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PG-TRB-PHYSICS-
MODEL TEST-III- QUESTION BANK-CONTACT:
8072230063.

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PHYSICS
MODEL TEST-III
QUESTION BANK
2019-2020


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1. A cyclotron of radius 64 cm accelerates deuterons (m = 3.3 x 10^{-27} kg). If the cyclotron frequency is 5 MHz, then the maximum speed with which the deuterons emerge, is
   (a) 3 x 10^7 m/s    (b) 2 x 10^7 m/s    (c) 1.5 x 10^7 m/s    (d) 2 x 10^6 m/s

2. In a typical electron synchrotron, the magnetic field
   (a) Is varied with time while the radio frequency is held constant
   (b) Is held constant while the radio frequency is varied with time
   (c) As well as the radio frequency are varied with time
   (d) As well as the radio frequency are held constant

3. Consider the following statements

   Stern and Gerlach experiment gives a direct and convincing confirmation of
   1. Space quantization.  2. Wave nature of electron.
   3. Spin of electron.  4. Quantized atomic magnetic moment.

   Which of the above statements are correct?
   (a) 3 and 4  (b) 1, 2 and 4  (c) 1, 3 and 4  (d) 1 and 2

4. Ionization potential for a hydrogen atom is 13.6 eV. The ionization potential for a positronium atom where an electron revolves round a positron, is
10. Consider the following statements about a neutron

1. Neutron is a fermium.

2. A neutron is heavier than a proton.

3. A free neutron is an unstable particle.

Which of the above statements are correct?

(a) 6.8 eV  
(b) 13.6 eV’  
(c) 3.4 eV  
(d) 1.7 eV

5. The glancing angle in a X-rays diffraction experiment is 30° and the wavelength of the X-rays used is 20 nm. The inter planar spacing of the crystal diffracting these X-rays will be

(a) 20 nm  
(b) 40 nm  
(c) 15 nm  
(d) 10 nm

6. If a proton and an electron have same de-Broglie wavelength, then

(a) Both have same kinetic energies

(b) Proton has more kinetic energy than electron

(c) Electron has more kinetic energy than proton

(d) Both have same velocity

7. Six α-decays and a number of 13-decays occur before 90Th232 achieves stability; the final product in the chain being 82Pb208. The number of β-deintegrations taking place is

(a) 2  
(b) 4  
(c) 6  
(d) 8

8. Two. Substances X and Y are made radioactive and contain equal number of atoms. X has half life of 1 h and Y has half-life of 2 h. After a lapse of 2 h, the ratio of the rate of disintegration of X to that of Y will be

(a) 1: 4  
(b) 2: 1  
(c) 1: 1  
(d) 1: 2

9. An unstable particle of rest energy 1000 MeV ecays into a μ-meson and a neutrino, with a mean life time of 10-8 s, when at rest. The mean decay distance, in meters, when the particle has a momentum of 1000 MeV/c is

(a) 3  
(b) 6  
(c) 9  
(d) 12

10. Consider the following statements about a neutron

1. Neutron is a fermium.

2. A neutron is heavier than a proton.

3. A free neutron is an unstable particle.

Which of the above statements are correct?
11. The annihilation of a slow positron and an electron cannot result into a photon, but must produce at least two photons traveling in opposite directions. This implies conservation of

(a) Energy (b) Baryons (c) Leptons (d) Momentum

12. The energy of a particle in a potential box and that of the hydrogen atom varies with the quantum number n, respectively, as

(a) n^2 and 1/n^2 (b) 1/n^2 and n^2 (c) n^2 (d) 2/n^2 and 1/n^2

13. An excited state of hydrogen atom has a life time of 2.5 x 10^{-14} s. The minimum error in the measurement of the energy of the excited state will be

(a) 1.656 x 10^{-40} erg (b) 1.656 x 10^{-40} J (c) 2.65 x 10^{-13} erg (d) 2.65 x 10^{-13} J

14. If input impedance of an FET is R1, and that of a BJT is R2, then

(a) R1 > R2 (b) R1 (c) R1 = R2 (d) None of these

15. The correct sequence of the band-gaps of germanium (Eg1) silicon (Eg2) and gallium arsenide (Eg3) will be

(a) Eg1 > Eg2 > Eg3 (b) Eg1 < Eg2 (c) Eg2 < Eg1 < Eg3 (d) Eg2 > Eg1 > Eg3

16. The Fermi level of an intrinsic semiconductor is pinned at the centre of the band-gap. The probability of occupation of the highest electron state in valence band at room temperature will be

