



# NARAYANA MEDICAL ACADEMY

## India

SR N40+LT N40 (PROG-1)

NEET GRAND TEST-4

Date: 24-04-2018

Duration: 3 Hrs

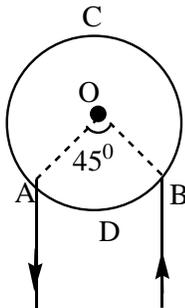
Max. Marks: 720 M

### Note: Important Instructions

- Duration of test is 3 hours and question paper contains 180 questions. The maximum marks are 720.
- Each correct answer carries 4 marks, while 1 mark will be deducted for every wrong answer. Guessing of answer is harmful.
- The candidate has to write his/her answers in the OMR sheet by darkening the appropriate bubble with the help of Blue/Black Ball Point Pen only as the correct answer(s) of the question attempted

### PHYSICS

1. A heat engine has an efficiency  $\eta$ . Temperatures of source and sink are each decreased by 100K. The efficiency of the engine
- 1) increases
  - 2) decreases
  - 3) remains constant
  - 4) becomes 1
2. A and B are two points on a uniform ring of resistance  $15\Omega$ . The  $\angle AOB = 45^\circ$ . The equivalent resistance between A and B is



- 1)  $1.64\Omega$
  - 2)  $2.84\Omega$
  - 3)  $4.57\Omega$
  - 4)  $2.64\Omega$
3. A quantity X is given by  $\epsilon_0 L \frac{\Delta V}{\Delta t}$  where  $\epsilon_0$  is the permittivity of the free space, L is a length,  $\Delta V$  is a potential difference and  $\Delta t$  is a time interval. The dimensional formula for X is the same as that of
- 1) resistance
  - 2) charge
  - 3) voltage
  - 4) current
4. The focal length of the lenses of an astronomical telescope are 50 cm and 5 cm.

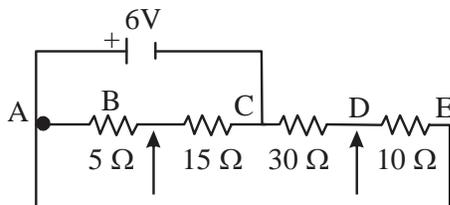
The length of the telescope when the image is formed at the least distance of distinct vision is

- 1) 45 cm
  - 2) 55 cm
  - 3)  $\frac{275}{6} \text{ cm}$
  - 4)  $\frac{325}{6} \text{ cm}$
5. In Young's double slit experiment distance between two sources is 0.1 mm. The distance of screen from the source is 20 cm. Wavelength of light used is  $5460 \text{ \AA}$ . Then, angular position of the first dark fringe is approximately
- 1)  $0.08^\circ$
  - 2)  $0.16^\circ$
  - 3)  $0.20^\circ$
  - 4)  $0.31^\circ$
6. The equations of motion of a projectile are given by  $x=36t$  m and  $2y=96t-9.8t^2$  m. The angle of projection is
- 1)  $\sin^{-1}\left(\frac{4}{5}\right)$
  - 2)  $\sin^{-1}\left(\frac{3}{5}\right)$
  - 3)  $\sin^{-1}\left(\frac{4}{3}\right)$
  - 4)  $\sin^{-1}\left(\frac{3}{4}\right)$
7. Two samples X and Y contain equal amount of radioactive substances. If  $\frac{1}{16}$ th of the sample X and  $\frac{1}{256}$ th of the sample Y, remain after 8 hours, then the ratio of half life periods of X and Y is
- 1) 2:1
  - 2) 1:2
  - 3) 1:4
  - 4) 4:1

8. An electron (mass  $m$ ) with an initial velocity  $\vec{v} = v_0 \hat{i}$  ( $v_0 > 0$ ) is in an electric field  $\vec{E} = -E_0 \hat{i}$  ( $E_0 = \text{constant} > 0$ ). Its de Broglie wavelength at time  $t$  is given by  $\left( \lambda_0 = \frac{h}{mv_0} \right)$

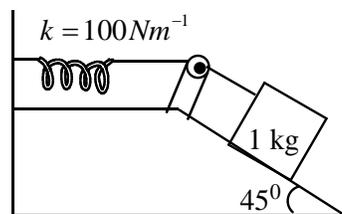
1)  $\frac{\lambda_0}{\left( 1 + \frac{eE_0 t}{mv_0} \right)}$       2)  $\lambda_0 \left( 1 + \frac{eE_0 t}{mv_0} \right)$   
 3)  $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$       4)  $\frac{\lambda_0}{\left( 1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2} \right)}$

9. Four resistors are connected as shown in the figure. A 6V battery of negligible resistance is connected across terminals A and C. The potential difference across terminals B and D will be



