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Test Booklet Code

F6

NEET 2023

Questions, Answer Key & Solutions

Date: 07 May, 2023 | 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 **Chemistry, Physics 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 F6. 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

1. In a series LCR circuit, the inductance L is 10mH, capacitance C is 1μF and resistance R is 100Ω. The frequency at which resonance occurs is : **[P-AC-D]_E**

(1) 15.9 kHz

(2) 1.59 rad/s

(3) 1.59 kHz

(4) 15.9 rad/s

Ans. **(3)**

Sol. $f = \frac{1}{2\pi\sqrt{LC}}$

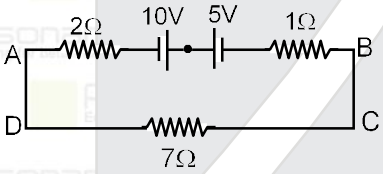
$= \frac{1}{2\times 3.14\sqrt{10\times 10^{-3}\times 10^{-6}}}$

$= \frac{10^4}{6.28}$

$= \frac{10}{6.28}\times 10^3$

= 1.59Hz

2. The magnitude and direction of the current in the following circuit is **[P-CE-C]_E**



(1) 0.5 A from A to B through E

(2) $\frac{5}{9}$ A from A to B through E

(3) 1. 5 A from B to A through E

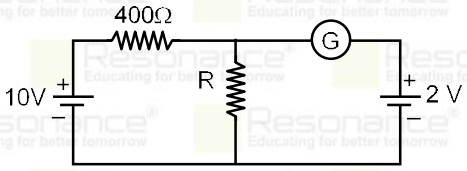
(4) 0.2 A from B to A through E

Ans. **(1)**

Sol. Direction of current is from A to B

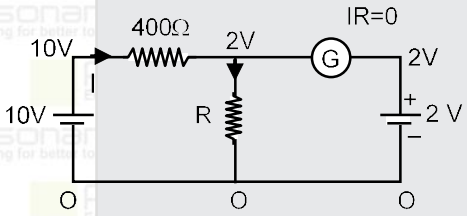
$i = \frac{10-5}{2+7+1} = \frac{5}{10} = 0.5A$

3. If the galvanometer G does not show any deflection in the circuit shown, the value of R is given by: **[P-CE-C]_E**



(1) 50Ω
(2) 100Ω
(3) 400Ω
(4) 200Ω

Ans. **(2)**



Sol.

$$I = \frac{10}{400 + R}$$

$IR = 2$

$$\frac{10R}{400 + R} = 2$$

$10R = 800 + 2R$

$8R = 800$

$R = 100\ \Omega$

4. The temperature of a gas is –50º C. To what temperature the gas should be heated so that the rms speed in increased by 3 times? **[P-KTG-B]_M**

(1) 3295ºC
(2) 3097 K
(3) 223 K
(4) 669ºC

Ans. **(1)**

Sol. $\frac{V_{rm_1}}{V_{rms_2}} = \sqrt{\frac{T_1}{T_2}}$

$$\frac{1}{4} = \sqrt{\frac{T_1}{T_2}}$$

$T_2 = 16\ T_1$

$= 16\times(273–50)\ k$

$= 16 \times 223\ k$

$= 3968\ k$

$T_2 = 3968 –273$

$= 3295ºC$

5. The ratio of radius of gyration of a solid sphere of mass M and radius R about its own axis to the radius of gyration of thin hollow sphere of same mass and radius about its axis is : **[P-RBD-B]_E**

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

Ans. **(4)**

Sol. $MK_1^2 = \frac{2}{5}MR^2$

$MK_2^2 = \frac{2}{3}MR^2$

$\frac{K_1}{K_2} = \sqrt{\frac{3}{5}}$

6. A Carnot engine has an efficiency of 50% when its source is at temperature 327º C. The temperature of the sink is : **[P-KTG-J]_E**

(1) 15ºC
(2) 100º C
(3) 200ºC
(4) 27ºC

Ans. **(4)**

Sol. $T_1 = 327+273 = 600k$

$n = \frac{1}{2} = 1 - \frac{T_2}{T_1}$

$\frac{1}{2} = \frac{T_2}{T_1}$

$T_2 = \frac{T_1}{2} = 300k$

$T_2 = 27ºC$

7. A bullet is fired from a gun at the speed of 280 ms^{-1} in the direction 30º above the horizontal. The maximum height attained by the bullet is (g = 9.8 ms^{-2}, sin 30º = 0.5): **[P-PM-A]_E**

