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Test Booklet Code
S3

NEET 2022

Questions, Answer Key & Solutions

Date: 17 July, 2022 | TIME: (02:00 PM to 05:20 PM)
Duration: 200 minutes (03 Hrs. 20 Min.) | Max. Marks: 720

Important Instructions:

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on OFFICE Copy carefully with **blue/black** ball point pen only.
2. The test is of **3 hours 20 minutes** duration and Test Booklet contains **200** multiple-choice questions (four options with a single correct answer) from **Physics, Chemistry and Biology (Botany and Zoology). 50** questions in each subject are divided **into two Sections (A and B)** as per details given below :
   (a) **Section A** shall consist of **35 (Thirty-five)** Questions in each subject (Questions Nos – 1 to 35, 51 to 85, 101 to 135 and 151 to 185). All questions are compulsory.
   (b) **Section B** shall consist of **15 (Fifteen)** questions in each subject (Question Nos - 36 to 50, 86 to 100, 136 to 150 and 186 to 200). In Section B, a candidate needs to **attempt any 10 (Ten) questions out of 15 (Fifteen)** in each subject.
   Candidates are advised to read all 15 questions in each subject of Section B before they start attempting the question paper. In the event of a candidate attempting more than ten questions, **the first ten questions answered by the candidate shall be evaluated.**
3. Each question carries **4 marks**. For each correct response, the candidate will get 4 marks. For each incorrect response, **one mark** will be deducted from the total scores. **The maximum marks are 720.**
4. Use **Blue/Black Ball Point Pen only** for writing particulars on this page/marking responses on Answer Sheet.
5. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
6. On completion of the test, the candidate **must hand over the Answer Sheet (ORIGINAL and OFFICE Copy) to the Invigilator** before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.
7. **The CODE for this Booklet is S3. Make sure that the CODE printed on the Original Copy of the Answer Sheet is the same as that on this Test Booklet.** In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.
8. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.
9. Use of white fluid for correction is **NOT** permissible on the Answer Sheet.
10. Each candidate must show on-demand his/her Admit Card to the Invigilator.
11. No candidate, without special permission of the centre Superintendent or Invigilator, would leave his/her seat.
12. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign (with time) the Attendance Sheet twice. **Cases, where a candidate has not signed the Attendance Sheet second time, will be deemed not to have handed over the Answer Sheet and dealt with as an Unfair Means case.**
13. Use of Electronic/ Manual Calculator is prohibited.
14. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Room/Hall. All cases of unfair means will be dealt with as per the Rules and Regulations of this examination.
15. **No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.**
16. The candidates will write the Correct Test Booklet Code as given in the Test Booklet/Answer Sheet in the Attendance Sheet.
17. Compensatory time of one hour five minutes will be provided for the examination of three hours and 20 minutes duration, whether such candidate (having a physical limitation to write) uses the facility of scribe or not.

In case of any ambiguity in translation of any question, English version shall be treated as final.
प्रश्नों के अनुवाद में किसी अस्पष्टता की स्थिति में, अंग्रेजी संस्करण को ही अन्तिम माना जायेगा।

Name of the Candidate (in Capital letters): ______________________________

Roll Number: in figures: | | | | | | | | | in words: ______________________

Name of Examination Centre (in Capital letters) : ______________________________

Candidate's Signature: ____________________ Invigilator's Signature: ____________________

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PART : PHYSICS

Section-I

Single Choice Type

This section contains **35 Single choice questions.** Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which **Only One** is correct.

1. Two resistors of resistance, 100Ω and 200 Ω are connected in parallel in an electrical circuit. The ratio of the thermal energy developed in 100 Ω to that in 200 Ω in a given time is

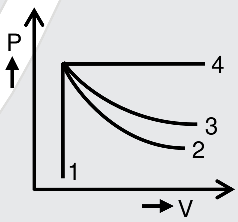
(1) 1 : 4 (2) 4 : 1 (3) 1 : 2 (4) 2 :1

Ans. (4)

Sol. $P = \frac{V^2}{R}$

$$\frac{P_{100}}{P_{200}} = \frac{\frac{V^2}{100}}{\frac{V^2}{200}} = 2:1$$

2. An ideal gas undergoes four different process from the same initial state as shown in the figure below. Those processes are adiabatic, isothermal, isobaric and isochoric. The curve which represents the adiabatic process among 1, 2, 3 and 4 is



