MHT-CET 2020 Question Paper

14th October 2020

1. One thousand small water drops of equal radii combine to form a big drop. The ratio of final surface energy to the total initial surface energy is
(A) 1 : 1000 (B) 1 : 100
(C) 1 : 10 (D) 1 : 1

2. For which logic gate the following statement is true? The output is high if and only if all inputs are high.
(A) OR (B) NAND
(C) AND (D) NOR

3. An electron revolving in circular orbit of radius 'r' with velocity 'v' and frequency 'ν' has orbital magnetic moment ' M'. If the frequency of revolution is doubled then the new magnetic moment will be
(A) M (B) 2M
(C) $\frac{M}{4}$ (D) $\frac{M}{2}$

4. A sonometer wire resonates with a given tuning fork forming standing wave with 5 antimodes between two bridges when mass of 9 kg is suspended from the wire. When mass 'm' is suspended from the wire, with same fork and same length between two bridges 3 antinodes are formed. Mass M is
(A) 25 kg (B) 10 kg
(C) 15 kg (D) 20 kg

5. A progressive wave of frequency 50 Hz is travelling with velocity 350 m/s through a medium. The change in phase at a given time interval of 0.01 s is
(A) $\frac{\pi}{2}$ rad (B) $\frac{\pi}{4}$ rad
(C) π rad (D) $\frac{3\pi}{2}$ rad

6. The ratio of frequencies of oscillations of two simple pendulums is 3 : 4, then their lengths are in the ratio
(A) 9 : 16 (B) 16 : 9
(C) $\sqrt{3} : \sqrt{4}$ (D) $\sqrt{4} : \sqrt{3}$

7. In the case of spherical mirrors, the images formed on the side of the object and images formed on the opposite side are respectively.
(A) virtual and real
(B) real and virtual
(C) virtual and virtual
(D) real and real

8. A large vessel completely filled with water has two holes 'A' and 'B' at depths 'h' and '4h' from the top. Hole 'A' is a square of side 'L' and hole 'B' is circle of radius 'R'. If from both the holes same quantity of water is flowing per second, then side of square hole is
(A) $\sqrt{2\pi R}$ (B) $\sqrt{2\pi}.R$
(C) $2\pi R$ (D) $\frac{R}{2}$

9. Two wires of same length and material are stretched by same force. If their masses are in the ratio 3 : 4, then the ratio of their elongations is
(A) $\frac{1}{3}$ (B) $\frac{2}{3}$ (C) $\frac{4}{3}$ (D) $\frac{5}{3}$

10. Two rings of radius 'R' and 'nR' made of same material have the ratio of moment of inertia about an axis passing through its centre and perpendicular to the plane as 1 : 8. The value of 'n' is (mass per unit length is constant)
(A) 1 (B) 3 (C) 4 (D) 2

11. Let M and L be the mass and length of thin uniform rod respectively. In 1st case, axis of rotations is passing through centre and perpendicular to its length. In 2nd case, axis of rotation is passing through one end and perpendicular to its length. The ratio of radius of gyration in first case to second case is
(A) 1 : 3 (B) 3 : 1
(C) 1 : 2 (D) 2 : 1

12. When a resistnace of 200 Ω is connected in series with a galvanometer of resistance 'G' its range is 'V'. To triple its range, a resistance of 2000 Ω is connected in series. The value of G is
(A) 900 Ω (B) 700 Ω
(C) 600 Ω (D) 400 Ω

13. An air filled parallel plate capacitor has a uniform electric field 'E' in the space between the plates. If the distance between the plates is 'd' and area of each plate is 'A', the energy stored in the capacitor is (ε_0 = permittivity of free spcae)
(A) $\varepsilon_0 EAD$ (B) $\frac{1}{2}\varepsilon_0 E^2 AD$
(C) $E^2 \frac{Ad}{\varepsilon_0}$ (D) $\frac{1}{2}\varepsilon_0 E^2$

14. The magnetic moment produced in a samaple of 2 gram is 8×10^{-7} A/m^2. If its density is 4 g/cm^3, then the magnetization of the sample is
(A) 1.2 (B) 1.4
(C) 1.8 (D) 1.6