(1) 2000 m
(2) 1000 m
(3) 3000 m
(4) 2800 m

Ans. **(2)**

Sol. $H = \frac{u^2 \sin^2\theta}{2g}$

$= \frac{(280)^2 \frac{1}{4}}{2(9.8)} = 1000m$

8. An electric dipole is placed at an angle of 30º with an electric field of intensity 2×10^5 NC^{-1}. It experiences a torque equal to 4 N m. Calculate the magnitude of charge on the dipole, if the dipole length is 2 cm. **[P-ES-H]_E**

(1) 6 mC
(2) 4 mC
(3) 2 mC
(4) 8 mC

Ans. **(3)**

Sol. $\tau = -pE\sin\theta = qlE$

$$q = \frac{4\times10^{-5}}{2\times10^{-2}} = 2mc$$

9. Given below are two statements :
Statement I : Photovoltaic devices can convert optical radiation into electricity.
Statement II : Zener diode is designed to operate under reverse bias in breakdown region.
In the light of the above statements, choose the **most appropriate** answer from the options given below : **[P-SS-B]_E**

(1) Both **Statement I** and **Statement II** are incorrect.
(2) **Statement I** is correct but **Statement II** is incorrect.
(3) **Statement I** is incorrect but **Statement II** is correct.
(4) Both **Statement I** and **Statement II** are correct.

Ans. **(4)**

Sol. Theory based

10. The errors in the measurement which arise due to unpredictable fluctuations in temperature and voltage supply are : **[P-ME-A]_M**

(1) Personal errors
(2) Lease count errors
(3) Random errors
(4) Instrumental errors

Ans. **(3)**

Sol. Theory based

11. The ratio of frequencies of fundamental harmonic produced by an open pipe to that of closed pipe having the same length is : **[P-SW-E]_E**

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

Ans. **(1)**

Sol. $\frac{f_1}{f_2} = \frac{v/2\ell}{v/4\ell} = \frac{2}{1}$

12. The net magnetic flux through any closed surface is : **[P-EMF-F]_E**

(1) Positive
(2) Infinity
(3) Negative
(4) Zero

Ans. **(4)**

Sol. As magnetic fixed lines from closed surface

$\oint \vec{B} \cdot d\vec{s} = 0$ always

13. The work functions of Caesium (Cs), Potassium (K) and Sodium (Na) are 2.14eV, 2.30eV and 2.75eV respectively. If incident electromagnetic radiation has and incident energy of 2.20eV, Which of these photosensitive surfaces may emit photoelectrons? **[P-MP-A]_E**

(1) Both Na and K
(2) K only
(3) Na only
(4) Cs only

Ans. **(4)**

Sol. For Cs, work function is less the energy of incidental photon.

14. The minimum wavelength of X-rays produced by an electron accelerated through a potential difference of V volts is proportional to : **[P-MP-B]_E**

(1) $\frac{1}{V}$

(2) $\frac{1}{\sqrt{V}}$

(3) V^2

(4) $\sqrt{V}$

Ans. **(1)**

Sol. $\frac{hc}{\lambda} = eV$

$\lambda = \frac{hc}{eV}$

15. A 12 V,60 W lamp is connected to the secondary of a step down transformer, whose primary is connected to ac mains of 220 V. Assuming the transformer to be ideal, what is the current in the primary winding ? **[P-AC-E]_E**

(1) 2.7 A
(2) 3.7 A
(3) 0.37 A
(4) 0.27 A

Ans. **(4)**

Sol. For ideal transformer

$e_s I_s = e_p I_p$

$60 = 220 I_P$

$I_p = 0.27$ A

16. Light travels a distance x in time t_1 in air and 10x in time t_2 another denser medium. What is the critical angle for this medium? **[P-GO-C]_M**