(1) 3 (2) 4 (3) 1 (4) 2

Ans. (4)

Sol. adiabatic curve is more steeper out of 3 & 2

3. The ratio of the distance travelled by a freely falling falling body in the 1st , 2nd, 3rd and 4th second:

(1) 1 : 3 : 5 : 7 (2) 1 : 1 : 1 : 1 (3) 1 : 2 : 3 : 4 (4) 1: 4 : 9 : 16

Ans. (1)

Sol. $S_1 = \frac{1}{2}g1^2$

$S_2 = \frac{1}{2}g(2^2 - 1^2)$

$S_3 = \frac{1}{2}g(3^2 - 2^2)$

$S_4 = \frac{1}{2}g(a^2 - 3^2)$

$S_1 : S_2 : S_3 : S_4$

$= 1 : 3 : 5 : 7$

4. Given below are two statement:

Statement I: Bio-Savart's law gives us the expression for the magnetic field strength of an infinitesimal current element (Idl) of a current carrying conductor only

Statement: Bio-Savart's law is analogous to Coulomb's inverse square law of charge q, with the former being related to the field produced by a scalar source $I\vec{dl}$ while the latter being produced by a vector source q.

In light of above statement choose the most appropriate answer from the options given below:

(1) Statement I is correct and statement II is incorrect

(2) Statement I is incorrect and Statement II is correct

(3) Both Statement I and Statement II are correct

(4) Both Statement I and Statement II are incorrect

Ans. (1)

Sol. $I\vec{dl}$ is vector source

q is scalar source

5. A body of mass 60 g experiences a gravitational force of 3.0 N, when placed at a particular point. The magnitude of the gravitational field intensity at that point is:

(1) 20 N/kg (2) 180N/kg (3) 0.05 N/kg (4) 50 N/kg

Ans. (4)

Sol. $3 = \frac{60}{1000} \times g$

$\Rightarrow g = 50$ N/kg

6. The peak voltage of the ac source is equal to:

(1) $\sqrt{2}$ times the rms value of the ac source

(2) $1/\sqrt{2}$ times the rms value of the ac source

(3) the value of voltage supplied to the ciruit

(4) the rms value of the ac source

Ans. (1)

Sol. $V_{rms} = \frac{V_0}{\sqrt{2}}$

7. The energy that will be ideally radiated by a 100 kW transmitter in 1 hour is

(1) 36×10^5J (2) 1×10^5J (3) 36×10^7 J (4) 36×10^4J

Ans. (3)

Sol. $E = 100 \times 10^3 \times 3600$

$= 36 \times 10^7$ J

8. A copper wire of length 10 m and radius $\left(10^{-2}/\sqrt{\pi}\right)$m has electrical resistance of 10 Ω. The current density in the wire for an electric field strength of 10 (V/m) is:

(1) 10^{-5} A/m^2 (2) 10^5 A/m^2 (3) 10^4 A/m^2 (4) 10^6 A/m^2

Ans. (2)

Sol. $J = \sigma E$ ...(1)

Also

$$R = \frac{\rho\ell}{A} = \frac{1}{\sigma}\frac{\ell}{A}$$

$$\Rightarrow \sigma = \frac{\ell}{RA} = 10^4$$

$$\Rightarrow J = 10^4 \times 10 = 10^5$$

9. In half wave rectification, if the input frequency is 60 Hz, then the output frequency would be:

(1) 60 Hz (2) 120 Hz (3) Zero (4) 30 Hz

Ans. (1)

Sol. Information

10. If a soap bubble expands, the pressure inside the bubble:

(1) remains the same (2) is equal to the atmospheric pressure
(3) decreases (4) increases

Ans. (3)

Sol. $P_{inside} = \frac{2T}{R} + P_{out}$

11. The ratio of the radius of gyration of a thin uniform disc about an axis passing thorough its centre and normal to its plane to the radius of gyration of the disc about its diameter is

(1) 4 : 1 (2) $1:\sqrt{2}$ (3) 2 : 1 (4) $\sqrt{2}:1$

Ans. (4)

Sol. $\frac{mR^2}{2} = mx_1^2$ ....(1)

