# Rahul's Science Academy
## CET 2020 Physics 1

1. A particle moves in a circle of radius 2 m at a speed given by $v = 4t$ where v is in m/s and t is in second.

   What is its resultant (total) acceleration at time $t = 1$ s ?

   (a) $8$ m/s$^2$  (b) $4\sqrt{2}$ m/s$^2$
   (c) $5\sqrt{5}$ m/s$^2$  (d) $4\sqrt{5}$ m/s$^2$

2. Two discs are rotating about their axes, normal to the discs and passing through the centres of the discs. Disc $D_1$ has 2 kg mass and 0.2 m radius and initial angular velocity of 50 rad/s. Disc $D_2$ has 4 kg mass, 0.1 m radius and initial angular velocity of 200 rad/s. The two discs are brought in contact face to face, with their axes of rotation coincident. The final angular velocity (in rad/s) of the system is

   (a) 40  (b) 60
   (c) 100  (d) 120

3. The increase in pressure in kPa required to decrease 200 litre volume of a liquid by 0.004% is (bulk modulus of the liquid = 2100 MPa)

   (a) 84  (b) 92.4
   (c) 8.4  (d) 168

4. Two closed pipes produce 10 beats/sec when emitting their fundamental frequencies. If their lengths are in ratio of 25 : 26 their fundamental frequencies (in Hz) are

   (a) 260, 270  (b) 270, 280
   (c) 250, 260  (d) 260, 250

5. A ray of light in air is incident at an angle of 45° on the surface of separation of a medium. It is refracted in the medium at an angle of 30°. What is the velocity of light in that medium ?

   (a) $1.5 \times 10^8$ m/s  (b) $2.12 \times 10^8$ m/s
   (c) $3.5 \times 10^8$ m/s  (d) $3.33 \times 10^8$ m/s

6. A surface $S = 10\ \vec{j}$ is kept in an electric field of $\vec{E} = 3\hat{i} + 5\hat{j} + 6\hat{k}$. How much electric flux will come out through the surface ?

   (a) 30 units  (b) 40 units
   (c) 50 units  (d) 60 units

7. If L and R denote the inductance and resistance of a coil respectively, then $\dfrac{R}{L}$ has the dimensions of

   (a) time  (b) length
   (c) frequency  (d) mass

8. The velocity of an electron in the ground state of hydrogen atom is $2.1 \times 10^6$ m/s. What is its velocity in the third Bohr orbit ?

   (a) $18.9 \times 10^6$ m/s  (b) $6.3 \times 10^6$ m/s
   (c) $7 \times 10^6$ m/s  (d) $7 \times 10^5$ m/s

9. What is the potential energy of a satellite having mass 'm' and rotating at a height of $6.4 \times 10^6$ m from the surface of the earth of radius R ? [R = $6.4 \times 10^6$ m]

   (a) $4\ mgR_e$  (b) $-2\ mgR_e$
   (c) $-0.5\ mgR_e$  (d) $-mgR_e$

10. A particle executes a linear S.H.M. with an angular velocity and maximum acceleration of 3.5 rad/s and 7.5 m/s$^2$ respectively. What is the amplitude of osciallation ?

    (a) 0.61 m  (b) 0.53 m
    (c) 0.28 m  (d) 0.36 m

11. The surface tension for pure water in a capillary tube experiment is

    (a) $\dfrac{2}{hr\rho g}$  (b) $\dfrac{r\rho g}{2h}$
    (c) $\dfrac{hr\rho g}{2}$  (d) $\dfrac{\rho g}{2hr}$

12. With same initial conditions, an ideal gas expands from volume $V_1$ to $V_2$ in three different ways. The work done by the gas is $W_1$, if the process is isothermal, $W_2$ if isobaric and $W_3$ if adiabatic, then

    (a) $W_1 > W_3 > W_2$  (b) $W_1 > W_2 > W_3$
    (c) $W_2 > W_1 > W_3$  (d) $W_2 > W_3 > W_1$

13. The wavelength of sodium $D_2$ line obtained from a sodium vapour lamp is 5890 Å. If the wavelength of sodium $D_2$ line emitted by a star is measured as 5895 Å, then this implies that

    (a) the star is revolving round the earth

(b) the star is moving away from the earth

(c) the star is moving towards the earth

(d) the star is stationary

14. A resistance of 20 Ω is connected across the left gap of a metre bridge and an unknown resistance (X) greater then 20 Ω is connected across the right gap. When these resistances are interchanged, the balance point shifts by 20 cm. What is the unknown resistance ?