(1) $\sin^{-1}\left(\frac{10t_2}{t_1}\right)$

(2) $\sin^{-1}\left(\frac{t_1}{10t_2}\right)$

(3) $\sin^{-1}\left(\frac{10t_1}{t_2}\right)$

(4) $\sin^{-1}\left(\frac{t_2}{t_1}\right)$

Ans. **(3)**

Sol. $V_1 = \frac{x}{t_1}$ Rare

$V_2 = \frac{10x}{t_2}$ Denser

$\text{Sin c} = \frac{1}{\left(\frac{n_D}{n_r}\right)} = \frac{n_r}{n_D} = \frac{V_D}{V_r} \quad \mu\alpha\frac{1}{v}$

$\text{Sinc} = \frac{10x}{t_2} \times \frac{t_1}{x} = \frac{10t_1}{t_2}$

$C = \text{Sin}^{-1}\left(\frac{10t_1}{t_2}\right)$

17. A metal wire has mass (0.4 ± 0.002) g, radius (0.3±0.001) mm and length (5 ± 0.02) cm. The maximum possible percentage error in the measurement of density will nearly be: **[P-ME-A]_E**

(1) 1.3 %

(2) 1.6 %

(3) 1.4 %

(4) 1.2 %

Ans. **(2)**

Sol. $d = \frac{m}{\pi r^2 \ell}$

$\frac{\Delta\ell}{d} = \pm\left[\frac{\Delta m}{m} + 2\frac{\Delta r}{r} + \frac{\Delta\ell}{\ell}\right]$

$\frac{\Delta d}{d} \times 100 = \left[\frac{.002}{.4} + \frac{2(0.001)}{0.3} + \frac{.02}{5}\right] \times 100$

$= \left[\frac{.02}{4} + \frac{.02}{3} + \frac{.02}{5}\right] 100\%$

$= \frac{2}{4} + \frac{2}{3} + \frac{2}{5}$

= 0.50+ 0.67+ 0.40
= 1.57
= 1.6%

18. For Young's double slit experiment, two statements are given below: **[P-WO-B]_E**

Statement I : If screen is moved away from the plane of slits, angular separation of the fringes remains constant.

Statement II : If the monochromatic source is replaced by another monochromatic source of larger wavelength, the angular separation of fringes decreases.

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

(1) Both **Statement I** and **Statement II** are false.
(2) **Statement I** true but **Statement II** is false.
(3) **Statement I** If is false but **Statement II** is true.
(4) Both **Statement I** and **Statement II** are true.

Ans. **(2)**

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

$\theta = \frac{\beta}{D} = \frac{\lambda}{d}$

Statement (1) is True
Statement (2) is False

19. The half life of a radioactive substance is 20 Minutes. In How much time, the activity of substance drops to $\left(\frac{1}{16}\right)^{th}$ of its initial value? **[P-MP-D]_E**

(1) 40 minutes
(2) 60 minutes
(3) 80 minutes
(4) 20 minutes

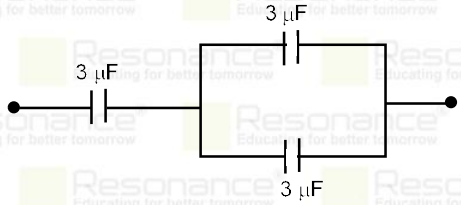
Ans. **(3)**

Sol. $A = \frac{A_o}{2^n}$

$\frac{A_o}{16} = \frac{A_o}{2^n}$

X = 4 half lives
$= 4 \times 20$
80 minutes

20. The equivalent capacitance of the system shown in the following circuit is : **[P-CP-C]_E**



(1) 3 μF
(2) 6 μF
(3) 9 μF
(4) 2 μF

Ans. **(4)**

Sol. C_1= 3+3= 6μF

$$C_{eq} = \frac{3\times 6}{3+6} = 2\mu F$$

21. Resistance of a carbon resistor determined from colour codes is (22000±5%) Ω. The colour of third band must be: **[P-CE-B]_E**
(1) Green
(2) Orange
(3) Yellow
(4) Red