(a) Zero (b) Between zero and half (c) Half (d) One

17. If a semiconductor has an intrinsic carrier concentration of 1.41 x 10^{16}/m^3 when doped with 1021/m^3 phosphorus atoms, then the concentration of holes/m^3 at room temperature will be
20. If a transistor amplifier has a gain of 20 dB, then the ratio of output to input power is
(a) 100 (b) 10 (c) 20 (d) 200

21. for a square-wave response (with respect to its maximum response), the rise-time of a transistor is defined as the time duration in which its response varies from
(a) 10% to 50% (b) 0% to 50%
(c) 10% to 90% (d) 25% to 75%

22. If the energy, B = Gr where G is the universal gravitational constant, h is the Planck’s constant and c is the velocity of light, then the values of p, q and r are, respectively.
(a) –½, ½ and 5/2 (b) ½, –½ and 5/2
(c) –½, ½ and 3/2 (d) ½, –½ and 3/2

23. Two bodies A and B start from rest and from the same point with a uniform acceleration of 2 m/s². If B starts one second later, then the two bodies are separated, at the end of the next second, by
(a) 1 m (b) 2 m (c) 3 m (d) 4 m

24. A 25 kg crate, starting from rest at the top, slides down a plane that makes an angle of 30° with the horizontal. When it reaches the bottom of the 10 m long slide, its velocity is 8 m/s. The work done by the force of friction is closest to a value of
(a) 17.0 x 10²J (b) 6.5 x 10²J (c) 8.0 x 10²J (d) 4.5 x 10²J
25. A particle of mass 10 kg is moving in a straight line. If its displacement, \(x=(t^3 - 2t - 16)\) m, then the force acting on it at the end of 4 s is

(a) 24N  (b) 300N  (c) 240N  (d) 1200N

26. A golf ball of mass 005 kg placed on a tee, is struck by a golf club. The speed of the golf ball as it leaves the tee is 100 m/s. The time of contact between them is 0.02 s. If the force decreases to zero linearly with time, then the force at the beginning of the contact is

(a) 500 N  (b) 250 N  (c) 200 N  (d) 100 N

27. The moment of inertia of a dumbbell, consisting of point masses \(m_1 = 2.0\) kg and \(m_2 = 1.0\) kg, fixed to the ends of a rigid massless rod of length \(L = 0.6\) m, about an axis passing through the centre of mass and perpendicular to its length, is

(a) 0.72 kg·m\(^2\)  (b) 0.36 kg·m\(^2\)  (c) 0.27 kg·m\(^2\)  (d) 0.24 kg·m\(^2\)

28. A merry-go-round starting from rest accelerates for 5 s with an angular acceleration of 0.4 rad/s\(^2\). It then rotates at constant angular velocity for 30 s before slowing down at the same rate. The distance covered by a thud, sitting on a toy-horse 3 m from the centre, is

(a) 35 m  (b) 55m  (c) 105 m  (d) 210m

29. Two springs A and B with spring constants, \(k_A = 2k_B\) are stretched by applying forces of equal magnitudes at their ends. If the energy stored in A is \(E\), then the energy stored in B is

(a) \(E/4\)  (b) \(E/2\)  (c) \(E\)  (d) \(2E\)

30. In a circus, a person with a mass of 70 kg stands without any floor-support against the wall of a cylindrical rotor. If the coefficient of friction between the rotor-wall surface and the man’s feet is 0.4 and radius of rotor is 2.0 m, then the minimum angular speed of rotor such that the person does not fall, should be

(a) 7.0 rad/s  (b) 1.75 rad/s  (c) 3.5 rad/s  (d) 5.25 rad/s

31. A comet moves in an elliptical orbit with an eccentricity of \(e = 0.20\) around a star. The distance between the perihelion and the aphelion is 1.0 x 108 km. If the speed of the comet at perihelion is 81 km/s, then the speed of the comet at the aphelion, is
32. A chair is suspended from a spring with spring constant of 600 N/m. The periodic time for oscillation of system is 1 s. When a man sits in this chair, the periodic time becomes 2.5 s. The weight of the man is closest to a value of

