1 + C_2 x)e^{2x}$

(3) $(C_1 + C_2 x)e^x$ (4) None of the above

---

4. The relation between the phase velocity V_p and group velocity V_g of matter waves of wavelength λ is :

(1) $V_g = V_p + V_p \frac{d\lambda}{V_g}$ (2) $V_g = V_p - \lambda \frac{dV_p}{d\lambda}$

(3) $V_g = V_p - \frac{1}{\lambda} \frac{dV_p}{d\lambda}$ (4) $V_g = V_p + \lambda \frac{dV_p}{d\lambda}$

---

5. In a LASER stimulated emission occurs because photons are :

(1) Fermions (2) Bosons (3) Mesons (4) Muons

SPACE FOR ROUGH WORK

P.T.O.

6. Faraday's Law states that :
   (1) When the magnetic flux linked with a circuit changes an emf is induced in it.
   (2) An induced current in a closed conducting loop will appear in such a direction that it opposes the original flux change.
   (3) The line integral of the tangential component of the magnetic field over any closed path is equal to the amount of current enclosed by the loop.
   (4) All of the above.

7. The radioactive emission producing maximum ionization in a gas is :
   (1) β - rays (2) γ - rays (3) α - rays (4) X - rays

8. According to Kepler's Second Law, the radius vector to a planet from the sun sweeps out equal area in equal intervals of time. The law is a consequence of conservation of :
   (1) Potential energy (2) Kinetic energy
   (3) Angular momentum (4) Mass

9. Molybdenum has a BCC structure. Its density is 10.2×10^3 kg/m^3 and its atomic weight is 95.94. The radius of the molybdenum atom is :
   (1) 3.15 Au (2) 1.364 Au
   (3) 2.227 Au (4) None of the above

10. Maxwell's second electromagnetic equation describes :
   (1) Gauss's Law of electrostatics
   (2) Gauss's Law of electromagnetism
   (3) Faraday's Law of electromagnetic induction
   (4) All of the above

11. If v is the velocity of the spaceship with respect to a given frame of reference, where an observer makes observations, then according to Einstein's special theory of relativity, the mass of the spaceship increases by a factor :

   (1) $\sqrt{1 - \frac{v^2}{c^2}}$ (2) $\frac{m_o}{\sqrt{1 - \frac{v^2}{c^2}}}$ (3) $\frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$ (4) $m_o\sqrt{1 - \frac{v^2}{c^2}}$

12. If N is the total number of atoms in the crystal and E_v is the energy required for vacancy formation, then the equilibrium number of vacancies 'n' is given by :

   (1) $n = N \exp\left[-\frac{E_v}{KT}\right]$ (2) $n = \frac{1}{N} \exp\left[-\frac{E_v}{KT}\right]$

   (3) $n = N \exp\left[\frac{E_v}{KT}\right]$ (4) $n = N \exp\left[\frac{E_v}{KT} - 1\right]$

SPACE FOR ROUGH WORK

13. The vector product of two vectors is :

(1) Distributive (2) Commutative

(3) Not commutative (4) Non distributive

---

14. If both the junctions of a transistor are reverse biased the transistor is said to be in :

(1) Inverted mode (2) Saturation region

(3) Active region (4) Cut-off region

---

15. Let d_1, d_2 and d_3 be the interplanar spacings of the (100), (110) and (111) planes respectively, of a cubic crystal system. If $d_1 : d_2 : d_3 :: 1 : \sqrt{2} : \frac{1}{\sqrt{3}}$ then the structure is :

(1) Simple cubic (2) Body centered cubic

(3) Face centered cubic (4) Base centered cubic

---

16. Heisenberg's uncertainty principle arises due to :

(1) inaccuracy of measuring instruments.

(2) size of the matter particle.

(3) wave nature of matter.

(4) particle nature of matter.

---

17. In a N-type extrinsic semiconductor the Fermi Energy level is :

(1) At the centre of the forbidden energy gap.

(2) Just below the conduction band.

(3) Just above the valence band.

(4) Anywhere in the forbidden energy gap.

---

18. In a half wave rectifier, the load current flows for :

(1) the complete cycle of the input signal.