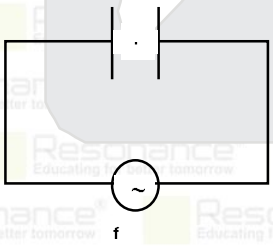
Ans. **(2)**

Sol. R = 22000 ± 5% ,R = AB × 10^C ± D%
= 22×10^3 ± 5 % C =3 = orange

22. An ac source is connected to an capacitor C. Due to decrease in its operating frequency: **[P-EMW-A]_E**
(1) displacement current increases.
(2) displacement current decreases.
(3) capacitive reactance remains constant
(4) capacitive reactance decreases

Ans. **(2)**

Sol.



$$q = CV_o Sin\omega t$$

$$i = \frac{dq}{dt} = CV_o\omega \cos\omega t$$

$$\frac{CV_o}{\left(\frac{1}{\omega}\right)}\cos\omega t$$

$$X_C = \frac{1}{c\omega}$$

$\omega \downarrow$
$X_C \uparrow$
$i_d \downarrow$

23. A vehicle travels half the distance with speed ϑ and the remaining distance with speed 2ϑ. Its average speed is: **[P-RM-B]_E**

(1) $\frac{2\vartheta}{3}$

(2) $\frac{4\vartheta}{3}$

(3) $\frac{3\vartheta}{3}$

(4) $\frac{3\vartheta}{3}$

Ans. **(2)**

Sol. $V_{av} = \frac{2(v)(2v)}{3v}$

$= \frac{4v}{3}$

24. The amount of energy required to form a soap bubble of radius 2 cm from a soap solution is nearly: (surface tension of soap solution = 0.03 N m^{-1}) **[P-ST-A]_M**

(1) 5.06×10^{-4}J

(2) 3.01×10^{-4}J

(3) 50.1×10^{-4}J

(4) 30.16×10^{-4}J

Ans. **(2)**

Sol. $U = 2T\left(4\pi r^2\right)$

$= 2 \times 0.03 \times 4\pi\left(2 \times 10^{-2}\right)^2$

$= 2 \times 4\pi \times 4 \times 3 \times 10^{-6}$

$= 96\pi \times 10^{-6}$ J

$= 96 \times 3.14 \times 10^{-6}$ J

$= 3.01 \times 10^{-4}$ J

25. The venturi-meter works on: **[P-FM-C]_E**

(1) Bernoulli's principle

(2) The principle of parallel axes

(3) The principle of perpendicular axes

(4) Huygen's principle

Ans. **(1)**

Sol.

26. In hydrogen spectrum, the shortest wavelength in the Balmer series is λ. The shortest wavelength in the Bracket series is : **[P-MP-C]_E**

(1) 4 λ
(2) 9 λ
(3) 16 λ
(4) 2 λ

Ans. **(1)**

Sol. $\frac{1}{\lambda_{Balmer}} = R\left[\frac{1}{4} - \frac{1}{\infty}\right] = 1/\lambda$

$\frac{1}{\lambda_{Bracket}} = R\left[\frac{1}{16} - \frac{1}{\infty}\right]$

$\frac{\lambda_{Bracket}}{\lambda} = \frac{R/4}{R/16} = 4$

$\lambda_{Bracket} = 4\lambda$

27. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm, potential energy stored in it will be: **[P-WPE-D]_E**

(1) 4U
(2) 8U
(3) 16U
(4) 2U

Ans. **(3)**

Sol. $U = \frac{1}{2}kx^2$

$U = \frac{1}{2}k(2)^2$

$U^1 = \frac{1}{2}k(8)^2$

$\frac{U^1}{U} = \frac{64}{4}$

$U^1 = 16u$

28. A full wave rectifier circuit consists of two p-n junctions diodes, a centre-tapped transformer, capacitor and a load resistance. Which of these components remove the ac ripple from the rectified output? **[P-SS-D]_E**

(1) p-n junction diodes
(2) Capacitor
(3) Load resistance
(4) A centre-tapped transformer

Ans. **(2)**

Sol.