$\frac{mR^2}{4} = mx_2^2$ ....(2)

$\Rightarrow \frac{x_1}{x_2} = \frac{\sqrt{2}}{1}$

12. If the initial tension on a stretched string is doubled, then the ratio of the initial and final speeds of a transverse wave along the string is:

(1) $1:\sqrt{2}$ (2) 1 : 2 (3) 1 : 1 (4) $\sqrt{2}:1$

Ans. (1)

Sol. $v = \sqrt{\dfrac{T}{\mu}}$

$$\frac{V_1}{V_2} = \frac{\sqrt{\dfrac{T}{\mu}}}{\sqrt{\dfrac{2T}{\mu}}} = \frac{1}{\sqrt{2}}$$

13. Two object of mass 10 kg and 20 kg respectively are connected to the two ends of a rigid rod of length 10 m with negligible mass. The distance of the center of mass of the system from the 10 kg mass is :

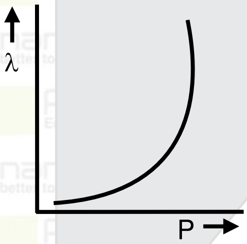
(1) 10 m (2) 5 m (3) $\frac{10}{3}$ m (4) $\frac{20}{3}$ m

Ans. (4)

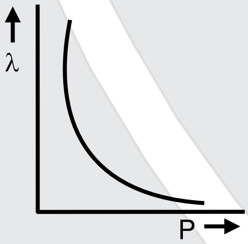
Sol. Distance = $\dfrac{20 \times 10}{10 + 20}$ m.

14. The graph which shows the variation of the de Broglie wavelength (λ) of a particle and its associated momentum (p) is

(1)



(2)



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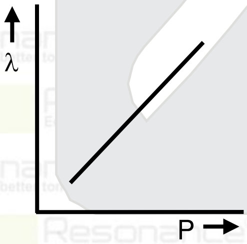

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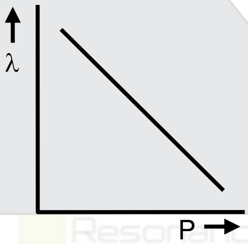


Ans. (2)

Sol. $\lambda = \dfrac{h}{p}$

For $p \to 0$

$\lambda \to \infty$

and for $p \to \infty$

$\lambda \to 0$

15. A long solenoid of radius 1 mm has 100 turns per mm. If 1 A current flows in the solenoid, the magnetic field strength at the centre of the solenoid is:

(1) 12.56×10^{-4} T (2) 6.28×10^{-4}T (3) 6.28×10^{-2}T (4) 12.56×10^{-2}T

Ans. (4)

Sol. $B = \mu_0 ni$

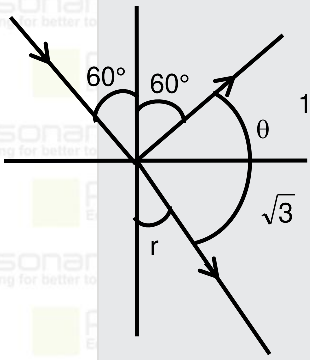
$= 4\pi \times 10^{-7} \times \frac{100}{10^{-3}} \times 1 = 12.56 \times 10^{-2}$

16. A light ray falls on a glass surface of refractive index $\sqrt{3}$ at an angle 60º. The angle between the refracted and reflected rays would be :

(1) 90º (2) 120º (3) 30º (4) 60º

Ans. (1)

Sol.



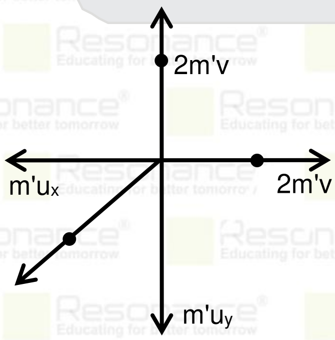
$1 \sin 60° = \sqrt{3} \sin r \Rightarrow r = 30° \Rightarrow \theta = 90°$

17. A shell of mass m is at rest initially. It explodes into three fragments having mass in the ratio 2 : 2 : 1. If the fragments having equal mass fly off along mutually perpendicular direction with speed u, the speed of the third (lighter) fragment is :

(1) $2\sqrt{2}u$ (2) $3\sqrt{2}u$ (3) u (4) $\sqrt{2}u$

Ans. (1)

Sol.



