

INDIAN ASSOCIATION OF PHYSICS TEACHERS

NATIONAL STANDARD EXAMINATION IN ASTRONOMY 2014 -15

Date of Examination: 23rd November, 2014

Time: 1500 to 1700 Hrs

Q. Paper Code: A 412

Write the question paper code mentioned above on YOUR answer sheet (in the space provided), otherwise your answer sheet will NOT be assessed. Note that the same Q. P. Code appears on each page of the question paper.

Instructions to Candidates –

1. Use of mobile phones, smartphones, ipads during examination is **STRICTLY PROHIBITED**.
2. In addition to this question paper, you are given answer sheet along with Candidate's copy.
3. On the answer sheet, make all the entries carefully in the space provided **ONLY** in **BLOCK CAPITALS** as well as by properly darkening the appropriate bubbles.
Incomplete/ incorrect/carelessly filled information may disqualify your candidature.
4. On the answer sheet, use only **BLUE or BLACK BALL POINT PEN** for making entries and filling the bubbles.
5. Question paper has 80 multiple choice questions. Each question has four alternatives, out of which **only one** is correct. Choose the correct alternative and fill the appropriate bubble, as shown.

Q. No. 22 ☐ a ☒ ☐ c ☐ d

6. A correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer.
7. Any rough work should be done only in the space provided.
8. Use of **non-programmable** calculator is allowed.
9. No candidate should leave the examination hall before the completion of the examination.
10. After submitting your answer paper, take away the Candidate's copy for your reference.

Please DO NOT make any mark other than filling the appropriate bubbles properly in the space provided on the answer sheet.

Answer sheets are evaluated using machine, hence CHANGE OF ENTRY IS NOT ALLOWED.

Scratching or overwriting may result in a wrong score.

DO NOT WRITE ON THE BACK SIDE OF THE ANSWER SHEET.

Instructions to Candidates (continued) –

Read the following instructions after submitting the answer sheet.

11. Comments regarding this question paper, if any, may be sent by email only to iapt pune@gmail.com till 25th November, 2014.
12. The answers/solutions to this question paper will be available on our website – www.iapt.org.in by 3rd December, 2014.
13. **CERTIFICATES and AWARDS –**
Following certificates are awarded by the IAPT to students successful in NSEs
 - (i) Certificates to “Centre Top 10%” students
 - (ii) Merit Certificates to “Statewise Top 1%” students
 - (iii) Merit Certificates and a book prize to “National Top 1%” students
14. Result sheets and the “Centre Top 10%” certificates will be dispatched to the Prof-in-charge of the centre by January, 2015.
15. List of students (centre number and roll numberwise) having score above MAS will be displayed on our website (www.iapt.org.in) by 22nd December, 2014. See the **Eligibility Clause** in the Student’s brochure on our website.
16. Students eligible for the INO Examination on the basis of selection criteria mentioned in Student’s brochure will be informed accordingly.

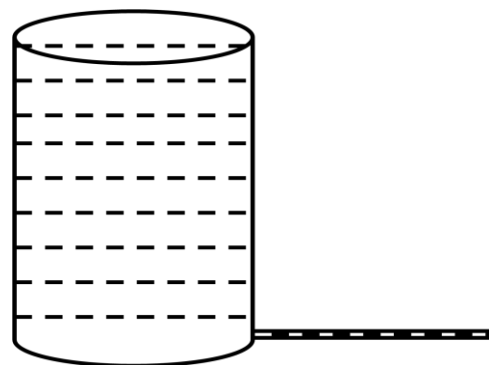
Indian Association of Physics Teachers**NATIONAL STANDARD EXAMINATION IN ASTRONOMY 2014-2015**