15. A metal surface having work function 'W_0' emits photoelectrons when photons of energy 'E' are incident on it. The electron enters the uniform magnetic field (B) in perpendicular direction and moves in circular path of radius 'r'. Then 'r' is equal to (m and e the mass and charge of electron respectively).
(A) $\frac{\sqrt{2m(E-W_0)}}{eB}$ (B) $\frac{\sqrt{m(E-W_0)}}{eB}$
(C) $\frac{m(E-W_0)}{eB}$ (D) $\frac{2m(E-W_0)}{eB}$

16. Let the inductane and resistance be denoted by 'L' and 'R' respectively. The dimensions of $\frac{L}{R}$ are
(A) $[L^0M^1T^0]$ (B) $[L^1M^0T^1]$
(C) $[L^0M^0T^1]$ (D) $[L^1M^0T^0]$

17. Two wires of same material are vibrating under the same tension. If the first overtone of first wire is equal to the second overtone of second wire and radius of first wire is twice the radius of the second then the ratio of length of first wire to second wire is
(A) 2 : 1 (B) 1 : 2
(C) 1 : 3 (D) 3 : 1

18. An electron and photon are accelerated through the same potential difference. The ratio of the de-Broglie wavelength λ_p to λ_e is [me = mass of electron, m_p = mass of proton]
(A) $\left(\frac{m_e}{m_p}\right)^{\frac{1}{2}}$ (B) $\left(\frac{m_p}{m_e}\right)$
(C) $\left(\frac{m_p}{m_e}\right)^{\frac{1}{2}}$ (D) $\left(\frac{m_e}{m_p}\right)$

19. In any Bohr orbit of hydrogen atom, the ratio of K.E. to P.E. of revolving electron at a distance 'r' from the nucleus is
(A) $-\frac{1}{2}$ (B) $+\frac{1}{2}$
(C) 1 (D) -1

20. The angular speed of the minute hand of a clock in degrees per second is
(A) 0.01 (B) 10
(C) 1 (D) 0.1

21. Two open organ pipes of fundamental n_1 and n_2 are joined in series. The fundamental frequency of the new pipe is
(A) $\frac{n_1n_2}{(n_1+n_2)}$ (B) $n_1 - n_2$
(C) $\frac{n_1+n_2}{n_1n_2}$ (D) $\frac{1}{n_1n_2}$

22. A small mass 'm' is suspended at the end of a wire having (negligible mass) length 'L' and cross-sectional are 'A'. The frequency of oscillation for the S.H.M. along the vertical line is (Y = Young's modulus of the wire)
(A) $\frac{1}{2\pi}\left(\frac{YA}{mL}\right)^{\frac{1}{2}}$ (B) $\frac{YA}{2\pi mL}$
(C) $2\pi\left(\frac{YA}{mL}\right)^{\frac{1}{2}}$ (D) $\frac{2\pi YA}{mL}$

23. A ray of light travels from air to water to glass and again from glass to air. Refractive index of water with respect to air is 'x' glass with respect to water is 'y' and air with respect to glass is 'z'. which one of the following is correct?
(A) xz = y (B) yz = x
(C) xy = z (D) xyz = 1

24. Heat is applied to a rigid diatomic gas at constant pressure. The ratio $\Delta Q : \Delta U : \Delta W$ is
(A) 7 : 5 : 2 (B) 2 : 5 : 7
(C) 5 : 7 : 2 (D) 5 : 2 : 7

25. An electron is projected along the axis of circular conductor carrying current I. Electron will experience
(A) no force
(B) a force along the axis
(C) a force perpendicular to the axis
(D) a force at an angle of 30° with the axis

26 When light enters glass from vacuum then the wavelength of light
(A) remains constant
(B) decreases
(C) becomes zero
(D) increases

27. A coil of radius 'r' is placed on another coil (whose radius is 'R' and current flowing through it is changing) so that their centres coincide. (R >> r) If both the coils are coplanar then the mutual inductance between them is proportional to
(A) $\frac{R}{r}$ (B) $\frac{r^2}{R}$
(C) $\frac{R}{r^2}$ (D) $\frac{r}{R}$

28. The motion of a rocket in upward direction with high speed is based on the principle of conservation of
(A) angular momentum
(B) kinetic energy
(C) linear momentum
(D) mass