(2) only for the positive half cycle of the input signal.

(3) less than half cycle of the input signal.

(4) more than half cycle but less than the complete cycle of the input signal.

SPACE FOR ROUGH WORK

P.T.O.

19. The Laplace transform of $e^{3t}\sin^2 t$ is :

(1) $\frac{1}{2}\left[\frac{1}{S} - \frac{S}{S^2+4}\right]$ (2) $\frac{1}{2}\left[\frac{1}{S-3} - \frac{S-3}{(S-3)^2+4}\right]$

(3) $\frac{1}{2}\left[\frac{1}{S-3} + \frac{S-3}{(S-3)^2+4}\right]$ (4) $\frac{1}{2}\left[\frac{1}{S-3} - \frac{S-3}{(S-3)^2-4}\right]$

---

20. The susceptibility of a superconductor is :

(1) positive and small (2) positive and unity

(3) negative and small (4) negative and unity

---

21. If there are 9×10^{28} valence electrons/m^3 and the conductivity of copper is 6×10^7 mho/m, the mobility of the electrons is given by :

(1) $4.16\ \frac{m^2}{VS}$ (2) $4.163\times10^3\ \frac{m^2}{VS}$

(3) $4.16\times10^{-3}\ \frac{m^2}{VS}$ (4) $4.163\times10^{-4}\ \frac{m^2}{VS}$

---

22. If the earth receives 2 cal/min/cm^2 of Solar energy, what is the amplitude of the electric field of radiation ?

(1) 376.72 Volt/m (2) 726.6 Volt/m

(3) 1.928 Volt/m (4) None of the above

---

23. An event occurs at $x=100$ m, $y=10$ m, $z=5$ m and $t=1\times10^{-4}$ sec, in a frame S. Find the co-ordinates of this event in a frame S' which is moving with velocity 2.7×10^8 m/s with respect to frame S along the common XX' axes using Lorentz Transformation :

(1) $x' = -60720$ m, $y'=5$ m, $z'=10$ m

(2) $x' = -61720$ m, $y'=10$ m, $z'=5$ m

(3) $x' = -66720$ m, $y'=10$ m, $z'=5$ m

(4) None of the above

SPACE FOR ROUGH WORK

24. The one dimensional time dependant Schrodinger's wave equation is given by :

(1) $-\frac{\hbar^2}{2m}\frac{\partial^2\psi}{\partial t^2} + V\psi = i\hbar\frac{\partial\psi}{\partial x}$ (2) $-\frac{h}{2m}\frac{\partial\psi}{\partial t} = i\hbar\frac{\partial^2\psi}{\partial x^2} + V\psi$

(3) $-\frac{\hbar^2}{2m}\frac{\partial^2\psi}{\partial x^2} + V\psi = i\hbar\frac{\partial\psi}{\partial t}$ (4) None of the above

---

25. The wavelength of continuous X-rays depends upon :

(1) Target material (2) Filament current

(3) Accelerating potential difference (4) All of the above

---

26. A Field Effect Transistor (FET) :

(1) uses a high concentration emitter junction.

(2) uses a forward biased PN junction.

(3) has a very high input resistance.

(4) depends on minority carrier flow.

---

27. In j - j coupling, the following interaction is stronger :

(1) Spin and orbital angular momentum vectors of each electron

(2) Between spin vectors of each electron

(3) Between orbital angular momentum vectors of each electron

(4) Resultant spin vector and Resultant orbital angular momentum vector of the atom

---

28. In a LCR circuit, the discharge will be oscillatory if :

(1) $R^2 = \frac{4L}{C}$ (2) $R^2 > \frac{4L}{C}$ (3) $R^2 < \frac{4L}{C}$ (4) $R^2 < \frac{L}{4C}$

---

29. A Flipflop is called a latch when it is :

(1) edge triggered (2) level triggered

(3) both edge and level triggered (4) untriggered

---

30. The input impedance of an active filter is :

(1) Zero.

(2) 100 Ω.

(3) in the range from a few kΩ to some thousand MΩ.

(4) in the range from a few kΩ to some hundred kΩ.

SPACE FOR ROUGH WORK

P.T.O.

