BITSAT : SOLVED PAPER 2020

(memory based)

INSTRUCTIONS

- *This question paper contains total 150 questions divided into four parts:*

  Part I : Physics Q. No. 1 to 40

  Part II : Chemistry Q. No. 41 to 80

  Part III : (A) English Proficiency Q. No. 81 to 95

  (B) Logical Reasoning Q. No. 96 to 105

  Part IV : Mathematics Q. No. 106 to 150

- *All questions are multiple choice questions with four options, only one of them is correct.*
- *Each correct answer awarded 3 marks and –1 for each incorrect answer.*
- *Duration of paper-3 Hours*

PART - I : PHYSICS

1. An organ pipe, open from both end produces 5 beats per second when vibrated with a source of frequency 200 Hz. The second harmonic of the same pipes produces 10 beats per second with a source of frequency 420 Hz. The fundamental frequency of organ pipe is

(a) 195 Hz (b) 205 Hz

(c) 190 Hz (d) 210 Hz

2. A vessel of depth 2d cm is half filled with a liquid of refractive index μ_1 and the upper half with a liquid of refractive index μ_2. The apparent depth of the vessel seen perpendicularly is

(a) $\left(\frac{\mu_1\mu_2}{\mu_1+\mu_2}\right)d$ (b) $\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}\right)d$

(c) $\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}\right)2d$ (d) $\left(\frac{1}{\mu_1\mu_2}\right)2d$

3. The upper half of an inclined plane with inclination ϕ is perfectly smooth while the lower half is rough. A body starting from rest at the top will again come to rest at the bottom if the coefficient of friction for the lower half is given by

(a) $2\cos\phi$ (b) $2\sin\phi$

(c) $\tan\phi$ (d) $2\tan\phi$

4. A body of density ρ' is dropped from rest at a height h into a lake of density ρ where $\rho > \rho'$ neglecting all dissipative forces, calculate the maximum depth to which the body sinks before returning to float on the surface :

(a) $\frac{h}{\rho-\rho'}$ (b) $\frac{h\rho'}{\rho}$

(c) $\frac{h\rho'}{\rho-\rho'}$ (d) $\frac{h\rho}{\rho-\rho'}$

5. If the forward voltage in a semiconductor diode is changed from 0.5V to 0.7 V, then the forward current changes by 1.0 mA. The forward resistance of diode junction will be

(a) 100 Ω (b) 120 Ω

(c) 200 Ω (d) 240 Ω

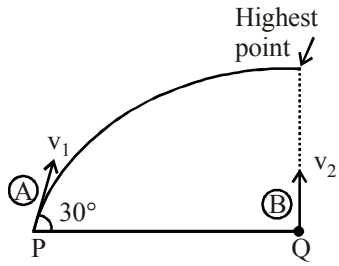
6. The heat generated in a circuit is given by $Q = I^2Rt$, where I is current, R is resistance and t is time. If the percentage errors in measuring I, R and t are 2%, 1% and 1% respectively, then the maximum error in measuring heat will be

(a) 2% (b) 3% (c) 4% (d) 6%

7. The r.m.s. velocity of oxygen molecule at 16°C is 474 m/sec. The r.m.s. velocity in m/s of hydrogen molecule at 127°C is

(a) 1603 (b) 1896 (c) 2230.59 (d) 2730

8. A projectile A is thrown at an angle of 30° to the horizontal from point P. At the same time, another projectile B is thrown with velocity v_2 upwards from the point Q vertically below the highest point. For B to collide with A, $\frac{v_2}{v_1}$ should be



(a) 1 (b) 2

(c) $\frac{1}{2}$ (d) 4

9. The coefficient of friction between the rubber tyres and the road way is 0.25. The maximum speed with which a car can be driven round a curve of radius 20 m without skidding is ($g = 9.8\ m/s^2$)