29. The magnetic energy stored in an inductor of inductance 4 μH carrying a current of 2 A is: **[P-EMI-G]_E**

(1) 4 m J
(2) 8 m J
(3) 8 μ J
(4) 4 μ J

Ans. **(3)**

Sol. $U = \frac{1}{2}LI^2$

$= \frac{1}{2} \times 4 \times 10^{-6} (2)^2$

$= 8\mu J$

30. If $\oint_S \vec{E}.\vec{ds} = 0$ over a surface, then : **[P-ES-I]_E**

(1) The magnitude of electric field on the surface is constant.
(2) All the charges mist necessarily be inside the surface.
(3) The electric field inside the surface is necessarily uniform.
(4) The number of flux lines entering the surface must be equal to the number of flux lines leaving it.

Ans. **(4)**

Sol.

31. A football player is moving southward and suddenly turns east ward with the same speed to avoid an opponent. The force that acts on the player while turning is: **[P-NLM-E]_E**

(1) along northward
(2) along north-east
(3) along north-west
(4) along eastward

Ans. **(2)**

Sol.

V_i = southword $(\hat{j})$

V_f = eastward $(\hat{i})$

$a = \frac{V_f - V_i}{\Delta t} = \frac{\hat{i} + \hat{j}}{\Delta t}$

$\hat{i} + \hat{j}$ means northeast

Means force acts on the player always North east.

32. Let a wire be suspended from the ceiling (rigid support) and stretched by a weight W attached at its free end. The longitudinal stress at any point of cross-sectional area A of the wire is : **[P-EV-A]_E**

(1) W / A (2) W / 2A (3) Zero (4) 2W / A

Ans. **(1)**

Sol.

$$\text{Stress} = \frac{W}{A}$$

33. The angular acceleration of a body, moving along the circumference of a circle, is : **[P-EV-A]_E**

(1) along the radius towards the centre

(2) along the tangent to its position

(3) along the axis of rotation

(4) along the radius, away from centre

Ans. **(3)**

Sol.

34. In a plane electromagnetic wave travelling in free space, the electric field component oscillates sinusoidally at a frequency of 2.0×10^{10}Hz and amplitude 48 V m^{-1}. Then the amplitude of oscillating magnetic field is : (Speed of light in free space = 3×10^8 m s^{-1}) **[P-EMW-A]_E**

(1) 1.6×10^{-8}T (2) 1.6×10^{-7}T (3) 1.6×10^{-6}T (4) 1.6×10^{-9}T

Ans. **(2)**

Sol. $C = \frac{E_0}{B_0}$

$$B_O = \frac{E_0}{C}$$

$$= \frac{48}{3\times10^8}$$

$= 16 \times 10^{-8}$T

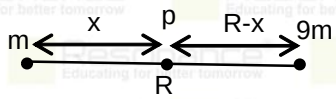
$= 1.6 \times 10^{-7}$ T

35. Two bodies of mass m and 9m are placed at a distance R. The gravitational potential on the line joining the bodies where the gravitational field equals zero, will be (G = gravitational constant) : **[P-GR-C]_E**

(1) $-\frac{12Gm}{R}$ (2) $-\frac{16Gm}{R}$ (3) $-\frac{20Gm}{R}$ (4) $-\frac{8Gm}{R}$

Ans. **(2)**

Sol.



$E_g = 0$

$$\frac{Gm}{x^2} = \frac{G\,9m}{(R-x)^2}$$

$$\frac{1}{x} = \frac{3}{R-x}$$

$R-x = 3x$

$4x = R$

$$x = \frac{R}{4}$$

$$R - x = \frac{3R}{4}$$

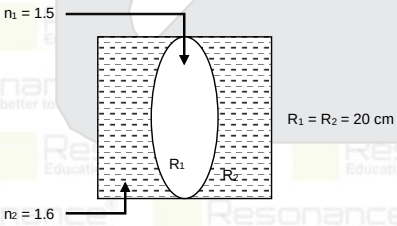
$$V_p = -\frac{Gm}{x} - \frac{G(9m)}{R-x}$$

$$= -\frac{4Gm}{R} - \frac{9Gm.4}{3R}$$

$$= -\frac{16Gm}{R}$$

Ans. (2)

36. In the figure shown here, what is the equivalent focal length of the combination of lenses (Assume that all layers are thin) ? **[P-GO-G]_E**