Total time: 120 minutes

Marks: 240

Only one out of four options is correct

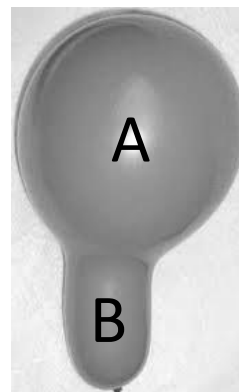
- 1) A certain star appears to rise from the east at 9:30 pm on a particular day. From the same place of observation, after 25 days the same star appears to rise from east at about
 a) 11:10 pm b) 7:50 pm c) 8:05 pm d) 10:20 pm
- 2) A mixture of two moles of hydrogen and one mole of argon gas is taken in a closed container at room temperature. Consider the following two statements
 i) The average kinetic energy of each atom of H and Ar are the same.
 ii) The pressure due to argon gas is more than that due to hydrogen gas.
 a) Both statement i) and ii) are correct
 b) Statement i) is correct while statement ii) is incorrect
 c) Both statement i) and ii) are incorrect
 d) Statement i) is incorrect while statement ii) is correct
- 3) If $f(x) = \sqrt{x^2 - 3x + 2} + \frac{1}{\sqrt{x^2 - 3x - 4}}$, the domain of $f(x)$ is
 a) $(-\infty, -1) \cup (4, \infty)$ b) $[-\infty, -1] \cup [4, \infty]$
 c) $(-\infty, 4)$ d) None of these
- 4) Order of magnitude calculation in astronomy plays an important role in understanding the concepts. The order of magnitude of number of Fe atom present in a solid cube of volume 1 cc is (molecular mass of iron is around 56 gmol^{-1})
 a) 10^{25} b) 10^{27} c) 10^{22} d) 10^{21}
- 5) The viscosity of water can be determined by studying the Poiseuille's flow in a capillary tube connected to cylindrical container as shown in the adjacent figure. The density and viscosity of water are given by 1.00 gcc^{-1} and 1.00 mNsm^{-2} . The radius and length of the capillary is 1.00 mm and 20.0 cm. If Radius of the vessel is 15.0cm, then the time taken for height of water to reduce to half the initial is
 a) 15.02 minute b) 1.502 hour
 c) 22.03 minute d) 42.43 minute



- 6) The range of the function, $x \in \mathbb{R}$ (square bracket indicates integer values only)

$$f(x) = \frac{\sin(\pi[x^2 + 1])}{x^4 + 1} \text{ is}$$

- a) $[0, 1]$ b) $[-1, 1]$ c) $\{0\}$ d) None of these
- 7) An inflated balloon is shown in the adjacent figure. Two regions of interest are marked on it as A and B. Which of the following statement is incorrect (R_A and R_B are radii of curvature at A and B respectively)
- a) The pressure at A and B are the same.
 b) The pressure at A and B are different.
 c) Tension of the rubber membrane at A (T_A) and B (T_B) are different.
 d) The ratio T_A/R_A at A and T_B/R_B at B are same.

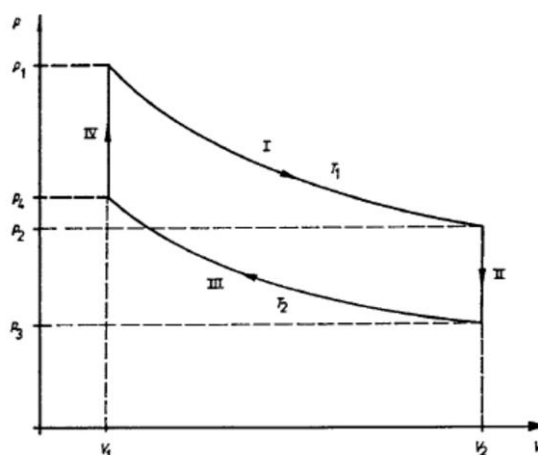


- 8) A meteor shower occurs when
- a) Earth passes through the asteroid belt
 b) Earth passes through a swarm of dust particles in space, which are remnants of a comet
 c) Head of a comet hits the earth's atmosphere
 d) A distant star explodes

- 9) If $\tan 25^\circ = x$, then $\frac{\tan 155^\circ - \tan 115^\circ}{1 + \tan 155^\circ \tan 115^\circ}$ is equal to

- a) $\frac{1-x^2}{2x}$ b) $\frac{1+x^2}{2x}$ c) $\frac{1+x^2}{1-x^2}$ d) $\frac{1-x^2}{1+x^2}$

- 10) Sterling engine involves cyclic process similar to Carnot cycle. It consists of two isothermal process at temperature T_1 and T_2 . Adiabatic processes are practically difficult to achieve and hence they are replaced by isochoric processes as shown in the adjacent figure. The efficiency of the engine is equal to (γ is the ratio of C_p to C_v)



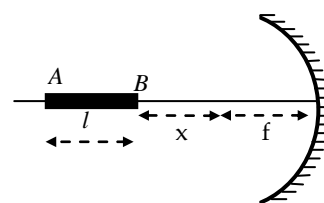
- a) $\frac{1}{\gamma} \frac{T_1 - T_2}{T_1}$
 b) $\frac{T_1 - T_2}{T_1}$
 c) $\frac{1}{(\gamma-1)} \frac{T_1 - T_2}{T_1}$
 d) $\frac{1}{2\gamma} \frac{T_1 - T_2}{T_1}$

- 11) Sun appears against different constellation in different months of an year due to
- a) Earth's rotation about its axis
 b) Earth's orbit motion around the sun
 c) Sun's motion around the centre of milky way galaxy
 d) Precession of earth's axis of rotation or precession of equinoxes.