$x : m'u_x = 2m'v \Rightarrow u_x = 2v$

$y : m'u_y = 2m'v \Rightarrow u_y = 2v \qquad \Rightarrow u = \sqrt{u_x^2 + u_y^2} = 2v\sqrt{2}$

18. In a Young's double slit experiment, a student observes 8 fringes in a certain segment of screen when a monochromatic light of 600 nm wavelength is used. If the wavelength of light is changed to 400 nm, then the number of fringes he would observe in the same region of the screen is

(1) 9 (2) 12 (3) 6 (4) 8

Ans. (2)

Sol. $\beta = \frac{D\lambda}{d}$

A/q $8 \times \frac{D}{d} \times 600\text{ nm} = n \times \frac{D}{d} \times 400\text{ nm} \Rightarrow n = 12$

19. An electric lift with a maximum load of 2000 kg (lift + passengers) is moving up with a constant speed of 1.5 ms^{-1}. The frictional force opposing the motion is 3000 N. The minimum power delivered by the motor to the lift in watts is : (g = 10 ms^{-2})

(1) 34500 (2) 23500 (3) 23000 (4) 20000

Ans. (1)

Sol. F = 3000 + 2000 × g = 23000

P = F × V = 23000 × 1.5 = 34500

20. Plane angle and solid angle have :

(1) No units an no dimensions (2) Both units and dimensions
(3) Units but no dimensions (4) Dimensions but no units

Ans. (3)

Sol. Information

21. In the given nuclear reaction, the elements X is $^{22}_{11}\text{NA} \rightarrow X + e^{+} + \nu$

(1) $^{22}_{10}\text{Ne}$ (2) $^{22}_{12}\text{Ng}$ (3) $^{23}_{11}\text{Na}$ (4) $^{23}_{10}\text{Ne}$

Ans. (1)

Sol. $^{22}_{11}\text{NA} \rightarrow X + _{+1}e^{0} + \nu$

No change in mass number

atomic number = 11 – 1

22. When light propagates through a material medium of relative permittivity ϵ_1 and relative permeability μ_r, the velocity of light, u is given by : (c- velocity of light in vacuum)

(1) $u = \sqrt{\frac{\epsilon_r}{\mu_r}}$ (2) $u = \frac{c}{\sqrt{\epsilon_r\, \mu_r}}$ (3) u = c (4) $u = \sqrt{\frac{\mu_r}{\epsilon_r}}$

Ans. (2)

Sol. $V_{med} = \frac{1}{\sqrt{\mu_{med}\, \varepsilon_{med}}} = \frac{1}{\sqrt{\mu_r \mu_0 \varepsilon_r \varepsilon_0}}$

$= \frac{c}{\sqrt{\epsilon_r\, \mu_r}}$

23. As the temperature increases, the electrical resistance :
(1) increases for conductors but decreases for semiconductors
(2) decreases for conductors but increases for semiconductors
(3) increases for both conductors and semiconductors
(4) decreases for both conductors and semiconductors

Ans. (1)

Sol. Information

24. The dimensions $[MLT^{-2}A^{-2}]$ belong to the :
(1) magnetic permeability
(2) electric permittivity
(3) magnetic flux
(4) self inductance

Ans. (1)

Sol. $B = \mu ni = \frac{F}{qv}$

$$\Rightarrow \mu = \frac{F}{qvni} = \frac{MLT^{-2}}{A.T.LT^{-1}.L^{-1}A} = [MLT^{-2}A^{-2}]$$

25. The angle between the electric lines of force and the equipotential surface is
(1) 90º (2) 180º (3) 0º (4) 45º

Ans. (1)

Sol. Electric lines of force is perpendicular to the equipotential surface.