(a) 650 N  
(b) 800 N  
(c) 950 N  
(d) 1100 N

33. When a spring is stretched by a distance x, it exerts a force, given by \( F = (-5x - 16x^2) \) N. The work done, when the spring is stretched from 0.1 m to 0.2 m, is

(a) 8.1 \times 10^{-2} J  
(b) 12.2 \times 10^{-2} J  
(c) 8.1 \times 10^{-1} J  
(d) 12.2 \times 10^{-1} J

34. If the momentum of an electron moving with a velocity 0.9 c is increased by 1%, then the increase in its energy is

(a) 1%  
(b) 0.9%  
(c) 0.81%  
(d) 0.5%

34. An inertial frame of reference B is moving along the X-axis with a velocity 9 \times 10^6 m/s with respect to another inertial frame A. A rod is located in the frame A with its two ends at the coordinate points (5, -5, 0) m and (5, 7, 5) m. The length of the rod as observed from the frame B is

(a) 13.5 m  
(b) 13.0 m  
(c) 12.75 m  
(d) 12.5 m

35. A rain drop of radius 1.5 mm, experiences a drag force, \( F = (2 \times 10^{-5}v) \) N, while falling through air from a height of 2 km, with a velocity V. The terminal velocity of the rain drop will be nearly.

(a) 200 m/s  
(b) 80 m/s  
(c) 7 m/s  
(d) 3 m/s

36. Two traveling waves \( y_1 = 0.65 \sin (0.4x - 800t) \) m and \( y_2 = -0.65 \sin (0.4x + 800t) \) m are superposed in a medium. For the resultant wave at the point \( x = 2.5 \) m, the maximum displacement is

(a) Zero  
(b) 0.65 m  
(c) 1.30 m  
(d) 0.91 m

37. The maximum amplitude in the case of a forced oscillator occurs at the

(a) Natural frequency of the oscillator  
(b) Frequency of the force
42. Colloidal particles of mass M are suspended in a gas at 300 K and 1 atm. The most probable energy of these particles is equal to the kinetic energy of a gas molecule moving with the most probable velocity \( V_p \), at the temperature

(a) 450 K  
(b) 380 K  
(c) 300 K  
(d) 150 K

43. In the van der Waals’ equation, the terms \( (a/V^2) \) and \( (b) \) are introduced to account for the
(a) Inter-molecular attraction and the total volume occupied by the gas
(b) Molecular size and the size of the containing vessel
(c) Inter-molecular attraction and the volume of the molecules
(d) Inter-molecular attraction and the force exerted by the molecules on the walls of the container

44. In the spectrum of black body radiation, the distribution of energy switches from adherence to Planck’s law, to Wien’s law (in short Wavelength region) because of the fact that both these laws.

(a) Assume continuous variation of energy
(b) assume discontinuous Variation of energy
(c) Use the same expressions for different modes of vibration
(d) Lead to very small values for the probability factor

45. The phenomenon of viscosity in gases is associated with momentum transport from ‘high velocity’ region to ‘low velocity’ region. The mean square velocity of those molecules which participate in the transfer of momentum across a hypothetical layer of the gas is given by

(a) 2kT/m  (b) 8kT/m  (c) 3kT/m  (d) 4kT/m

46. Two organ pipes closed at one end, when blown simultaneously produce 4 beat/s. If the length of the shorter pipe is 0.75 m, the length of the other will be (velocity of sound = 330 m/s)

(a) 1m  (b) 0.87m  (c) 0.82m  (d) 0.78m

47. Two glass slabs of thickness 6 cm and 7 cm with refractive indices 1.5 and 1.75 respectively, are placed one above the other on an ink drop. The apparent depth of the ink drop is

(a) 8 cm  (b) 5 cm  (c) 2 cm  (d) 6.5 cm

48. A prism of glass (n = 1.5) has the prism angle as 60°. If angles of incidence and emergence at first and second refracting faces are i1 and i2, then for minimum deviation

(a) i1 = i2  (b) i1 > i2  (c) i1 = 0  (d) i1 < i2
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49. Indicate the color of light, among the following, which travels through glass with the minimum speed:

(a) Red    (b) Yellow    (c) Green    (d) Violet

50. Objectives of a pair of binoculars have apertures 60 mm and focal length 250 mm. The ocular aperture is 250 mm and focal length 22 mm. The angular magnification is, approximately.

(a) 11.4    (b) 114    (c) 1140    (d) 11400

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