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- 23) The planet in which sun appears to rise in the west is
 a) Venus b) Uranus c) Saturn d) Mercury
- 24) If $x = 2 + 5i$, then the value of $x^3 - 5x^2 + 33x - 19$ is equal to
 a) -5 b) -7 c) 7 d) 10
- 25) The lift force per unit length of wingspan (F) of an aircraft depends on width L of the its wing, velocity v , air density ρ . The correct expression for F is (Where k is a dimensionless constant).
 (a) $F = kLv^2\rho$ (b) $F = kv^3\rho$ (c) $F = kL^2v^2\rho^2$ (d) $F = kLv\rho^2$
- 26) For places equidistant from the equator in northern and southern hemisphere choose the correct statement,
 a) Summers are warmer and winters are colder in the southern hemisphere
 b) Summers are colder and winters are warmer in the southern hemisphere
 c) Both summers and winters are warmer in northern hemispheres
 d) Both summers and winters are colder in northern hemisphere
- 27) The absolute temperature T of a gas is plotted against its pressure P for two different constant volumes V_1 and V_2 where $V_1 > V_2$. T is plotted along x -axis and P along y -axis.
 a) Slope for curve corresponding to volume V_1 is greater than that corresponding to volume V_2
 b) Slope for curve corresponding to volume V_2 is greater than that corresponding to volume V_1
 c) Slope for both curves are equal
 d) Slope for both curves are unequal such that they intersect at $T = 0$
- 28) The phenomenon of streams of hot hydrogen gas bursting out of the sun's surface for a height and falling back on the surface are called
 a) Solar flares b) spicules c) solar prominences d) solar storms
- 29) A rod of length $l = 10$ cm and diameter $d = 2.0$ mm is placed along the axis of a concave mirror of focal length $f = 10$ cm as shown in the figure. End B is at distance $x = 10$ cm from the focus F of the mirror. Then
 a) Length of the image is 5.0 cm and end A is 1.0 mm thick
 b) Length of the image is 6.0 cm and end A is 1.0 mm thick
 c) Length of the image is 5.0 cm and end A is 2.0 mm thick
 d) Length of the image is 6.0 cm and end A is 4.0 mm thick



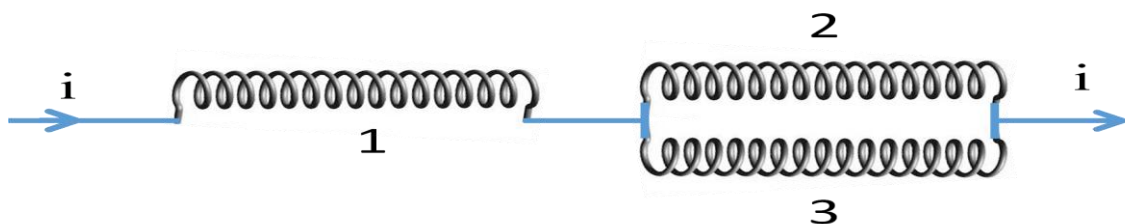
- 30) Read the following statements
 (i) Photons emitted by the sun are produced by electromagnetic processes in the photosphere
 (ii) A photon liberated in the core of the sun, takes about a few hundred thousand years to reach its surface

Pick out the correct option given below

- a) (i) is true but (ii) is wrong
 b) Both (i) and (ii) are wrong
 c) (i) is wrong but (ii) is true
 d) Both (i) and (ii) are true