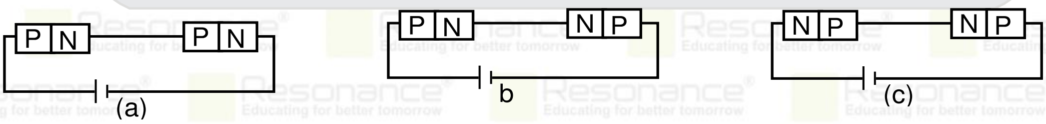
26. Let T_1 and T_2 be the energy be the energy of an electron in the first and second excited states of hydrogen atom, respectively. According to the Bohr's model of an atom, the ratio $T_1 : T_2$ is
(1) 4 : 9 (2) 9 : 4 (3) 1 : 4 (4) 4 : 1

Ans. (2)

Sol. $T_n = \frac{-13.6z^2}{(n+1)^2}$

$$\frac{T_1}{T_2} = \frac{9}{4}$$

27



In the given circuits (a), (b) and (c), the potential drop across the two p-n junctions are equal in :
(1) Circuit (c) only
(2) Both circuits (a) and (c)
(3) Circuit (a) only
(4) Circuit (b) only

Ans. (2)

Sol. In circuit (a) and (c) diodes are forward biased.

28. A biconvex lens ha radii of curvature, 20 cm each. If the refractive index of the material of lens is 1.5, the power of the lens is :

(1) +5D (2) infinity (3) +2D (4) +20 D

Ans. (1)

Sol. $P = \frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = +5D$. Put R_1 and R_2 in meters.

29. When two monochromatic lights of frequency ν and $\frac{\nu}{2}$ are incident on a photoelectric metal, their stopping potential becomes $\frac{V_s}{2}$ and V_s respectively. The threshold frequency for this metals is :

(1) $\frac{2}{3}\nu$ (2) $\frac{3}{2}\nu$ (3) $2\,\nu$ (4) $3\,\nu$

Ans. **(Bonus)**

Sol. $eV_s = h\frac{\nu}{2} - h\nu_0$

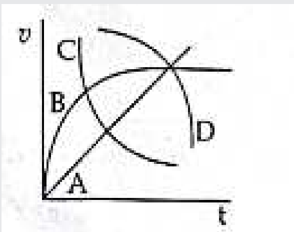
$eV_s = h\nu - h\nu_0$

$2h\nu - 2h\nu_0 = h\frac{\nu}{2} - h\nu_0$

$\left(2 - \frac{1}{2}\right)h\nu = h\nu_0$

$\frac{3}{2}\nu = \nu_0$ not possible

30. A spherical ball is dropped in a long column of a highly viscous liquid. The curve in the graph shown, which represents the speed of the ball (v) as a function of time (t) is



(1) C (2) D (3) A (4) B

Ans. (4)

Sol. Speed will increase and finally ball will attain terminal constant velocity.

31. The angular speed of fly wheel moving with uniform angular acceleration changes from 1200 rpm to 3120 rpm in 16 seconds. The angular acceleration in rad/s² is :

(1) $12\,\pi$ (2) 104π (3) 2π (4) 4π

Ans. (4)

Sol. $\alpha = \dfrac{\frac{3120 \times 2\pi}{60s} - \frac{1200 \times 2\pi}{60s}}{16s} = 4\pi$

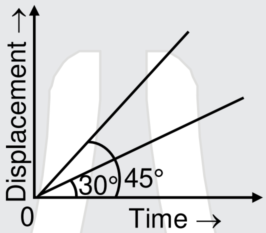
32. A square loop of side 1 m and resistance 1Ω is placed in a magnetic field of 0.5T. If the plane of loop is perpendicular to the direction of magnetic field, the magnetic flux through the loop is :

(1) 1 weber (2) zero weber (3) 2 weber (4) 0.5 weber

Ans. (4)

Sol. $\phi = 0.5 \times 1^2 = 0.5$

33. The displacement-time graphs of two moving particles make angles of 30° and 45° with x-axis as shown in the figure. The ratio of their respective velocity is :



(1) 1 : 2 (2) $1 : \sqrt{3}$ (3) $\sqrt{3} : 1$ (4) 1 : 1

Ans. (2)

Sol. Velocity = slope of displacement time graph

$V_1 = \tan 30°$; $V_2 = \tan 45°$

$V_1 : V_2 = \frac{1}{\sqrt{3}} : 1$

$V_1 : V_2 = 1 : \sqrt{3}$

34. Match List-I with List-II :

	List-I (Electromagnetic waves)	List-II (Wavelength)
(a)	AM radio waves	(i) 10^{-10} m
(b)	Microwaves	(ii) 10^2 m
(c)	Infrared radiations	(iii) 10^{-2} m
(d)	X-rays	(iv) 10^{-4} m