- 1) zero      2) 1.5 V  
 3) 2 V      4) 3 V

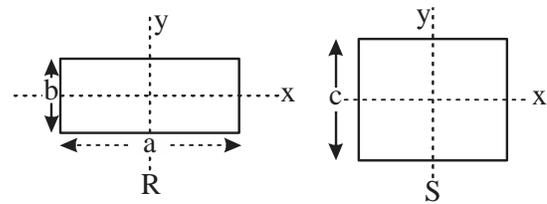
10. A 1 kg block situated on a rough incline is connected to a spring of negligible mass having spring constant  $100 \text{ Nm}^{-1}$  as shown in the figure. The block is released from rest with the spring in the unstretched position. The block moves 10 cm down the incline before coming to rest. The coefficient of friction between the block and the incline is nearly (take  $g = 10 \text{ ms}^{-2}$  and assume that the pulley is frictionless)



- 1) 0.2      2) 0.3  
 3) 0.5      4) 0.6

11. A uniform rectangular plate R of sides  $a$  and  $b$  and a uniform square plate S of side  $c$  have same masses and area as shown in the figure.

$x$ - $y$  axes are in the planes of plates. If  $I$  is moment of inertia, then



I)  $\frac{I_{XR}}{I_{XS}} < 1$       II)  $\frac{I_{YR}}{I_{YS}} > 1$

Which of the above relations is correct

- 1) I only      2) II only  
 3) Both I and II      4) Neither I nor II

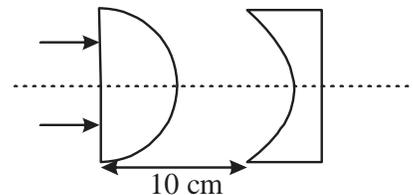
12. A solenoid has core of a material with relative permeability 500 and its windings carry a current of 1 A. The number of turns of the solenoid is 500 per metre. The magnetization of the material is nearly

1)  $2.5 \times 10^3 \text{ Am}^{-1}$       2)  $2.5 \times 10^5 \text{ Am}^{-1}$   
 3)  $2.0 \times 10^3 \text{ Am}^{-1}$       4)  $2.0 \times 10^5 \text{ Am}^{-1}$

13. The breakdown in a reverse biased p-n junction diode is more likely to occur due to

- 1) large velocity of the minority charge carriers if the doping concentration is small  
 2) large velocity of the minority charge carriers if the doping concentration is large  
 3) strong electric field in a depletion region if the doping concentration is small  
 4) none of these

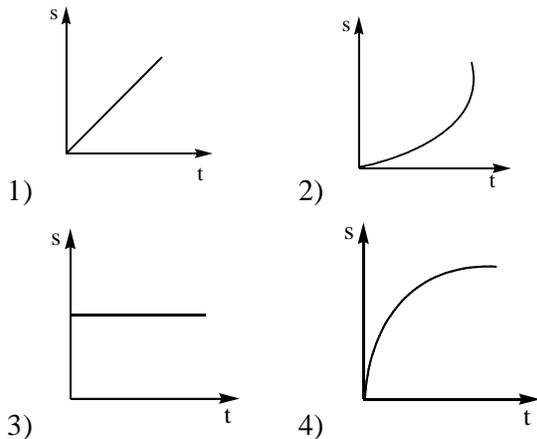
14. In the given figure, the radius of curvature of curved surface for both the plano-convex and plano-concave lens is 10 cm and refractive index for both is 1.5. The location of the final image after all the refractions through lenses is



- 1) 15 cm from plano-concave lens  
 2) 20 cm from plano-concave lens  
 3) 25 cm from plano-convex lens  
 4) 40 cm from plano-convex lens



23. A body is moving unidirectionally under the influence of a source of constant power supplying energy. Which of the diagrams shown in figure correctly shows the displacement (s) –time(t) curve for its motion?



24. Two spheres of the same material have radii 1m and 4m and temperatures 4000K and 2000K respectively. The energy radiated per second by the first sphere is

- 1) greater than that by the second
- 2) less than that by the second
- 3) equal in both cases
- 4) the information is incomplete to draw any conclusion

25. The magnitude of torque experienced by a square coil of side 12cm which consists of 25 turns and carries a current 10 A suspended vertically and the normal to the plane of coil makes an angle of  $30^\circ$  with the direction of a uniform horizontal magnetic field of magnitude 0.9 T is

- 1) 1.62 Nm
- 2) 1.22 Nm
- 3) 1.42 Nm
- 4) 1.82 Nm

26. The force acting on a window of area  $50\text{cm} \times 50\text{cm}$  of a submarine at a depth of 2000 m in an ocean, the interior of which is maintained at sea level atmospheric pressure is (Density of sea water =  $10^3 \text{kg m}^{-3}$ ,