(1) – 40 cm (2) – 100 cm (3) – 50 cm (4) 40 cm

Ans. **(2)**

Sol. $$\frac{1}{f_1} = (1.6)\left[\frac{1}{\infty} - \frac{1}{20}\right] = -0.6 \times \frac{1}{20}$$

$$\frac{1}{f_2} = (1.5-1)\left[\frac{1}{20} - \frac{1}{-20}\right] = 0.5 \times \frac{2}{20} = \frac{1}{20}$$

$$\frac{1}{f_3} = (1.6-1)\left[\frac{1}{-20} + \frac{1}{\infty}\right] = 0.6 \times \frac{1}{20}$$

$$\frac{1}{f}=\frac{1}{f_1}+\frac{1}{f_2}+\frac{1}{f_3}$$

$$=\frac{1}{20}[-0.6+1-0.6]$$

$$\frac{1}{f}=\frac{-0.2}{20}$$

$$f=\frac{-200}{2} \qquad =-100$$

37. Calculate the maximum acceleration of a moving car so that a body lying on the floor of the car remains stationary. The coefficient of static friction between the body and the floor is 0.15 ($g = 10\ m\ s^{-2}$). **[P-FR-B]_E**

(1) 150 m s^{-2} (2) 1.5 m s^{-2} (3) 50 m s^{-2} (4) 1.2 m s^{-2}

Ans. **(2)**

Sol. $ma = \mu mg$

$a = \mu g$

$= 0.15 \times 10$

$= 1.5\ m/s^2$

38. A satellite is orbiting just above the surface of the earth with period T. If d is the density of the earth and G is the universal constant of gravitation, the quantity $\frac{3\pi}{Gd}$ represents : **[P-GR-D]_E**

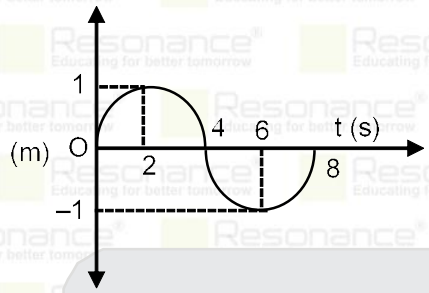
(1) T^2 (2) T^3 (3) $\sqrt{T}$ (4) T

Ans. **(1)**

Sol. $$\frac{3\pi}{ud}=\frac{3\pi}{\frac{FL^2}{M_1M_2}\times\frac{M}{L^3}}=\frac{ML}{F}$$

$$=\frac{M^1L^1}{M^1L^1T^{-2}}=T^2$$

39. The x-t graph of a particle performing simple harmonic motion is shown in the figure. The acceleration of the particle at t = 2 s is : **[P-SHM-A]_M**



(1) $-\frac{\pi^2}{8}\text{m s}^{-2}$ (2) $\frac{\pi^2}{16}\text{m s}^{-2}$ (3) $-\frac{\pi^2}{16}\text{m s}^{-2}$ (4) $\frac{\pi^2}{8}\text{m s}^{-2}$

Ans. **(3)**

Sol. T = 8

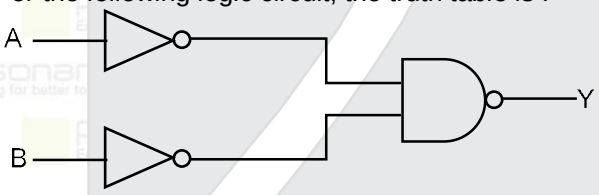
$$w = \frac{2\pi}{8} = \frac{\pi}{4}$$

$$a = -w^2A$$

$$= \frac{-\pi^2}{16} \times 1\text{m/s}^2$$

$$= \frac{-\pi^2}{16}\ \text{m/s}^2$$

40. For the following logic circuit, the truth table is : **[P-SS-D]_E**



(1)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(2)

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

(3)

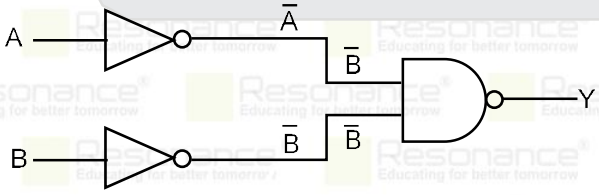
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(4)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

Ans. **(1)**

Sol.