29. A satellite of 'm', revolving round the earth of radius 'r' has kinetic energy (E). Its angular momentum is
(A) (mEr^2) (B) $(2mEr^2)$
(C) $\left(2mEr^2\right)^{\frac{1}{2}}$ (D) $\left(mEr^2\right)^{\frac{1}{2}}$

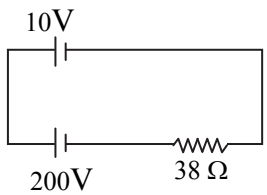
30. The escape velocity from the surface of earth of mass 'M' and radius 'R' is 'v_e'. The escape velocity from the surface of a planet whose mass and radius are 3 times that of the earth, will be
(A) $9\ v_e$ (B) v_e
(C) $3\ v_e$ (D) $12\ v_e$

31. A vector $\vec{A}$ when added to the sum of the vectors $\left(\hat{i}-2\hat{j}+2\hat{k}\right)$ and $\left(-2\hat{i}+\hat{j}-\hat{k}\right)$ gives a unit vector along y-axis. The magnitude of the vector $\vec{A}$ is
(A) $\sqrt{10}$ (B) $\sqrt{3}$ (C) $\sqrt{8}$ (D) $\sqrt{6}$

32. The density and bulk modulus of a metal bar is 'ρ' and 'K' respectively. When pressure 'P' is applied from all sides to that metal bar, the increase in its density is
(A) $\frac{K-P}{\rho}$ (B) $\frac{\rho P}{(K+P)}$
(C) $\frac{\rho P}{(K-P)}$ (D) $\frac{K+P}{\rho}$

33. In potentiometer experiment, cells of e.m.f. E_1 and E_2 are connected in series ($E_1 > E_2$), the balancing length is 64 cm of the wire. If the polarity of E_2 is reversed, the balancing length becomes 32 cm. The ratio $\frac{E_1}{E_2}$ is
(A) 1 : 2 (B) 1 : 3
(C) 3 : 1 (D) 2 : 1

34. Using Kirchhoff's law, find the current flowing through the given circuit.



(A) 3 A (B) 10 A
(C) 7.5 A (D) 5 A

35. The moment of inertia of a thin uniform rod about a perpendicular axis passing through one of its ends is 'I'. Now, the rod is bent in a ring and its moment of inertia about diameter is 'I_1'. Then $\frac{I}{I_1}$ is
(A) $\frac{4\pi^2}{3}$ (B) $\frac{11\pi^2}{3}$
(C) $\frac{8\pi^2}{3}$ (D) $\frac{\pi^2}{3}$

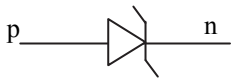
36. The excess pressure inside the first soap bubble of radius 'R_1' is two times, that inside the second soap bubble of radius 'R_2'. The ratio of volumes of the first bubble to that of second bubble is
(A) 1 : 2 (B) 1 : 8
(C) 1 : 1 (D) 1 : 4

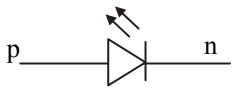
37. The displacement of the particle executing linear S.H.M. is x = 0.25 sin (11t + 0.5) m. The period of S.H.M. is ($\pi = \frac{22}{7}$)
(A) $\frac{3}{7}$ s (B) $\frac{2}{7}$ s
(C) $\frac{4}{7}$ s (D) $\frac{1}{7}$ s

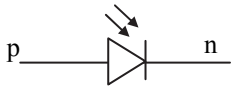
38. According to theoretical study of radiation from a same antenna, the power radiated is proportional to [λ = wavelength]
(A) λ^{-2} (B) λ^{-1}
(C) λ^2 (D) λ

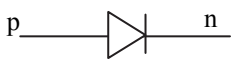
39. A double slit experiment is immersed in water of refractive index 1.33. The slit separation is 1 mm, distance between slit and screen is 1.33 m. The slits are illuminated by a light of wavelength 6300 Å. The fringewidth is
(A) 8.6×10^{-4} m (B) 6.3×10^{-4} m
(C) 5.8×10^{-4} m (D) 6.9×10^{-4} m

40. Which one of the following symbols represents a photodiode?

(I) 