(a) 5 m/s (b) 7 m/s

(c) 10 m/s (d) 14 m/s

10. A boy pushes a toy box 2.0 m along the floor by means of a force of 10 N directed downward at an angle of 60º to the horizontal. The work done by the boy is

(a) 6 J (b) 8 J (c) 10 J (d) 12 J

11. The engine of a truck moving along a straight road delivers constant power. The distance travelled by the truck in time t is proportional to

(a) t (b) t^2 (c) $\sqrt{t}$ (d) $t^{3/2}$

12. The escape velocity from a planet is v_e. A tunnel is dug along a diameter of the planet and a small body is dropped into it at the surface. When the body reaches the centre of the planet, its speed will be

(a) v_e (b) $v_e/\sqrt{2}$

(c) $v_e/2$ (d) zero

13. If the the earth is at one-fourth of its present distance from the sun, the duration of year will be

(a) half the present year

(b) one-eight the present year

(c) one-fourth the present year

(d) one-sixth the present year

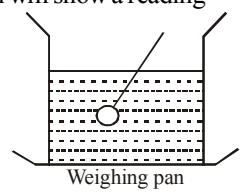
14. A vessel with water is placed on a weighing pan and it reads 600 g. Now a ball of mass 40 g and density 0.80 g cm^{-3} is sunk into the water with a pin of negligible volume, as shown in figure keeping it sunk. The weighing pan will show a reading

(a) 600 g

(b) 550 g

(c) 650 g

(d) 632 g



15. In an adiabatic process, the pressure is increased by $\frac{2}{3}\%$. If $\gamma = \frac{3}{2}$, then the volume decreases by nearly

(a) $\frac{4}{9}\%$ (b) $\frac{2}{3}\%$ (c) 1% (d) $\frac{9}{4}\%$

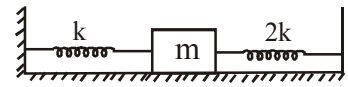
16. The equation of a projectile is $y = \sqrt{3}x - \frac{gx^2}{2}$

The angle of projection is given by

(a) $\tan\theta = \frac{1}{\sqrt{3}}$ (b) $\tan\theta = \sqrt{3}$

(c) $\frac{\pi}{2}$ (d) zero.

17. Frequency of oscillation is proportional to



(a) $\sqrt{\frac{3k}{m}}$ (b) $\sqrt{\frac{k}{m}}$

(c) $\sqrt{\frac{2k}{m}}$ (d) $\sqrt{\frac{m}{3k}}$

18. Two wires A and B of the same material, having radii in the ratio 1 : 2 and carry currents in the ratio 4 : 1. The ratio of drift speed of electrons in A and B is

(a) 16 : 1 (b) 1 : 16 (c) 1 : 4 (d) 4 : 1

19. An instantaneous displacement of a simple harmonic oscillator is $x = A\cos(\omega t + \pi/4)$. Its speed will be maximum at time

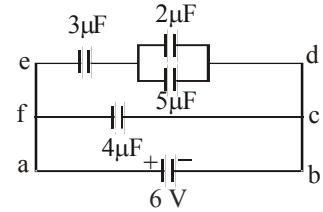
(a) $\pi/4\omega$ (b) $\pi/2\omega$ (c) π/ω (d) $2\pi/\omega$

20. The energy of electron in the nth orbit of hydrogen atom is expressed as $E_n = \frac{-13.6}{n^2}$ eV. The shortest and longest wavelength of Lyman series will be

(a) 910 Å, 1213 Å (b) 5463 Å, 7858 Å

(c) 1315 Å, 1530 Å (d) None of these

21. In the circuit given below, the charge in μC, on the capacitor having 5 μF is



(a) 4.5 (b) 9 (c) 7 (d) 15

22. A crystal has a coefficient of expansion 13×10^{-7} in one direction and 231×10^{-7} in every direction at right angles to it. Then the cubical coefficient of expansion is

(a) 462×10^{-7} (b) 244×10^{-7}

(c) 475×10^{-7} (d) 257×10^{-7}

23. A solid cylinder and a hollow cylinder both of the same mass and same external diameter are released from the same height at the same time on an inclined plane. Both roll down without slipping. Which one will reach the bottom first?