31. A beam of X-Rays $\lambda = 0.842$ Au is incident on a crystal at a glancing angle of 8° 35' when first order Bragg's diffraction occurs. The glancing angle for the third order diffraction is :

(1) 25.05° (2) 26.55° (3) 24.56° (4) 53.10°

---

32. A ballot box with mass 6 kg slides with a speed 4 m/s across a frictionless floor in the positive x-direction. It suddenly explodes into two pieces. One piece with mass $m_1 = 2$ kg moves in the positive x-direction with speed $v_1 = 8$ m/s. What is the velocity of the second piece ?

(1) -4 m/s (2) 4 m/s (3) 2 m/s (4) None of the above

---

33. Assuming each fission event produces 200 MeV of energy, find the energy produced due to fission of 1 gm of U^{235} :

(1) 8.2×10^7 J (2) 3.6×10^6 J

(3) 8.2×10^{10} J (4) None of the above

---

34. A cyclotron with its dees of radius 2 m has a magnetic field of 0.75 wb/m^2. The maximum energy to which a proton (mass $= 1.67 \times 10^{-27}$ kg) can be accelerated is :

(1) 1.73×10^{-11} eV (2) 107.9×10^6 keV

(3) 1.73×10^{-11} J (4) 107.9 keV

---

35. If two objects A and B are moving with velocities u and v, with respect to each other along the x-axis, the relative velocity of A with respect to B is given by :

(1) $v_x = \dfrac{v-u}{1-\dfrac{uv}{c^2}}$ (2) $v_x = \dfrac{v-u}{\sqrt{1-\dfrac{v^2}{c^2}}}$ (3) $v_x = \dfrac{u-v}{1-\dfrac{uv}{c}}$ (4) $v_x = \dfrac{u-v}{1-\dfrac{uv}{c^2}}$

---

36. The Potential barrier in a PN junction is due to the charges on either side of the junction. These charges are :

(1) Minority carriers.

(2) Majority carriers.

(3) Both majority and minority carriers.

(4) Fixed donor and acceptor ions.

---

37. A perfect Black Body is :

(1) A good absorber of all radiations.

(2) A perfect radiator of all radiations.

(3) A good absorber and also a perfect radiator when hot.

(4) One which can be maintained at a constant temperature.

SPACE FOR ROUGH WORK

38. The radiant energy of the sun results from :

(1) nuclear fission (2) combustion

(3) nuclear fusion (4) cosmic radiation

---

39. If the mass of one $_{17}Cl^{35}$ nucleus is 34.9800 amu, mass of one neutron is 1.008665 amu and mass of one proton is 1.007825 amu, the Binding energy per nucleon of $_{17}Cl^{35}$ is :

(1) 288 MeV (2) 8.22 MeV

(3) 931 MeV (4) None of the above

---

40. The magnetic flux density in air at a point 5 cm from a long straight wire carrying a current of 15 Amp is :

(1) 6×10^{-6} wb/m^2 (2) 6×10^{-5} wb/m^2

(3) 3×10^{-6} wb/m^2 (4) 3×10^{-5} Tesla

---

41. Find the De Broglie wave length of a 46 gm golf ball moving at 30 m/s. Planck's constant $h = 6.62\times10^{-34}$ Js

(1) 1380 m (2) 4.8×10^{-34} m

(3) 4.8×10^{-31} m (4) 4.8×10^{34} m

---

42. The critical magnetic field of a superconductor :

(1) does not depend on temperature.

(2) increases if temperature increases.

(3) increases if temperature decreases.

(4) does not depend on superconducting transition temperature.

---

43. The Poynting vector $\vec{S}$ is given by :

(1) $\vec{S} = \dfrac{\left(\vec{E}\times\vec{B}\right)K}{\epsilon_0}$ (2) $\vec{S} = \dfrac{\vec{E}\times\vec{B}}{\epsilon_0}$

(3) $\vec{S} = \dfrac{\vec{E}\times\vec{B}}{\mu_0}$ (4) $\vec{S} = \dfrac{\vec{E}\times\vec{B}}{\mu_0 C}$

SPACE FOR ROUGH WORK

P.T.O.