Choose the correct answer from the options given below :

(1) (a) – (iii), (b) – (iv), (c) – (ii), (d) – (i)
(2) (a) – (ii), (b) – (iii), (c) – (iv), (d) – (i)
(3) (a) – (iv), (b) – (iii), (c) – (ii), (d) – (i)
(4) (a) – (iii), (b) – (ii), (c) – (i), (d) – (iv)

Ans. (2)

Sol. Based on theory

d – (i)

c – (iv)

35. Two hollow conducting spheres of radii R_1 and R_2 ($R_1 \gg R_2$) have equal charges. The potential would be:

(1) equal on both the spheres

(2) dependent on the material property of the sphere

(3) more on bigger sphere

(4) more on smaller sphere

Ans. (4)

Sol. Potential on sphere surface

$$V = \frac{kq}{r}$$

$$V_1 = \frac{kq}{r_1} \; ; \; V_2 = \frac{kq}{r_2}$$

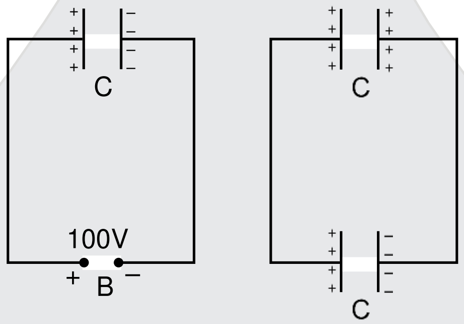
$\because$ $R_1 > R_2$ So $V_1 < V_2$

Section-II

Single Choice Type

This section contains **15 Single choice questions.** Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which **Only One** is correct.

36. A capacitor of capacitance C = 900 mF is charged fully by 100V battery B as shown in figure (a). Then it is disconnected from the battery and connected to another uncharged capacitor of capacitance C = 900 pF as shown in figure (b). The electrostatics energy stored by the system (b) is :



(1) 2.25×10^{-6} J (2) 1.5×10^{-6} J (3) 4.5×10^{-6} J (4) 3.25×10^{-6} J

Ans. (1)

Sol. q = CV = 900 pF × 100V = 90nC

$$W = \frac{(q/2)^2}{2C} + \frac{(q/2)^2}{2C} = \frac{q^2}{4C} = \frac{90\times10^{-9}\times90\times10^{-9}\times10^{3}}{4\times900\times10^{-12}}$$

$$= \frac{9}{4}\times10^{-6} = 2.25\mu J$$

37. The volume occupied by the molecules contained in 4.5 kg water at STP, if the intermolecular forces vanish away is :

(1) 5.6×10^{-3} m^3 (2) 5.6 m^3 (3) 5.6×10^{6} m^3 (4) 5.6×10^{3} m^3

Ans. (2)

Sol. No. of mole = 4.5 kg/m

= 4500/18 = 250

PV = nRT

$V = \frac{nRT}{P}$

$= 250 \times 0.0821 \times 273.10$

$= 5.6$ m^3

38. Match List-I with List-II :

List-I	**List-II**
(a) Gravitational constant (G)	(i) $[L^2T^{-2}]$
(b) Gravitational potential energy	(ii) $[M^{-1}L^3T^{-2}]$
(c) Gravitational potential	(iii) $[LT^{-2}]$
(d) Gravitational intensity	(iv) $[ML^2T^{-2}]$

Choose the correct answer from the options given below :

(1) (a) – (ii), (b) – (iv), (c) – (iii), (d) – (i)
(2) (a) – (iv), (b) – (ii), (c) – (i), (d) – (iii)
(3) (a) – (ii), (b) – (i), (c) – (iv), (d) – (iii)
(4) (a) – (ii), (b) – (iv), (c) – (i), (d) – (iii)

Ans. (4)