$$Y = \overline{\bar{A}\cdot\bar{B}}$$

A	B	$\bar{A}$	$\bar{B}$	$\bar{A}\cdot\bar{B}$	$\overline{\bar{A}\cdot\bar{B}}$
0	0	1	1	1	0
0	1	1	0	0	1
1	0	0	1	0	1
1	1	0	0	0	1

41. A horizontal bridge is built across a river. A student standing on the bridge throws a small ball vertically upwards with a velocity 4 ms^{-1}. The ball strikes the water surface after 4 s. The height of bridge above water surface is (Take g = 10 ms^{-2}): **[P-RM-D]_E**

(1) 60 m (2) 64 m (3) 68 m (4) 56 m

Ans. **(2)**

Sol. $-h = 4(4) + \frac{1}{2}(-10)(4)^2$

$-h = +16 - 80$

$h = 64$ m

42. Two thin lenses are of same focal lengths (f), but one is convex and the other one is concave. When they are placed in contact with each other, the equivalent focal length of the combination will be: **[P-GO-G]_E**

(1) f/4 (2) f/2 (3) Infinite (4) Zero

Ans. **(3)**

Sol. $\frac{1}{f_{eq}} = \frac{1}{f} - \frac{1}{f} = 0$

$f_{eq} = \infty$

43. A wire carrying a current I along the positive x-axis has length L. It is kept in a magnetic field $\vec{B} = \left(2\hat{i} + 3\hat{j} - 4\hat{k}\right)$ T. The magnitude of the magnetic force acting on the wire is: **[P-EMF-H]_E**

(1) $\sqrt{5}$IL (2) 5 IL (3) $\sqrt{3}$IL (4) 3 IL

Ans. **(2)**

Sol. $\vec{F} = i\left(\vec{L} \times \vec{B}\right)$

$= I\left[L\hat{i} \times \left(2\hat{i} + 3\hat{j} - 4\hat{k}\right)\right]$

$= IL\left(3\hat{k} + 4\hat{j}\right)$

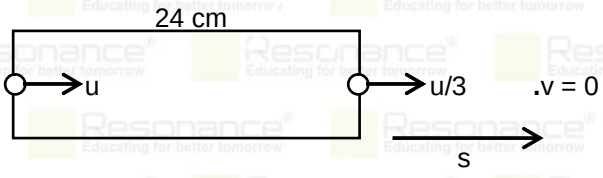
$\left|\vec{F}\right| = 5$ IL

44. A bullet from a gun is fired on a rectangular wooden block with velocity u. When bullet travels 24 cm through the block along its length horizontally, velocity of bullet becomes $\frac{u}{3}$. Then it further penetrates into the block in the same direction before coming to rest exactly at the other end of the block. The total length of the block is: **[P-WPE-C]_M**

(1) 24 cm (2) 28 cm (3) 30 cm (4) 27 cm

Ans. **(4)**

Sol.



$\left(\frac{u}{3}\right)^2 = u^2 + 2a(2u)$ ……(i)

$0 = \left(\frac{u}{3}\right)^2 + 2a(S)$ ……(ii)

from (i) & (ii)

$2aS = -\frac{u^2}{9}$

$48a = -\frac{8u^2}{9}$

$\frac{S}{24} = \frac{1}{8}$

$S = 3$

Total length = 27 cm

45. The resistance of platinum wire at 0°C is 2Ω and 6.8Ω at 80°C. The temperature coefficient of resistance of the wire is: **[P-CE-B]_E**

(1) 3×10^{-3} °C^{-1} (2) 3×10^{-2} °C^{-1} (3) 3×10^{-1} °C^{-1} (4) 3×10^{-4} °C^{-1}

Ans. **(2)**

Sol. $\Delta R = R \propto \Delta t$

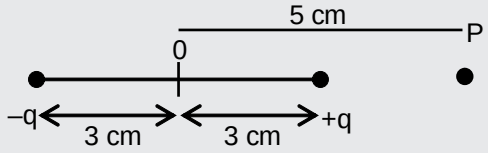
$\propto = \frac{\Delta R}{R \Delta t}$

$= \frac{6.8 - 2}{2(80)}$

$= \frac{4.8}{2 \times 80}$

$= \frac{2.4}{80} = \frac{0.3}{10}$ = .03 per °C

46. An electric dipole is placed as shown in the figure. **[P-ES-H]_E**

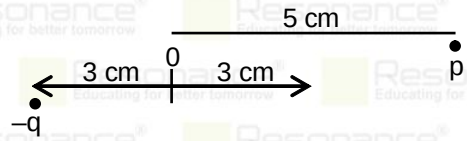


The electric potential (in 10^2 V) at point P due to the dipole is ($\in_0$ = permittivity of free space and $\frac{1}{4\pi \in_0}$ = K):