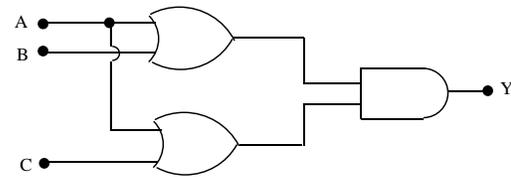
$$g = 10 \text{m s}^{-2})$$

- 1)  $5 \times 10^5 \text{ N}$
- 2)  $25 \times 10^5 \text{ N}$
- 3)  $5 \times 10^6 \text{ N}$
- 4)  $25 \times 10^6 \text{ N}$

27. An object 2cm high is placed at a distance of 16 cm from a concave mirror, which produces a real image 3 cm high. The focal length of the mirror is

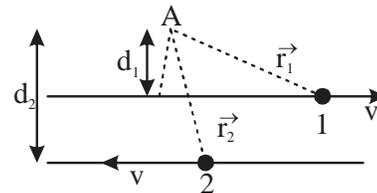
- 1) -9.6 cm
- 2) -3.6 cm
- 3) -6.3 cm
- 4) -8.3 cm

28. The output of given logic circuit is



- 1)  $A \cdot (B+C)$
- 2)  $A \cdot (B \cdot C)$
- 3)  $(A+B) \cdot (A+C)$
- 4)  $A+B+C$

29. Figure shows two identical particles 1 and 2, each of mass m, moving in opposite directions with same speed v along parallel lines. At a particular instant,  $\vec{r}_1$  and  $\vec{r}_2$  are their respective position vectors drawn from point A which is in the plane of the parallel lines. Which of the following is the correct statement?



$\otimes$  represents a unit vector going into the page  
 $\odot$  represents a unit vector coming out of the page

- 1) Angular momentum  $\vec{L}_1$  of particle 1 about A is  $\vec{L}_1 = mv\vec{r}_1 \odot$
- 2) Angular momentum  $\vec{L}_2$  of particle 2 about A is  $\vec{L}_2 = mv\vec{r}_2 \odot$
- 3) Total angular momentum of the system about A is  $\vec{L} = mv(\vec{r}_1 + \vec{r}_2) \odot$
- 4) Total angular momentum of the system about A is  $\vec{L} = mv(d_2 - d_1) \otimes$

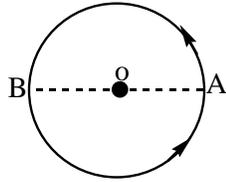
30. An electric dipole of moment  $\vec{p}$  is placed in a uniform electric field  $\vec{E}$ . Then

- i) the torque on the dipole is  $\vec{p} \times \vec{E}$
  - ii) the potential energy of the system is  $\vec{p} \cdot \vec{E}$
  - iii) the resultant force on the dipole is zero
- Choose the correct option

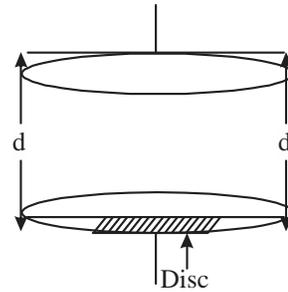
- 1) (i) and (ii) and (iii) are correct
- 2) (i) and (iii) are correct and (ii) is wrong
- 3) Only (i) correct
- 4) (i) and (ii) are correct and (iii) is wrong