44. At every instant the ratio of the electric field to the magnetic field of an electromagnetic wav is equal to :

(1) Wave amplitude (2) $\frac{\epsilon_0}{\mu_0}$

(3) C (4) $\frac{2\pi}{\lambda}$

---

45. The splitting of spectral lines by the action of an electric field is known as :

(1) Paschen - Back effect (2) Zeeman effect

(3) Stark effect (4) Lorentz effect

---

46. For dielectrics the ratio of the magnitude of the conduction current density to that of the displacement current density $\left(\frac{\sigma}{\omega\epsilon}\right)$ is :

(1) $\frac{1}{100}$ (2) 1 (3) less than $\frac{1}{100}$ (4) more than $\frac{1}{100}$

---

47. The angular momentum of a disc whose rotational energy is 10 kJ and moment of inertia about the axis of rotation is 8×10^{-4} kg m^2 is given by :

(1) 4 kg m^2/s (2) 16 kg m^2/s

(3) 2 kg m^2/s (4) None of the above

---

48. In a transistor the base is :

(1) thin and heavily doped (2) thin and moderately doped

(3) large and heavily doped (4) thin and lightly doped

---

49. A dual slope A/D convertor is extensively used in :

(1) De-multiplexers (2) Multiplexers

(3) Digital voltmeters (4) Ripple counters

---

50. Calculate the force between two charges of one Coulomb each when they are at a distance of 1 m :

(1) 8.986 N (2) 89.86×10^4 N

(3) 8.986×10^9 N (4) None of the above

SPACE FOR ROUGH WORK

51. The most unsymmetrical crystal system is :
(1) Monoclinic (2) Orthorhombic
(3) Triclinic (4) Cubic

52. The size of the aperture should be of the order of the incident wave length. This condition is required for :
(1) Interference (2) Rectilinear propogation
(3) Diffraction (4) Polarization

53. γ - rays of 2.21 MeV energy are used to split a deuterium nucleus into a proton and neutron. If the mass of the deuterium atom is 2.01472 amu and mass of proton is 1.00813 amu, the mass of the neutron is given by :
(1) 0.00238 amu (2) 1.00897 amu
(3) 1.00813 amu (4) None of the above

54. In Thermodynamics ISOCHORIC process is one in which :
(1) Temperature remains constant (2) Pressure remains constant
(3) Volume remains constant (4) Energy remains constant

55. A proton is made up of :
(1) One-quark and one anti-quark
(2) Two up quarks and one down quark
(3) Two down quarks and one up quark
(4) None of the above

56. The geometrical aspect of the crystal structure is given by :
(1) Basis (2) Unit cell
(3) Space lattice (4) Lattice array

57. According to Planck's law, the energy density of radiation is given by :
(1) $Q = \frac{8\pi^3 h\nu^3}{c^3}\left[\frac{1}{e^{h\nu/kT}-1}\right]$ (2) $Q = \frac{8\pi h\nu^3}{c^3}\left[\frac{1}{e^{h\nu/kT}-1}\right]$
(3) $Q = \frac{8\pi^3 h\nu^3}{c^3}\left[\frac{1}{e^{h\nu/kT}-2}\right]$ (4) $Q = \frac{8\pi h^3\nu^3}{c^5}\left[\frac{1}{e^{h\nu/kT}-1}\right]$

SPACE FOR ROUGH WORK

P.T.O.

58. The First Law of Thermodynamics states that :

(1) When two bodies are in thermal contact and no exchange of heat takes place, they a in thermal equilibrium.

(2) The ratio of the work done and heat produced is always constant.

(3) Heat cannot flow from a cold body to a hot body without the aid of some external agency.

(4) All of the above.