(1) $\left(\frac{5}{8}\right)$qK (2) $\left(\frac{8}{5}\right)$qK (3) $\left(\frac{8}{3}\right)$qK (4) $\left(\frac{3}{8}\right)$qK

Ans. **(4)**

Sol.



$$V_p = \frac{Kq}{.02} + \frac{Kq}{.08}$$

$$= Kq\left[\frac{.08+.02}{.02\times.08}\right]$$

$$= \frac{3}{8}qK \times 10^2$$

47. 10 resistors, each of resistance R are connected ¡n series to a battery of emf E and negligible internal resistance. Then those are connected in parallel to the same battery, the current is increased n times. The value of n is: **[P-CE-D]_E**

(1) 100 (2) 1 (3) 1000 (4) 10

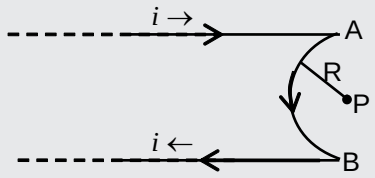
Ans. **(1)**

Sol. $I_1 = \frac{E}{10R}$

$$I_2 = \frac{E}{\left(\frac{R}{10}\right)} = \frac{10E}{R}$$

$$\frac{I_2}{I_1} = 100$$

48. A very long conducting wire ¡s bent in a semi-circular shape from A to B as shown in figure. The magnetic field at point P for steady current configuration is given by: **[P-EMF-D]_E**

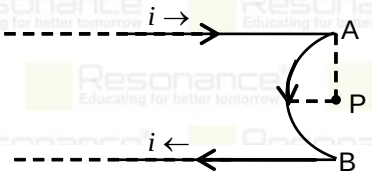


(1) $\frac{\mu_0 i}{4R}$ pointed away from the page (2) $\frac{\mu_0 i}{4R}\left(1-\frac{2}{\pi}\right)$ pointed away from page

(3) $\frac{\mu_0 i}{4R}\left(1-\frac{2}{\pi}\right)$ pointed into the page (4) $\frac{\mu_0 i}{4R}$ pointed into the page

Ans. **(2)**

Sol.



B_p = +

= + ⊙

Pointed away from page.

49. The radius of inner most orbit of hydrogen atom is 5.3×10^{-11} m. What is the radius of third allowed orbit of hydrogen atom? **[P-MP-C]_E**

(1) 1.06 Å (2) 1.59 Å (3) 4.77 Å (4) 0.53 Å

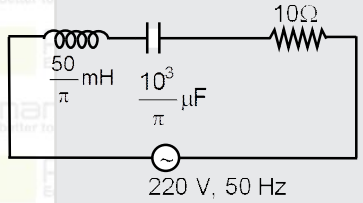
Ans. **(3)**

Sol. $R_3 = 5.3 \times 10^{-11} \times (9)$

$= 4.77 \times 10^{-10}$

$= 4.77$ Å

50. The net impedance of circuit (as shown in figure) will be: **[P-AC-C]_E**



(1) 15 Ω (2) $5\sqrt{5}$ Ω (3) 25 Ω (4) $10\sqrt{2}$ Ω

Ans. **(2)**

Sol. $X_L = L\omega$

$= \frac{50}{\pi} \times 2\pi \times 50 \times 10^{-3}$

$= 5\ \Omega$

$X_C = \frac{1}{C\omega} = \frac{\pi}{10^3 \times 2\pi \times 50 \times 10^{-6}} = 10\ \Omega$

$Z = \sqrt{10^2 + (10-5)^2}$

$= \sqrt{100+25}$

$= \sqrt{125}$

$= 5\sqrt{5}$

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