(a) 20 Ω

(b) 30 Ω

(c) 40 Ω

(d) 25 Ω

15. A boat is moving due east in a region where the earth's magnetic field is $5.0 \times 10^{-5}$ N/A/m due north and horizontal. The boat carries a vertical aerial 2 m long. If the speed of the boat is 1.50 m/s, the magnitude of the induced emf in the wire of aerial is

(a) 1 mV

(b) 0.75 mV

(c) 0.50 mV

(d) 0.15 mV

16. A NOR gate gives

(a) high output when both inputs are high

(b) high output when both inputs are low

(c) low output when both inputs are low

(d) high output when one input is low and the other input is high

17. A body is just being revolved in a vertical circle of radius R. The string breaks when the body is at the highest point. What is the horizontal distance covered by the body after the string breaks ?

(a) R

(b) $R\sqrt{2}$

(c) 4R

(d) 2R

18. What is the minimum phase difference between two simple harmonic oscillations given by

$$y_1 = \frac{1}{2}\sin \omega t + \frac{\sqrt{3}}{2}\cos \omega t$$

$$y_2 = \sin \omega t + \cos t \, \omega t \, ?$$

(a) $\frac{\pi}{12}$

(b) $\frac{7\pi}{12}$

(c) $\frac{\pi}{6}$

(d) $-\frac{\pi}{6}$

19. Which one of the following is the correct statement from the given graph of extension against load for four wires of the same material and same thickness ?
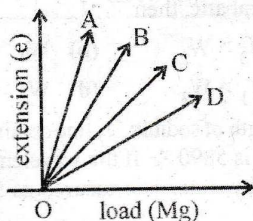


(a) D has the largest length

(b) C has the largest length

(c) B has the largest length

(d) A has the largest length

20. Two carnot engines A and B are operated in series. The engine A receives heat from the source at temperature $T_1$ and rejects the heat to the sink at temperature T. The second engine B receives the heat at temperature T and rejects to its sink at temperature $T_2$. For what value of T the efficiencies of the two engines are equal ?

(a) $\frac{T_1 + T_2}{2}$

(b) $\frac{T_1 - T_2}{2}$

(c) $T_1 T_2$

(d) $\sqrt{T_1 T_2}$

21. In a double slit experiment, the distance between the slits is increased 10 times whereas their distance from the screen is halved, then what is the fringes width ?

(a) Becomes $\frac{1}{20}$

(b) Becomes 20 times

(c) Becomes $\frac{1}{90}$

(d) It remains same

22. For making the electromagnets, the retentivity and permeability of the material should be respectively

(a) high - high

(b) low - low

(c) high - low

(d) low - high

23. The wavelength of the first line in Lyman series is λ. What is the wavelength of the first line in Balmer series ?

(a) $\frac{36}{5}\lambda$

(b) $\frac{5}{36}\lambda$

(c) $\frac{27}{5}\lambda$

(d) $\frac{5}{27}\lambda$

24. The ratio of minimum to maximum wavelength in Balmer series is

(a) 5 : 9

(b) 3 : 4

(c) 1 : 4

(d) 5 : 36

25. Average density of the earth

(a) is directly proportional to g

(b) is inversely proportional to g

(c) does not depend on g

(d) is a complex function of g

26. A horizontal platform with a small object placed on it executes a linear SHM in the vertical direction. The amplitude of oscillation is 40 cm. What should be the least period of these oscillations, so that the object is not detached from the platform? [Use g = 10 m/s$^2$]