---

59. The moment of inertia of a solid sphere of mass M and radius R, about its diameter is :

(1) $\frac{7}{5}MR^2$ (2) $\frac{MR^2}{2}$

(3) $\frac{2}{5}MR^2$ (4) None of the above

---

60. The product AB of two matrices

$$A = \begin{bmatrix} 1 & 3 & 0 \\ -1 & 2 & 1 \\ 0 & 0 & 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2 & 3 & 4 \\ 1 & 2 & 3 \\ -1 & 1 & 2 \end{bmatrix} \text{ is :}$$

(1) $\begin{bmatrix} -1 & 12 & 11 \\ -1 & 7 & 8 \\ -2 & -1 & 5 \end{bmatrix}$ (2) $\begin{bmatrix} 5 & 9 & 13 \\ -1 & 2 & 4 \\ -2 & 2 & 4 \end{bmatrix}$

(3) $\begin{bmatrix} 2 & 9 & 0 \\ -1 & 4 & 3 \\ 0 & 0 & 4 \end{bmatrix}$ (4) None of the above

---

61. In the liquid drop model of the nucleus, the nuclear forces play the role of :

(1) Cohesive force (2) Surface tension force

(3) Viscous force (4) Coulomb's attractive force

---

62. If the magnetic susceptibility is around -10^{-6}, the material is :

(1) paramagnetic (2) diamagnetic

(3) ferromagnetic (4) ferrimagnetic

SPACE FOR ROUGH WORK

63. Ampere's law allows us to calculate :

(1) Magnetic field caused by any current distribution.

(2) Magnetic field caused by a current carrying conductor in case of symmetry.

(3) The total magnetic flux produced by a linear current carrying conductor.

(4) None of the above.

---

64. When NaCl crystal is subjected to an electric field of 50 V/cm, the resulting polarization is 2.215×10^{-7} C/m^2. If the permittivity of free space is 8.854×10^{-12} F/m, then the relative permittivity of NaCl is :

(1) 5.006 (2) 5.666 (3) 6.006 (4) 6.506

---

65. Electrons bombarding the anode of a Coolidge tube produces X-rays of wavelength 1 Au. Find the energy of each electron at the moment of impact. Given

$h = 6.62 \times 10^{-34}$ Js and $e = 1.6 \times 10^{-19}$ C.

(1) 0.1241 keV (2) 12.41 eV

(3) 1.241 keV (4) 12.41 keV

---

66. X-Rays which give a line spectrum are called as :

(1) Continuous X-Rays (2) Characteristic X-Rays

(3) K_α X-Rays (4) Bremstrallung X-Rays

---

67. In an amplifier, the coupling capacitors are used to :

(1) control the output.

(2) to limit the bandwidth.

(3) to match the impedances.

(4) to prevent dc mixing with input or output.

---

68. The main function of a dielectric is :

(1) Electrical insulation (2) Charge storage

(3) Measuring magnetic field (4) Measuring electric field

---

69. Which of the following particles are Bosons ?

(1) Leptons (2) Mesons (3) Muons (4) Electrons

SPACE FOR ROUGH WORK

70. A 10 mW LASER has a beam diameter of 1.6 mm. What is the intensity of the light assuming that it is uniform across the beam ?

(1) $1.243\ kW/m^2$ (2) $4.97\ kW/m^2$

(3) $4.97\ MW/m^2$ (4) $4.97 \times 10^{-3}\ W/m^2$

---

71. An Electronic Register consists of a group of :

(1) multiplexers (2) flipflops

(3) logic gates (4) microprocessors

---

72. Two particles of masses 100 gm and 300 gm have at a given time, position $2i+5j+13k$ and $-6i+4j-2k$ cm respectively and velocities $10i-7j-3k$ and $7i-9j+6k$ cm/sec respectively. The velocity of the second particle in a frame of reference travelling with the centre of mass is :

(1) $\frac{31i-34j+15k}{4}$ cm/sec (2) $\frac{-3i-2j+9k}{4}$ cm/sec

(3) $\frac{-16i+17j+7k}{4}$ cm/sec (4) None of the above

---

73. Electrons are accelerated upto a Kinetic energy of 10^9eV. Find the ratio of their mass to the rest of the mass :

(1) $\frac{m}{m_0} = 1.77 \times 10^{-27}$ (2) $\frac{m}{m_0} = 9.15 \times 10^3$

(3) $\frac{m}{m_0} = 1.95 \times 10^3$ (4) $\frac{m}{m_0} = 0.95 \times 10^3$

---

74. The Boolean expression $Y = A + B$ represents :

(1) AND Gate (2) Exclusive OR Gate

(3) OR Gate (4) NAND Gate

---

75. In an elastic collision :

(1) Kinetic energy is conserved but momentum is not conserved.