(a) Solid cylinder

(b) Both together

(c) One with higher density

(d) Hollow cylinder

24. A whistle of frequency 1000 Hz is sounded on a car travelling towards a cliff with velocity of 18 m s^{-1} normal to the cliff. If c = 330 m s^{-1}, then the apparent frequency of the echo as heard by the car driver is nearly

(a) 1115 Hz (b) 115 Hz

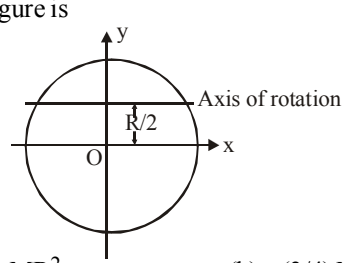
(c) 67 Hz (d) 47.2 Hz

25. A thin sheet of glass ($\mu = 1.5$) of thickness 6 micron introduced in the path of one of the interfering beams in a double slit experiment shifts the central fringe to a position previously occupied by fifth bright fringe. Then the wavelength of light used is

(a) 6000 Å (b) 3000 Å

(c) 4500 Å (d) 7500 Å

26. M.I of a circular loop of radius R about the axis in figure is



(a) MR^2 (b) $(3/4)\,MR^2$

(c) $MR^2/2$ (d) $2MR^2$

27. Three charge q, Q and 4q are placed in a straight line of length l at points distant 0, $\frac{1}{2}$ and l respectively from one end. In order to make the net froce on q zero, the charge Q must be equal to

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

28. In series combination of R, L and C with an A.C. source at resonance, if R = 20 ohm, then impedence Z of the combination is

(a) 20 ohm (b) zero

(c) 10 ohm (d) 400 ohm

29. An electron moves in a circular arc of radius 10 m at a contant speed of 2×10^7 ms^{-1} with its plane of motion normal to a magnetic flux density of 10^{-5} T. What will be the value of specific charge of the electron?

(a) 2×10^4 C kg^{-1} (b) 2×10^5 C kg^{-1}

(c) 5×10^6 C kg^{-1} (d) 2×10^{11} C kg^{-1}

30. From a 200 m high tower, one ball is thrown upwards with speed of 10 ms^{-1} and another is thrown vertically downwards at the same speeds simultaneously. The time difference of their reaching the ground will be nearest to

(a) 12 s (b) 6 s (c) 2 s (d) 1 s

31. A wheel is rotating at 900 r.p.m. about its axis. When power is cut off it comes to rest in 1 minute. The angular retardation in rad/s^2 is

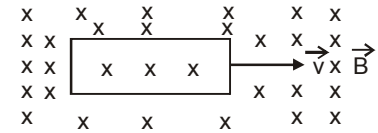
(a) $\pi/2$ (b) $\pi/4$ (c) $\pi/6$ (d) $\pi/8$

32. A particle executing simple harmonic motion along y-axis has its motion described by the equation $y = A\sin(\omega t) + B$. The amplitude of the simple harmonic motion is

(a) A (b) B

(c) A + B (d) $\sqrt{A+B}$

33. A conducting square loop of side L and resistance R moves in its plane with a uniform velocity v perpendicular to one of its side. A magnetic induction B constant in time and space, pointing perpendicular and into the plane of the loop exists everywhere.



The current induced in the loop is

(a) $\frac{B\ell v}{R}$ clockwise

(b) $\frac{B\ell v}{R}$ anticlockwise

(c) $\frac{2B\ell v}{R}$ anticlockwise

(d) zero

34. A body of mass 2 kg is placed on a horizontal surface having kinetic friction 0.4 and static friction 0.5. If the force applied on the body is 2.5 N, then the frictional force acting on the body will be [g = 10 ms^{-2}]

(a) 8 N (b) 10 N

(c) 20 N (d) 2.5 N

35. A nucleus splits into two nuclear parts which have their velocity ratio equal to 2 : 1. What will be the ratio of their nuclear radius?