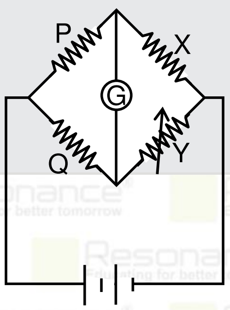
Sol. $[G] = [M^{-1}L^3T^{-2}]$

$[U] = [M^1L^2T^{-2}]$

$[V] = [L^2T^{-2}]$

$[g] = [L^1T^{-2}]$

39. A Wheatstone bridge is used to determine the value of unknown resistance X by adjusting the variable resistance Y as shown in the figure. For the most precise measurement of X, the resistances P and Q :



(1) should be very large and unequal
(2) do not play any significant role
(3) should be approximately equal to 2X
(4) should be approximately equal to are small

Ans. **(Bonus)**

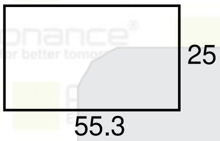
Sol. Recall P.O. box ; larger P/Q gives greater precision.

40. The area of a rectangular field (in m^2) of length 55.3 m and breadth 25 m after rounding off the value for correct significant digits is

(1) 1382.5 (2) 14×10^2 (3) 138×10^1 (4) 1382

Ans. (2)

Sol.



Area = 55.3×25

= 1382.5

So, ans in two significant digit

= 14×10^2

41. Given below are two statement : One is labelled as Assertion (A) and the other is labelled as Reason (R)

Assertion (A) : The stretching of a spring is determined by the shear modulus of the material of the spring.

Reason : A coil spring of copper has more tensile strength than a steel spring of same dimensions.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) (A) is true but (R) is false

(2) (A) is false but (R) is true

(3) Both (A) and (R) are true and (R) is the correct explanation of (A)

(4) Both (A) and (R) are true and (R) is not the correct explanation of (A)

Ans. (1)

42. From Ampere's Circuital law for a long straight wire of circular cross-section carrying a steady current, the variation of magnetic field in the inside and outside region of the wire is :

(1) A linearly increasing function of distance r upto the boundary of the wire and then decreasing one with 1/r dependence for the outside region.

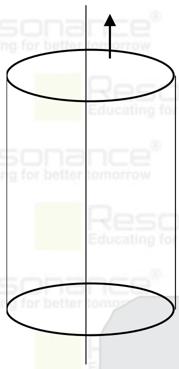
(2) a linearly decreasing function of distance upto the boundary of the wire and then a linearly increasing one for the outside region.

(3) uniform and remains constant for both the regions.

(4) a linearly increasing function of distance upto the boundary of the wire and then linearly decreasing for the outside region.

Ans. (1)

Sol.



$$B_{in} = \frac{\mu_0 Ir}{2\pi R^2}$$

$$B_{in} \propto r$$

$$B_{out} = \frac{\mu_0 i}{2\pi r}$$

$$B_{out} \propto \frac{1}{r}$$

43. Two pendulums of length 121 cm and 100 cm start vibrating in phase. At some instant, the two are at their mean position in the same phase. The minimum number of vibrations of the shorter pendulum after which the two are again in phase at the mean position is :

(1) 10 (2) 8 (3) 11 (4) 9

Ans. (3)

Sol. Length of 1st pendulum = 121

Length of 2nd pendulum = 100

$$T \propto \sqrt{\ell}$$

So $\frac{T_2}{T_1} = \sqrt{\frac{\ell_2}{\ell_1}} = \sqrt{\frac{100}{121}} = \frac{10}{11}$

P–I	P–II
$\ell_1 = 121$	$\ell_2 = 100$
T_1	T_2

$T_1 : T_2 = 11 : 10$

44. Two point charges – q and + q are placed at a distance of L, as shown in the figure.

The magnitude of electric field intensity at a distance R(R ≫ L) varies as :

(1) $1/R^4$ (2) $1/R^6$ (3) $1/R^2$ (4) $1/R^3$

Ans. (4)

Sol.