(2) The two colliding bodies stick to each other after collision.

(3) Kinetic energy and momentum are conserved.

(4) Kinetic energy is not conserved.

SPACE FOR ROUGH WORK

76. Constant forces $\vec{P} = 2\vec{i} - 5\vec{j} + 6\vec{k}$ and $\vec{Q} = -\vec{i} + 2\vec{j} - \vec{k}$ act on a particle. Deter... the work done when the particle is displaced from point A to point B, the position vectors o... A and B being $4\vec{i} - 3\vec{j} - 2\vec{k}$ and $6\vec{i} + \vec{j} - 3\vec{k}$ respectively :

(1) -15 units (2) 21 units

(3) -21 units (4) None of the above

---

77. A FET amplifier in the common source configuration uses a load resistance of 250 kΩ. The ac drain resistance of the device is 100 kΩ and transconductance is 0.5 mA/V. The voltage gain is :

(1) 71.4 (2) -35.71 (3) -71.4 (4) 35.71

---

78. An electron is confined in a box of length 10^{-8} m. Calculate the minimum uncertainty in velocity :

(1) 11.595 m/s (2) 1.1595×10^2 m/s

(3) 11.595×10^3 m/s (4) 1.055×10^{-26} m/s

---

79. The splitting of spectral lines under the action of a magnetic field is known as :

(1) Raman effect (2) Lyman effect

(3) Zeeman effect (4) Stark effect

---

80. The Zero-Point energy of a Harmonic Oscillator is given by :

(1) $E_0 = \frac{1}{2}\hbar\omega^2$ (2) $E_0 = \frac{\hbar^2\omega^2}{2\pi}$

(3) $E_0 = \frac{1}{2}\hbar\omega$ (4) None of the above

- o 0 o -

SPACE FOR ROUGH WORK

P.T.O.

सूचना — (पृष्ठ 1 वरून पुढे....)

(8) प्रश्नपुस्तिकेमध्ये विहित केलेल्या विशिष्ट जागीच कच्चे काम (रफ वर्क) करावे. प्रश्नपुस्तिकेव्यतिरिक्त उत्तरपत्रिकेवर वा इतर कागदावर कच्चे काम केल्यास ते कॉपी करण्याच्या उद्देशाने केले आहे, असे मानले जाईल व त्यानुसार उमेदवारावर शासनाने जारी केलेल्या "परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचे अधिनियम-82" यातील तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

(9) सदर प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपल्यानंतर उमेदवारला ही प्रश्नपुस्तिका स्वत:बरोबर परीक्षाकक्षाबाहेर घेऊन जाण्यास परवानगी आहे. **मात्र परीक्षा कक्षाबाहेर जाण्यापूर्वी उमेदवाराने आपल्या उत्तरपत्रिकेचा भाग-1 समवेक्षकाकडे न विसरता परत करणे आवश्यक आहे.**

नमुना प्रश्न

Pick out the correct word to fill in the blank :

Q. No. 201. I congratulate you _____ your grand success.

(1) for (2) at (3) on (4) about

ह्या प्रश्नाचे योग्य उत्तर "(3) on" असे आहे. त्यामुळे या प्रश्नाचे उत्तर "(3)" होईल. यास्तव **खालीलप्रमाणे** प्रश्न क्र. 201 समोरील उत्तर-क्रमांक "③" हे वर्तुळ पूर्णपणे छायांकित करून दाखविणे आवश्यक आहे.

प्र. क्र. 201. ① ② ● ④

अशा पद्धतीने प्रस्तुत प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाचा तुमचा उत्तरक्रमांक हा तुम्हाला स्वतंत्ररीत्या पुरविलेल्या उत्तरपत्रिकेवरील त्या त्या प्रश्नक्रमांकासमोरील संबंधित वर्तुळ पूर्णपणे छायांकित करून दाखवावा. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

कच्च्या कामासाठी जागा /SPACE FOR ROUGH WORK