31. A bullet is fired vertically upwards with velocity  $v$  from the surface of a spherical planet. When it reaches its maximum height, its acceleration due to the planet's gravity is  $1/4^{\text{th}}$  of its value at the surface of the planet. If the escape velocity from the planet is  $v_{\text{esc}} = v\sqrt{N}$ , then the value of  $N$  is (ignore energy loss due to atmosphere)
- 1) 2
  - 2) 3
  - 3) 4
  - 4) 5
32. In a single slit diffraction experiment, the width of the slit is made double its original width. Then the central maximum of the diffraction pattern will become
- 1) narrower and fainter
  - 2) narrower and brighter
  - 3) broader and fainter
  - 4) broader and brighter
33. A 100 kg gun fires a shell of 1 kg horizontally from a cliff of height 500 m. It falls on the ground at a distance of 400 m from the bottom of the cliff. The recoil velocity of the gun is (take  $g = 10\text{ms}^{-1}$ )
- 1)  $0.2\text{ms}^{-1}$
  - 2)  $0.4\text{ms}^{-1}$
  - 3)  $0.6\text{ms}^{-1}$
  - 4)  $0.8\text{ms}^{-1}$
34. Which of the following statements is incorrect regarding the polar satellite?
- 1) A polar satellite goes around the earth's poles in north-south direction
  - 2) Polar satellites are used to study the environmental changes of earth
  - 3) A polar satellite is high altitude satellite.
  - 4) The time period of polar satellite is about 100 minutes
35. A metallic surface is irradiated by a monochromatic light of frequency  $\nu_1$  and stopping potential is found to be  $V_1$ . If the light of frequency  $\nu_2$  irradiates the surface, the stopping potential will be
- 1)  $V_1 + \frac{h}{e}(\nu_1 + \nu_2)$
  - 2)  $V_1 + \frac{h}{e}(\nu_2 - \nu_1)$
  - 3)  $V_1 + \frac{e}{h}(\nu_2 - \nu_1)$
  - 4)  $V_1 - \frac{h}{e}(\nu_1 + \nu_2)$
36. A body of mass 0.4 kg starting at origin at  $t=0$  with a speed of  $10\text{ms}^{-1}$  in the positive x-axis direction is subjected to a constant force  $F=8\text{N}$  towards negative x-axis. The distance travelled by body in 25 s is
- 1) 6005 m
  - 2) 6000 m
  - 3) 5995 m
  - 4) 6002.5 m
37. A triply ionized beryllium ( $\text{Be}^{3+}$ ) has the same orbital radius as the ground state of hydrogen. Then the quantum state  $n$  of  $\text{Be}^{3+}$  is
- 1)  $n=1$
  - 2)  $n=2$
  - 3)  $n=3$
  - 4)  $n=4$
38. Identify the wrong statement
- 1) Eddy currents are produced in a steady magnetic field.
  - 2) Eddy currents can be minimized by using laminated core.
  - 3) Induction furnace uses eddy currents to produce heat.
  - 4) Eddy currents can be used to produce braking force in moving trains.
39. Two soap bubbles A and B are kept in a closed chamber where the air is maintained at pressure  $8\text{ N/m}^2$ . The radii of bubble A and B are 2 cm and 4cm, respectively. Surface tension of the soap-water used to make bubble is  $0.04\text{ N/m}$ . The ratio of  $n_B / n_A$  is (where  $n_A$  and  $n_B$  are the number of moles of air in bubbles A and B, respectively.) [Neglect the effect of gravity.]
- 1) 2
  - 2) 4
  - 3) 6
  - 4) 8
40. When a positively charged particle enters a uniform magnetic field with uniform velocity, its trajectory can be (i) a straight line (ii) a circle (iii) a helix.
- 1) (i) only
  - 2) (i) or (ii) only
  - 3) (i) or (iii) only
  - 4) any one of (i), (ii) and (iii)

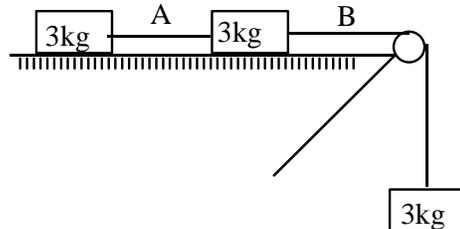
41. A particle is moving on a circular path of radius  $R$  with constant speed  $v$ . During motion of the particle from point A to point B



- 1) Average speed is  $v/2$   
 2) The magnitude of average velocity is  $\frac{v}{\pi}$   
 3) The magnitude of average acceleration is  $\frac{2v^2}{\pi R}$   
 4) Average velocity is zero
42. Two rods of equal length and diameter have thermal conductivities 3 and 4 units respectively. If they are joined in series, the thermal conductivity of the combination in the given units would be  
 1) 3.43                      2) 4.43  
 3) 5.43                      4) 2.43
43. A capacitor is made of two circular plates of radius  $R$  each, separated by a distance  $d \ll R$ . The capacitor is connected to a constant voltage source. A very thin conducting disc of same radius is placed at the centre of the bottom plate. If the mass of the disc is  $m$ , the minimum voltage required to lift the disc is



- 1)  $\frac{\sqrt{mgd}}{\pi\epsilon_0 r^2}$                       2)  $\frac{\sqrt{mgd}}{\pi\epsilon_0 r}$   
 3)  $\frac{\sqrt{mgd^2}}{\pi\epsilon_0 r^2}$                       4)  $\frac{\sqrt{mgd}}{\pi\epsilon_0 r^2}$
44. Three equal masses 3kg are connected by massless strings of cross sectional area  $0.005\text{cm}^2$  and Young's modulus  $2 \times 10^{11} \text{N/m}^2$ . In the absence of friction, the longitudinal strain in the wire ( $g = 10\text{m/s}^2$ )



- 1)  $A$  is  $10^{-4}$                       2)  $B$  is  $2 \times 10^{-4}$   
 3) Both (1) and (2)                      4) None of these
45. A gas is filled in a container at pressure  $P_0$ . If the mass of molecules is halved and their rms speed is doubled, then the resultant pressure would be  
 1)  $2P_0$                       2)  $4P_0$   
 3)  $\frac{P_0}{4}$                       4)  $\frac{P_0}{2}$