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- 31) The remainder obtained when $31 \times 32 \times 33 \times 34 \times 35$ is divided by 29 is
a) 2 b) 3 c) 15 d) 23
- 32) Out of the celestial objects, redgiant (RG), white dwarfs (WD), neutron star (NS) and black holes (BH), gravitational contraction is countered by degeneracy pressure in
a) RG, WD and NS only b) WD and NS only c) WD only d) WD, NS and BH only
- 33) For spherical mirrors which of the following depend on whether the rays are paraxial or not?
a) Pole
b) Focus
c) Radius of curvature
d) Principal axis
- 34) The number of real roots of $(7 + 4\sqrt{3})^{|x|-8} + (7 - 4\sqrt{3})^{|x|-8} = 14$ is
a) 0 b) 2 c) 3 d) 4
- 35) Ptolemy developed the concept of epicycles in planetary motion mainly to
a) Assert that earth is the centre of the universe.
b) Show that all planets revolve around the sun
c) Explain the observed retrograde motion of planets
d) To prove that circular motion is a natural state of motion for all celestial objects.
- 36) In Indian astronomy, the Zodiacal belt on the celestial sphere is divided into constellations. Each constellation is further divided into smaller units called Nakshatras. The mean time taken by sun to pass across a Nakshatra on the celestial sphere is about
a) 13.5 days b) 27.3 days c) 23 hrs 56 minutes d) 30 days
- 37) The value of $\lim_{n \rightarrow \infty} \left[\frac{n}{n^2 + 1^2} + \frac{n}{n^2 + 2^2} + \frac{n}{n^2 + 3^2} + \dots + \frac{1}{2n} \right]$ is
a) 1 b) $\log_e 2$ c) $\frac{1}{3}$ d) $\frac{\pi}{4}$
- 38) Three closely wound coils identical in respect of number of turns material of wire and the radius, are connected as shown in the figure.



The magnetic fields due to the steady current in coils 1, 2 and 3 are respectively \vec{B}_1, \vec{B}_2 and \vec{B}_3 . Then

- a) $\frac{\vec{B}_1}{2} = \vec{B}_2 = \vec{B}_3$ b) $|\vec{B}_2| = |\vec{B}_3| = |\frac{\vec{B}_1}{2}|$
- c) $\vec{B}_2 = \vec{B}_3$ d) $|\vec{B}_2| \neq |\vec{B}_3|$

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Passage question (39 to 42): Read the following passage and answer the questions below

The magnitude scale of the brightness of stars is logarithmic. As magnitude increases by 5, brightness decreases by factor of 100. The magnitudes of stars as observed from earth are called apparent magnitudes (m). Magnitude of a star as observed from a standard distance of 10 parsec is called the real or true magnitude (M). The relation between m and M may be written as

$$M = m + 5 - 5 \log d$$

Where d is the distance from earth to the star in the units of parsec. One parsec = 3.25 Ly

- 39) The brightness of two stars is b_1 and b_2 . If they have apparent magnitude m_1 and m_2 then the correct relation is

a) $m_1 - m_2 = 5 \log \left(\frac{b_1}{b_2} \right)$

b) $m_1 - m_2 = 5 \log \left(\frac{b_2}{b_1} \right)$

c) $m_1 - m_2 = 2.5 \log \left(\frac{b_1}{b_2} \right)$

d) $m_1 - m_2 = 2.5 \log \left(\frac{b_2}{b_1} \right)$

- 40) The star 'Jyeshta' has an apparent magnitude of about 0.92 and the real magnitude of about (-5.1). The distance of the star from earth is about

a) 250Ly

b) 160Ly

c) 520Ly

d) 210Ly

- 41) Sirius is a binary star with the star Sirius A having $m = -1.46$ and $M = 1.42$ and Sirius B having $m = 8.30$ and $M = 11.18$. As seen from the earth the star A is P times brighter than B. Then P is about

a) 250

b) 3900

c) 8017

d) 10,000

- 42) Two stars A and B have apparent magnitudes of -1.2 and 0.8 respectively, but their real magnitudes are same and equal to -2.4. Then we may conclude

a) Both A and B have same surface temperature

b) Both A and B are at the same distance from earth

c) As observed from the earth B is nearer to earth

d) Star A appears to be brighter than B by a factor of 6.3

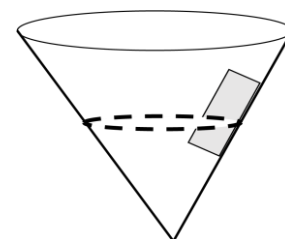
- 43) Consider a block moving in a horizontal circular path on the inner surface of a cone. The normal force on the block is

a) mg

b) always greater than mg

c) may be greater or less than mg

d) always less than mg



- 44) Three objects, all of mass M , are released simultaneously from the top of an inclined plane of inclination 60° and height H . The objects are described as follows

i) a cube of side R .

