NSEA 2026

Held On 21 November, Saturday 2026	TIME : 2 : 30 PM to 4 : 30 PM

ASTRONOMY

PART A-1

Q1 Part A-1

A person claims to have followed this path: She was standing at location 'A' on the Earth. She walked towards the north for 100 km. Next, she turned towards east and walked for 100 km. Then she turned towards south and walked for 100 km and reached back the same location 'A'.

(a) Her claim is not possible.

(b) Location A can be only one particular place on the Earth.

(c) Location A can be only at two distinct places on the Earth.

(d) Location A can be anywhere on the Earth.

Q2 Part A-1

For a binary star system with two identical mass stars,

(a) the orbit is always circular.

(b) the centre of mass of the system shows a periodic motion.

(c) the elliptical orbit may appear to be circular to the observer due to certain inclination.

(d) the stars can be always resolved using powerful telescopes.

Q3 Part A-1

Two locations on the southern hemisphere of the earth have exactly the same length of day (and night) on any given day, but the times of sunrise and sunset both are offset by twelve hours each. A plane flying between the two locations trying to cover the shortest path will always fly

(a) first southwards and then northwards

(b) first northwards and then southwards

(c) exactly westwards.

(d) exactly eastwards.

Q4 Part A-1

The light curve shows a fictional edge-on eclipsing binary system containing star X and star Y. Which of the following is the correct option about the light curve? *Figure: Light curve A plots flux in units of 10^{-12} W/m^2 against time in days from 0 to 20. The flux stays at 16 units except for four dips: two deeper dips down to 10 units (around day 2.5 and day 12.5) and two shallower dips down to about 11.5 units (around day 7.5 and day 17.5).*

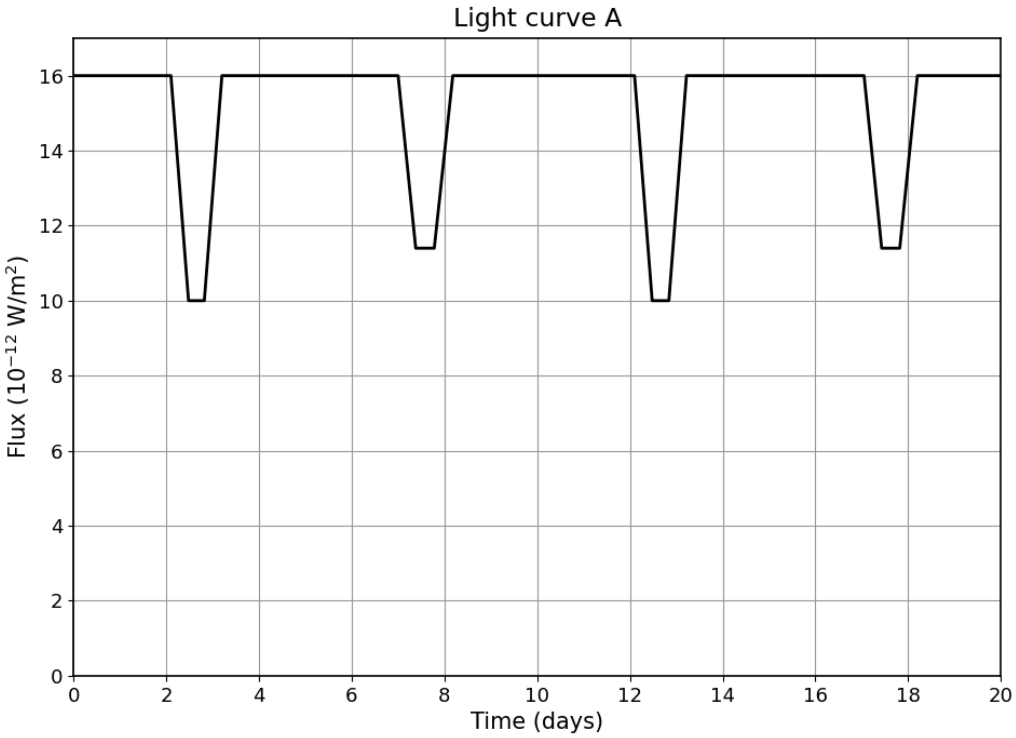


Figure for Q4.

(a) Two stars revolve around common centre of mass in necessarily circular orbit.

(b) Both stars are surely not of the same size.

(c) The two stars have their intensities in the ratio of 6 : 5.

(d) Larger dip is when cooler star comes in front of hotter star.

Q5 **Part A-1**

An astronomical telescope has objective with focal length of 750 mm. When eyepiece of 25 mm is used to observe a binary star, it is barely separated to a normal human eye. The aperture of telescope is 150 mm. The actual angular separation of the binary stars is approximately

(a) 1 arc sec (b) 2 arc sec (c) 1 arc min (d) 2 arc min

Q6 **Part A-1**

An observer is located at latitude of 60 degrees south and he can only see the sky above 10 degrees horizon due to local geography. What percentage of sky will he never see from his location?

(a) 17.1% (b) 25.0% (c) 32.9% (d) 41.3%

Q7 **Part A-1**

Brightness of stars is given in magnitude. If the flux of energy received from two stars is l_1 and l_2, their magnitudes (m_1 and m_2 respectively) are related as $m_2 - m_1 = -2.5 \log (l_2/l_1)$. A particular star X is seen with magnitude 3.0 from the earth and with magnitude 4.0 from an exoplanet around another star Y. From the Earth, stars X and Y are seen separated by 40 degrees with each other. The distance of the star Y from the Earth is 30 ly. The distance of the star X from the exoplanet is

(a) 23.6 ly (b) 21.5 ly (c) 13.5 ly (d) 9.4 ly

Q8 **Part A-1**

Which of the following constellations has smallest area?