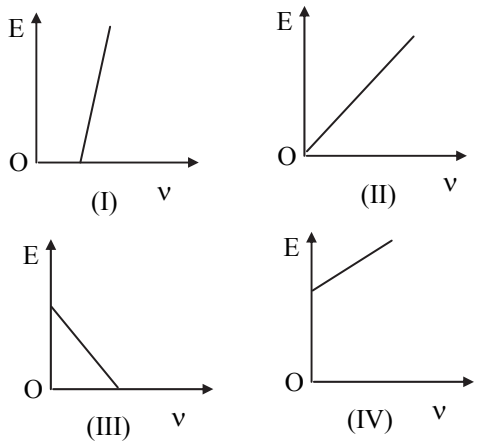
(II) 

(III) 

(IV) 

(A) (IV) (B) (II)
(C) (I) (D) (III)

41. Using Einstein's photoelectric equation, the graph between the K.E. (E) of photoelectrons emitted and the frequency of incident radiation (ν) is shown correctly in figure.



(A) (II) (B) (I)
(C) (IV) (D) (III)

42. The refractive index of the medium is $\mu = A + \frac{B}{\lambda^2}$, where A and B are constants and λ is the wavelength of light. The dimensions of B are same as that of
(A) volume (B) wavelenth
(C) area (D) velocity

43. The angle between two forces of equal magnitude R, if the magnitude of their resultant is $\frac{R}{2}$ is

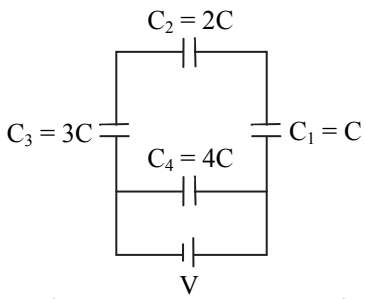
(A) $\cos^{-1}\left(\frac{-7}{8}\right)$ (B) $\cos^{-1}\left(-\frac{3}{7}\right)$
(C) $\cos^{-1}\left(-\frac{5}{7}\right)$ (D) $\cos^{-1}\left(-\frac{3}{4}\right)$

44. If the number of turns in the coil of galvanometer are decreased then the resistance of galvanometer
(A) remains the same
(B) increases
(C) may increase or decrease
(D) decreases

45. Two stones of masses m and 3m are whirled in horizontal circles, the heavier one in radius $\left(\frac{r}{3}\right)$ and lighter one in radius 'r'. The tangential speed of lighter stone is 'n' times that of the value of heavier stone, when they experience same centripetal force. The value of n is
(A) 4 (B) 1
(C) 2 (D) 3

46. A body initially at rest is acted upon by a constant force (F) for time (t). The kinetic energy at time t is
(A) $\frac{F^2t^2}{2m}$ (B) $\frac{Ft}{2m}$
(C) $\frac{F^2t^2}{m}$ (D) $\left(\frac{Ft}{m}\right)^2$

47. A network of 4 capacitors is connected to a battery as shown. The ratio of the charges on capacitors C_2 and C_4 is



(A) $\frac{3}{13}$ (B) $\frac{3}{22}$
(C) $\frac{3}{19}$ (D) $\frac{3}{17}$

48. Let the r.m.s. velocity of molecule of a given mass of gas C_1 at temperature 27°C. When the temperature is increased to 327°C, the r.m.s. velocity is C_2. The the ratio $\frac{C_2}{C_1}$ is
(A) $\sqrt{2}$ (B) 2
(C) $2\sqrt{2}$ (D) 4

49. The magnetic field due to a short bar magnet at an axial point at a distance 'r' from its centre is 'B'. If this axis is move towards the equator of the magnet along a circular path of radius 'r' then the magnetic field 'B' will
(A) not change
(B) go on decreasing
(C) go on increasing
(D) increase from zero to infinity

50. Two coherent sources of intensities I_1 and I_2 produce an interference pattern on screen. The maximum intensity in the interference pattern is
(A) $\left(\sqrt{I_1} + \sqrt{I_2}\right)^2$ (B) $I_1 + I_2$
(C) $(I_1 + I_2)^2$ (D) $I_1^2 + I_2^2$