ii) a solid cylinder of radius R

iii) a hollow cylinder of radius R

Assume the cylinders roll down the plane without slipping and the cube slides down the plane (coefficient of friction 0.4). Which object(s) reach(s) the bottom of the plane first?

a) I

b) II

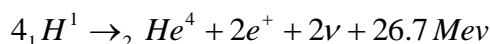
c) III

d) I & II

- 45) The value of $\int_0^{\frac{\pi}{4}} e^{\sqrt{x}} dx$
- a) e^2 b) e c) $2e$ d) $2e^2$
- 46) If $x + \frac{1}{x} = 2\cos\theta$ and $y + \frac{1}{y} = 2\cos\phi$ then $\sqrt{\frac{x}{y}} - \sqrt{\frac{y}{x}}$ is
- a) $2\cos\left(\frac{\theta-\phi}{2}\right)$ b) $2\cos\left(\frac{\theta+\phi}{2}\right)$ c) $2\sin\left(\frac{\theta+\phi}{2}\right)$ d) $2i\sin\left(\frac{\theta-\phi}{2}\right)$

Linked questions 47 to 51: Sun

- 47) Sun is the closest star and main source of energy for all the living beings on the earth. For all practical purpose it can be assumed to be a black body radiating energy in all wavelengths. The maximum intensity of radiation occurs at a wavelength of 500 nm. The temperature of sun is (Wien's constant = 2.8×10^{-3} mK)
- a) 5600K b) 14000K c) 17800K d) 4800K
- 48) Once the temperature of Sun is known, the Luminosity which is nothing but the total energy emitted per second can be determined. If the radius of Sun is 6.95×10^8 m, then the luminosity of sun is (Stefan's constant = $5.67 \times 10^{-8} \text{ Wm}^{-2}\text{K}^{-4}$)
- a) 4.2×10^{24} W b) 3.38×10^{26} W c) 3.38×10^{24} W d) 4.2×10^{26} W
- 49) The energy that comes out of the Sun is mainly due to thermo nuclear fusion that converts hydrogen into helium through Proton-Proton cycle. The reaction given below produces an amount of energy equal to 26.7MeV.

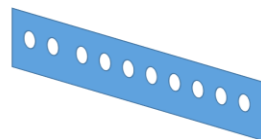


Assuming that all the energy produced in the fusion reaction is emitted, the number of reactions that has to occur in one second is given by

- a) 1.26×10^{19} b) 1.26×10^{26} c) 7.91×10^{37} d) 1.08×10^{42}
- 50) The energy released in a nuclear reaction is due to conversion of some amount of mass. Calculate the amount of hydrogen converted to helium in one second due to the fusion reaction (mass of proton = 1.67×10^{-27} kg)
- a) 528.38 million ton b) 345.14 million ton c) 356.15 million ton d) 768.34 million ton
- 51) A star is said to be in its prime age until all hydrogen in the core converts to helium. Most part of its life is spent in this phase. Assuming only 10% of total mass of sun is in the core and 74% of sun is made of hydrogen calculate the approximate life time of sun (mass of sun = 2×10^{30} kg)
- a) 12 billion years b) 9.1 billion years c) 9.8 billion years d) 8.9 billion years
- 52) If \vec{a} is perpendicular to \vec{b} and \vec{c} , $|\vec{a}| = 2$; $|\vec{b}| = 3$, $|\vec{c}| = 4$ and the angle between \vec{b} and \vec{c} is $\frac{2\pi}{3}$ then $[\vec{a} \vec{b} \vec{c}]$ is
- a) 24 b) 12 c) $12\sqrt{3}$ d) $24\sqrt{3}$