Electric field due to dipole

$E = \dfrac{2KP}{R^3}$

$E \propto \dfrac{1}{R^3}$

45. A series LCR circuit with inductance 10 H, capacitance 10 μF, resistance 50Ω is connected to an ac source of voltage, V = 200 sin(100t) volt. If the resonant frequency of the LCR circuit is ν_0 and the frequency of the ac source is ν, then :

(1) $\nu_0 = \dfrac{50}{\pi}$ Hz, $\nu = 50$ Hz

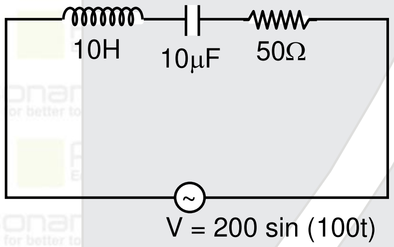
(2) $\nu = 100$ Hz ; $\nu_0 = \dfrac{100}{\pi}$ Hz

(3) $\nu_0 = \nu = 50$ Hz

(4) $\nu_0 = \nu = \dfrac{50}{\pi}$ Hz

Ans. (4)

Sol.



Resonant freq. $\nu_0 = \dfrac{1}{2\pi\sqrt{LC}} = \dfrac{1}{2\pi\sqrt{10\times10\times10^{-6}}}$

$\nu_0 = \dfrac{100}{2\pi} = \dfrac{50}{\pi}$

Given $\omega = 100$

$2\pi\nu = 100 \quad \Rightarrow \quad \nu = 100/2\pi = 50/\pi$

46. A nucleus of mass number 189 splits into two nuclei having mass number 125 and 64. The ratio of radius of two daughter nuclei respectively is :

(1) 5 : 4 (2) 25 : 16 (3) 1 : 1 (4) 4 : 5

Ans. (1)

Sol. $r = r_0 A^{1/3}$

$r_1 : r_2 = A_1^{1/3} : A_2^{1/3} = 125^{1/3} : 64^{1/3} = 5 : 4$

47. A ball is projected with a velocity 10 ms^{-1} , at an angle of 60º with the vertical direction. Its speed at the highest point of its trajectory will be :

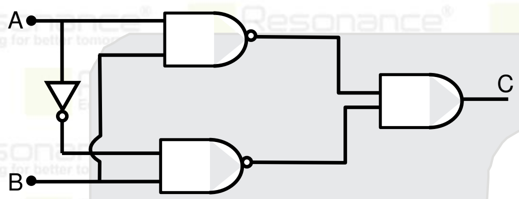
(1) 5 ms^{-1} (2) 10 ms^{-1} (3) Zero (4) $5\sqrt{3}$ ms^{-1}

Ans. (4)

Sol. Speed at highest point = $V\cos\theta$, θ = Projection angle from horizontal direction

$= 10\cos 30 = 5\sqrt{3}$ m/s

48.



The truth table for the given logic circuit is

(1)

A	B	C
0	0	1
0	1	0
1	0	1
1	1	0

(2)

A	B	C
0	0	0
0	1	1
1	0	0
1	1	1

(3)

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

(4)

A	B	C
0	0	1
0	1	0
1	0	0
1	1	1

Ans. (1)

49. Two transparent media A and B are separated by a plane boundary. The speed of light in those media are 1.5×10^8 m/s and 2.0×10^8 m/s, respectively. The critical angel for the ray of light for these two media is :

(1) $\tan^{-1}$ (0.500) (2) $\tan^{-1}$ (0.750) (3) $\sin^{-1}$ (0.500) (4) $\sin^{-1}$ (0.750)

Ans. (4)

Sol. $\sin\theta_c = \frac{\mu_2}{\mu_1} = \frac{v_1}{v_2} = \frac{1.5\times10^8}{2\times10^8} = \frac{3}{4} = 0.75$

$\theta_C = \sin^{-1}$ (0.75)

50. A big circular coil of 1000 turns and average radius 10 m is rotating about its horizontal diameter at 2 rad s^{-1}. If the vertical component of earth's magnetic field at that place is 2×10^{-5} T and electrical resistance of the coil is 12.56 Ω, then the maximum induced current in the coil will be :

(1) 1 A (2) 2 A (3) 0.25 A (4) 1.5 A

Ans. (1)

Sol. $E = NBA\omega \sin \omega t \Rightarrow E_{max} = NBA\omega$.

$$I_{max} = \frac{E_{max}}{R} = \frac{NBA\,\omega}{R} = \frac{1000\times2\times10^{-5}\times\pi.10^2\times2}{12.56}$$

$$= \frac{4\pi}{12.56} = \frac{4\times3.14}{12.56} = 1A$$

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>= 400 to < 449	>= 375 to < 399	>= 325 to < 349	70%	20000	55150	59850
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