(a) 0.2 π s

(b) 0.3 π s

(c) 0.4 π s

(d) 0.5 π s

27. When NaCl is added to water, the surface tension of water will

    (a) decrease
    (b) remains same
    (c) increase
    (d) nothing can be said

28. The efficiency of a carnot engine is 50% and the temperature of the sink is 500 K. If the temperature of the source is kept constant and its efficiency is to be raised to 60%, then the required temperature of the sink will be

    (a) 400 K
    (b) 500 K
    (c) 600 K
    (d) 100 K

29. A 700 pF capacitor is charged by a 50 V battery. The electrostatic energy stored by it is

    (a) $13.6 \times 10^{-9}$ J
    (b) $17.0 \times 10^{-8}$ J
    (c) $8.7 \times 10^{-7}$ J
    (d) $9.5 \times 10^{-9}$ J

30. A current of 0.01 mA passes through a potentiometer wire of resistivity $10^9$ Ω-cm and area of cross-section $10^{-2}$ cm$^2$. What is the potential gradient ?

    (a) $10^{11}$ V/m
    (b) $10^8$ V/m
    (c) $10^9$ V/m
    (d) $10^{10}$ V/m

31. An a.c. voltage is applied to a resistance R = 30 Ω and an inductor L in series. If the inductive reactance is also 30 Ω, the phase difference between the applied voltage and the current in the circuit is

    (a) $\dfrac{\pi}{6}$
    (b) $\dfrac{\pi}{2}$
    (c) $\dfrac{\pi}{3}$
    (d) $\dfrac{\pi}{4}$

32. A photocell is illuminated by a small bright source placed 1 m away from the photocell. When the same source of light is placed $\dfrac{1}{2}$ m away, the number of electrons emitted by the photocathode will be

    (a) increased by a factor of 4
    (b) decreased by a factor of 2
    (c) decreased by a factor of 4
    (d) increased by a factor of 2

33. The frequency of a given AC signal is 50 Hz. When it is connected to a half-wave rectifier, the number of output pulses given by the rectifier in 1 s is

    (a) 25
    (b) 150
    (c) 100
    (d) 50

34. What is the energy of a photon (in eV), whose frequency is $10^{12}$ MHz ? [h = $6.63 \times 10^{-34}$]

    (a) $4.14 \times 10^3$ MeV
    (b) $4.14 \times 10^3$ eV
    (c) $4.14 \times 10^2$ eV
    (d) $4.14 \times 10^3$ KeV

35. A galvanometer of 50 Ω resistance has 25 divisions. A current of $4 \times 10^{-4}$ A gives a deflection of one division. To convert this galvanometer into a voltmeter having a range of 0 to 25 V, it should be connected with a resistance of

    (a) 2450 Ω as a shunt
    (b) 2550 Ω in series
    (c) 2450 Ω in series
    (d) 2500 Ω as a shunt

36. The angular width of the central maximum in the Fraunhofer's diffraction pattern is measured. The slit is illuminated by the light of wavelength 6000 Å. If the slit is illuminated by light of another wavelength, the angular width decreases by 30%. What is the wavelength of light used ?

    (a) 6000 Å
    (b) 3500 Å
    (c) 4200 Å
    (d) 4700 Å

37. The third harmonic of an open pipe is in resonance with a tuning fork of frequency 495 Hz. What is the length of the open pipe if the velocity of sound in air is 330 m/s ? (neglect the end correction)

    (a) 0.5 m
    (b) 0.75 m
    (c) 1 m
    (d) 1.2 m

38. The equation of a progressive wave is given by

    y = 5 cos (100t – 5x) where y is in microns, x in metre and t is in second. What is the ratio of the maximum particle velocity to the velocity of wave propagation ?