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- 53) If \hat{i} , \hat{j} , \hat{k} are unit vectors and $\hat{i} \times \hat{j} = \hat{k}$, then $(\hat{i} + \hat{j}) \times (\hat{j} - \hat{i})$ is
 a) \hat{k} b) $2\hat{k}$ c) $-\hat{k}$ d) $-2\hat{k}$
- 54) If $\log_5 2$, $\log_5 (2^x - 5)$ and $\log_5 \left(2^x - \frac{7}{2}\right)$ are in A.P, then x is equal to
 a) $\frac{1}{2}, \frac{3}{2}$ b) 3 c) 4, 5 d) 8
- 55) A loudspeaker kept horizontal produces sound by means of oscillations of a diaphragm whose amplitude is limited to $0.2\mu\text{m}$. The minimum frequency above which dust particles sitting on the diaphragm loses the contact is
 a) 352.5M Hz b) 1.114 KHz c) $7.80 \times 10^6 \text{Hz}$ d) 352.5Hz
- 56) A block of mass 2kg connected to a spring of spring constant 8Nm^{-1} is allowed to oscillate on a rough horizontal surface. If the system experiences a *damping force* = $0.230 \times \text{Velocity}$, then the time required for the amplitude of resulting oscillation to fall to half of its initial value is
 a) 0.693 s b) 12 s c) 0.08 s d) 14.3 s
- 57) Two strings of a piano are identical in length, composition and diameter. One of the strings is tuned correctly to 300Hz. When the two strings are sounded together 2 beats per second is heard. The Percentage change in tension required to tune the string to match the frequency of the other string is
 a) 1% b) 1.66% c) 1.33% d) 2%
- 58) In an experiment to estimate the distance of a black board from a student using parallax method, 10 markings are made separated by 10.0cm from each as shown in the figure below. The student holds a pen in the hand in front of the eyes in the direction of the board. When she sees the pen with only left eye, it coincides with 8th marking on the board. When she sees the pen only with right eye, then the pen appears to coincide with 2nd marking. If the separation between eyes for normal human being is 8.0 cm and pen to eye distance is 30.0 cm, then distance from the student to the board is



- a) 225cm b) 145cm c) 255cm d) 175cm
- 59) In the expansion of $(1 + px)^n$, $n \in \mathbb{N}$ the coefficient of x and x^2 are 8 and 24 respectively, then
 a) $n = 3, p = 2$ b) $n = 4, p = 2$ c) $n = 4, p = 3$ d) $n = 5, p = 3$
- 60) The value of $1 + \frac{2}{5} + \frac{3}{25} + \dots$ to ∞ is
 a) $\frac{1}{25}$ b) $\frac{16}{25}$ c) $\frac{25}{16}$ d) $\frac{5}{4}$

- 61) A ball is thrown vertically up in air where the resistive force can be considered to be constant. If time of ascent is t_1 and time of descent is t_2 . The ratio of velocity of projection to the velocity just before it hits the ground is

a) $\frac{t_2}{t_1}$ b) $\left(\frac{t_2}{t_1}\right)^2$ c) $\frac{2t_2}{t_1}$ d) $\frac{t_2}{2t_1}$

- 62) Water level in a pool is 2 m. An iron pillar 3 m tall is placed in the water. If sun is 30° above the horizon, the shadow of the pole on the floor of the pool is

a) $2\sqrt{3}$ m.
b) Slightly less than $2\sqrt{3}$ m.
c) Slightly more than $2\sqrt{3}$ m.
d) $\sqrt{6}$ m.

- 63) The equations to the sides of a triangle are $x - 3y = 0$, $4x + 3y = 5$ and $3x + y = 0$. The line $3x - 4y = 0$ passes through the

a) incentre b) centroid
c) circumference d) orthocenter of the triangle

- 64) The area enclosed by $2|x| + 3|y| \leq 6$ is

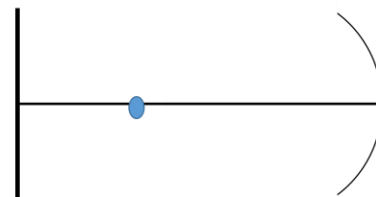
a) 3 sq.units b) 4 sq.units c) 12 sq.units d) 24 sq.units

- 65) The equation of the normal to the parabola $y^2 = 4x$ which makes an angle of 60° with x-axis is

a) $y = x\sqrt{3} - 5\sqrt{3}$ b) $y + x\sqrt{3} = 5\sqrt{3}$
c) $y = x\sqrt{3} + 5\sqrt{3}$ d) $y + x\sqrt{3} + 5\sqrt{3} = 0$

- 66) A plane mirror and a concave mirror of focal length 10 cm are 30 cm apart facing each other. A point object is placed 10 cm away from the plane mirror. Then,

a) number of images formed by the system is 2
b) number of images formed by the system is 3
c) number of images formed by the system is 1
d) distance between first two images formed is 20 cm.