(a) $2^{1/3} : 1$ (b) $1 : 2^{1/3}$

(c) $3^{1/2} : 1$ (d) $1 : 3^{1/2}$

36. A charge +q is at a distance L/2 above a square of side L. Then what is the flux linked with the surface?

(a) $\frac{q}{4\varepsilon_0}$ (b) $\frac{2q}{3\varepsilon_0}$

(c) $\frac{q}{6\varepsilon_0}$ (d) $\frac{6q}{\varepsilon_0}$

37. A plane electromagnetic wave is incident on a plane surface of area A, normally and is perfectly reflected. If energy E strikes the surface in time t then average pressure exerted on the surface is (c = speed of light)

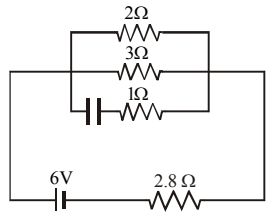
(a) zero (b) E/Atc

(c) 2E/Atc (d) E/c

38. There are two wire of same material and same length while the diameter of second wire is two times the diameter of first wire, then the ratio of extension produced in the wires by applying same load will be

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

39. Determine the current in 2Ω resistor.



(a) 1 A (b) 1.5 A (c) 0.9 A (d) 0.6A

40. The potential energy of a satellite of mass m and revolving at a height R_e above the surface of earth where R_e = radius of earth, is

(a) $-m g R_e$ (b) $\frac{-m g R_e}{2}$

(c) $\frac{-m g R_e}{3}$ (d) $\frac{-m g R_e}{4}$

42. The Lassaigne's extract is boiled with dil. HNO_3 before testing for halogens because

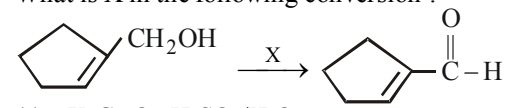
(a) silver halides are soluble in HNO_3

(b) Na_2S and NaCN are decomposed by HNO_3

(c) Ag_2S is soluble in HNO_3

(d) AgCN is soluble in HNO_3

43. What is X in the following conversion ?



(a) $K_2Cr_2O_7, H_2SO_4/H_2O$

(b) HIO_4

(c) PCC/CH_2Cl_2

(d) $OsO_4, (CH_3)_3C.COOH, (CH_3)_3COH, OH^-$

44. Maleic acid and fumaric acids are

(a) Chain isomers

(b) Functional isomers

(c) Tautomers

(d) Geometrical isomers

45. For which one of the processes represented by the following equations the enthalpy (heat) change is likely to be negative

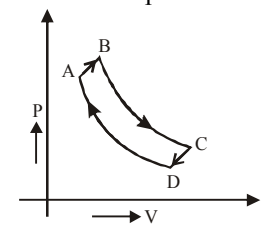
(a) $Cl^-(g) + aq \rightarrow Cl^-(aq)$

(b) $Cl(g) \rightarrow Cl^+(g) + e^-$

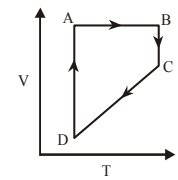
(c) $1/2Cl_2(g) \rightarrow Cl(g)$

(d) $Cl_2(l) \rightarrow Cl_2(g)$

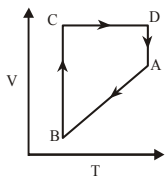
46. A cyclic process ABCD is shown in P–V diagram for an ideal gas. Which of the following diagram represents the same process?



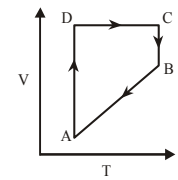
(a)



(b)



(c)



(d)