    (a) $50 \times 10^{-5}$
    (b) $2.5 \times 10^{-5}$
    (c) $2.5 \times 10^{-4}$
    (d) $2.5 \times 10^{-7}$

39. A solid sphere of mass M and radius R having moment of inertia I about its diameter is recast into a solid disc of radius r and thickness t. The moment of inertia of the disc about an axis passing through the edge and perpendicular to its plane remains I. R and r are related as

    (a) $r = \dfrac{\sqrt{2}}{15} R$
    (b) $r = \dfrac{2}{\sqrt{15}} R$
    (c) $r = \sqrt{\dfrac{2}{15}} R$
    (d) $r = \dfrac{2}{15} R$

40. The equation of a progressive wave is

    $$y = 8 \sin\left[\pi\left(\frac{t}{10} - \frac{x}{4}\right) + \frac{\pi}{3}\right] \text{m.}$$

    What is the wavelength of the wave ?

    (a) 10 m
    (b) 4 m
    (c) 8 m
    (d) 2 m

41. Air in a cylinder is suddenly compressed by a piston, which is then maintained at the same position. With the passage of time

    (a) the pressure may increase or decrease depending upon the nature of the gas
    (b) the pressure remains the same
    (c) the pressure decreases
    (d) the pressure increases

42. A hollow cylinder has a charge q coulomb enclosed in it. φ is the electric flux associated with the curved surface B of the cylinder. What is the flux linked with the plane surface A ?
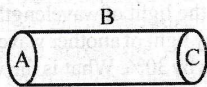


(a) $\left(\dfrac{q}{\varepsilon_0} + \phi\right)$

(b) $\dfrac{\phi}{3}$

(c) $\dfrac{q}{2\varepsilon_0}$

(d) $\dfrac{1}{2}\left(\dfrac{q}{\varepsilon_0} - \phi\right)$

43. A current of 2 A flows in the windings of a toroid having 400 turns and mean circumferencial length of 40 cm. If the inside magnetic field is 1 T, then the relative permeability of the medium is approximately equal to
$[\mu_0 = 4\pi \times 10^{-7}]$

(a) 200

(b) 300

(c) 400

(d) 100

44. The activity of a radioactive sample is measured as $N_0$ counts per minute at t = 0 and $N_0/e$ counts per minute at t = 5 minute. What is the time (in minutes) at which the activity of the sample reduces to half of its value ?

(a) $\log_e\left(\dfrac{2}{5}\right)$

(b) $5\log_e 2$

(c) $\dfrac{\log e^2}{5}$

(d) $5\log_{10} 2$

45. In an electromagnetic spectrum, the frequencies of γ-rays, X-rays and ultraviolet rays are denoted by $n_1$, $n_2$ and $n_3$ respectively then

(a) $n_1 > n_2 > n_3$

(b) $n_1 < n_2 < n_3$

(c) $n_1 > n_2 < n_3$

(d) $n_1 < n_2 > n_3$

46. What is the moment of inertia of a solid sphere of density ρ and radius R about its diameter ?

(a) $\dfrac{176}{105} R^5\rho$

(b) $\dfrac{176}{105} R^2\rho$

(c) $\dfrac{105}{176} R^5\rho$

(d) $\dfrac{105}{176} R^2\rho$

47. A point P is situated at 40.1 cm and 40.2 cm away from two coherent sources. If the wavelength of light used is 5000 Å, then the point P

(a) is dark

(b) is bright

(c) neither bright nor dark

(d) may be bright or dark

48. There are four light-weight-rod samples A, B, C, D separately suspended by threads. A bar magnet is slowly brought near each sample and the following observations are noted

(i) A is feebly repelled

(ii) B is feebly attracted

(iii) C is strongly attracted

(iv) D remains unaffected

Which one of the following is true ?

(a) B is of a paramagnetic material

(b) C is of a diamagnetic material

(c) D is of a ferromagnetic material

(d) A is of a non-magnetic material

49. The transfer characteristics of a base biased transistor has three regions viz., cut off region, active region and saturation region. In which region the transistor should be operated for using it as an amplifier ?

(a) Cut off region

(b) Active region

(c) Saturation region

(d) Cut off and saturation region

50. Which one of he following is not an atmospheric layer ?

(a) Troposphere

(b) Ionosphere

(c) Photosphere

(d) Stratosphere