- 67) Three polaroids are kept coaxially. Angle between the first and third polaroid is 90° . Angle between the first and second polaroid is 60° . If light energy incident on the first polaroid is I_0 . Light energy that emerges from the system is

a) zero b) $\frac{3I_0}{32}$ c) $\frac{3I_0}{16}$ d) $\frac{\sqrt{3}I_0}{8}$

- 68) The value of $\lim_{x \rightarrow \infty} \frac{(x+1)^{10} + (x+2)^{10} + \dots + (x+100)^{10}}{x^{10} + 10^{10}}$

a) 10 b) 100 c) 1000 d) 0

69) If $\tan \theta + \sec \theta = p$, then θ can be written as

- a) $\sec^{-1} \left[\frac{1+p^2}{2p} \right]$ b) $\cos^{-1} \left[\frac{1+p^2}{2p} \right]$
 c) $\tan^{-1} \left[\frac{2p}{2p^2-1} \right]$ d) $\tan^{-1} \left[\frac{p^2-1}{2p} \right]$

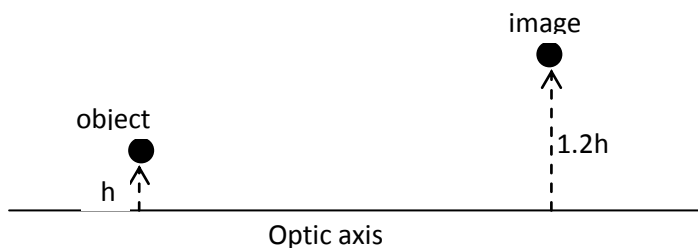
70) A boat carrying ten people is floating in a pond. Suppose all the ten people drink some water from the pond simultaneously then consider the two statements

- (i) The fraction of the boat immersed in water increases marginally.
 (ii) The level of the water in the pond will not change.

Choose the correct option

- a) Statement (i) is correct while statement (ii) is incorrect
 b) Statement (i) and (ii) are correct
 c) Statement (i) is incorrect while statement (ii) is correct
 d) Statement (i) and (ii) are incorrect

71) An optical system produces an image of an object as shown in the figure below. Guess the optical system and its position.



- (i) concave mirror between the object and the image
 (ii) biconvex lens on the left of the object.
 (iii) convex mirror between the object and the image

- a) (i), (ii) and (iii) are possible b) only (ii) and (iii) are possible
 c) only (i) and (iii) are possible d) only (i) and (ii) are possible

72) The number of distinct real roots of $\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$ in the interval $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$

is

- a) 0 b) 2 c) 1 d) 3

73) If $\tan A + \sin A = m$ and $\tan A - \sin A = n$ then $(m^2 - n^2)^2$ is

- a) $15mn$ b) $16mn$ c) $18mn$ d) $4mn$

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74) $\triangle ABC$ is a right angled triangle and $C = 90^\circ$ then $\tan A + \tan B$ is

- a) $\frac{b^2}{ac}$ b) $a + b$ c) $\frac{a^2}{bc}$ d) $\frac{c^2}{ab}$

75) The value of $\tan^{-1}\left(\frac{1}{a+b}\right) + \tan^{-1}\left(\frac{b}{a^2+ab+1}\right)$ is

- a) $\tan^{-1} a$ b) $\cot^{-1} a$ c) $\tan^{-1} b$ d) $\cot^{-1} b$

76) In a G.P of positive terms, for a fixed n , the n^{th} term is equal to sum of the next two terms.

Then the common ratio of the G.P is

- a) $2 \cos 18^\circ$ b) $\sin 18^\circ$ c) $\cos 18^\circ$ d) $2 \sin 18^\circ$

77) An equation of a circle touching the axes of co-ordinates and the line

$x \cos \alpha + y \sin \alpha = 2$ is $x^2 + y^2 - 2gx + 2gy + g^2 = 0$ where g is

- a) $2 (\cos \alpha + \sin \alpha + 1)^{-1}$ b) $2 (\cos \alpha - \sin \alpha + 1)^{-1}$
c) $2 (\cos \alpha + \sin \alpha - 1)^{-1}$ d) $-2 (\cos \alpha - \sin \alpha - 1)^{-1}$

78) If A is a square matrix of order 3 and $|A| = 3$, then $|\text{adj } A|$ is

- a) 3 b) 9 c) $\frac{1}{3}$ d) 0

79) The number of solutions of $\sqrt{4-x} + \sqrt{x+9} = 5$ is

- a) 0 b) 1 c) 2 d) 3

80) $2 (\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3)$ is

- a) 2π b) π c) $-\pi$ d) $\frac{\pi}{2}$