(a) Triangulum (b) Sagitta (c) Scutum (d) Crux

Q9 Part A-1

A comet is orbiting around the sun with the closest distance as 3.00 AU. If its period of revolution around the Sun is 6.55 years, what is its farthest distance from the Sun?

(a) 3.50 AU (b) 4.00 AU (c) 5.38 AU (d) 8.38 AU

Q10 Part A-1

Consider two statements A and R.
Statement A : The ion tail of a comet is always seen on the opposite side of the sun.
Statement R : Ion tail has very low density and hence it lags behind the comet approaching the Sun.
Choose the most appropriate option that best describe the above two statements.

(a) Both statements are correct and statement R is correct reason for statement A
(b) Both statements are correct, but statement R is not correct reason for statement A
(c) Statement A is correct, but statement R is wrong.
(d) Statement A is wrong, but statement R is correct.

Q11 Part A-1

It is observed that large number of stars follow $L \propto M^4$ relation between luminosity L and mass M. Similarly large number of stars have $R \propto M^{0.8}$. The surface temperature of stars will have relation $T \propto M^x$. The value of x is

(a) 3.2 (b) 1.7 (c) 0.8 (d) 0.6

Q12 Part A-1

Cosmological redshift

(a) is due to actual motion of galaxies away from the Milky Way.
(b) can be measured due to transverse motion of the sources as seen by the observer.
(c) is due to the cumulative expansion of space along the photon's path from the source to the observer.
(d) is due to slowing down of time near heavy stars and galaxies.

Q13 Part A-1

Planetary scientists are interested in the study of asteroids because asteroids are

(a) numerous and can easily be found anywhere and hence help to study stability of orbits.
(b) chemically undifferentiated due to their smaller mass and hence chemical composition of solar system can be determined.
(c) chemically volatile and reflect lot of light, hence can tell us more about their orbits.
(d) less massive and hence have very stable orbits.

Q14 Part A-1

In a true scale model of the Solar system, the Earth's size is represented by a one-rupee coin (diameter approximately 2.2 cm). At what average distance can the Jupiter be placed from this one-rupee coin?

(a) 12.2 km (b) 1.22 km (c) 122 m (d) 12.2 m

Q15 Part A-1

Period of satellite Io around the planet Jupiter is 42.5 hours. It is tidally locked to Jupiter. Period of Jupiter around the Sun is 11.86 years while period of its rotation is 9 h 56 m. An observer located on the Equatorial region of Io, is seeing Jupiter almost overhead while the Sun on the Eastern horizon. In how much minimum time will she see the Sun on her Western horizon?

(a) 4.96 hours
(b) 21.25 hours
(c) 5.93 years
(d) Sun will not change position in the sky

Q16 Part A-1

Brightness of celestial object is given in magnitude. If the flux of energy received from two objects are l_1 and l_2, then their magnitudes (m_1 and m_2 respectively) are related to fluxes as $m_2 - m_1 = -2.5 \log (l_2/l_1)$. A space probe from a distance of 50 pc is observing transit of Jupiter in front of the Sun. How much will be the change in magnitude when Jupiter's disc is fully in front of the Sun? Assume Sun's disc is uniformly bright. Sun's diameter is 109 times diameter of the Earth and Jupiter's diameter is 11 times that of the Earth.

(a) 0.01 (b) 0.02 (c) 0.04 (d) 0.5

Q17 Part A-1

A student applies various voltages (V) across a resistor and measures corresponding currents (I). She then plots the graph of I (1 cm as 1 mA on Y axis) and V (1 cm as 1 V on X axis). The best fit line makes an angle of 71 degrees ± 1 degree with voltage axis. The value of resistor can be determined as

(a) 344 ± 5 Ω (b) 344 ± 20 Ω (c) 2.90 ± 0.04 kΩ (d) 2.90 ± 0.16 kΩ

Q18 Part A-1

Weight of a cubical block is measured to be 360 gram force with a spring balance having least count of 20 gram force. Side length of the block, measured with least count of 1 mm, is equal to 13.6 cm. Calculation of pressure developed by the block on a table would have the uncertainty of

(a) 3 %
(b) 5 %
(c) 7 %
(d) will depend on size of the table

Q19 Part A-1

A truck of length 17 m is running on a straight highway with uniform speed of 60.0 km/hr. A car of length 3 m is running with zero acceleration on a track parallel to that of the truck. The car takes 3.6 seconds to completely overtake the truck. The speed of the car must be

(a) 20 km/hr (b) 71 km/hr (c) 80 km/hr (d) 82 km/hr

Q20 Part A-1

A circular loop of radius R has N closely wound turns of a wire carrying current I. It is suspended vertically in a region of horizontal magnetic field of strength B in such a way that its area vector makes an angle of 30 degrees with the magnetic field. Keeping the perimeter of the loop same if it is made into square shape,

(a) If the angle between area vector and B is increased to 60 degrees without changing N, I and B the amount of torque will decrease.
(b) With the same N and I, to get the same amount of torque, angle between area vector and B should be increased without changing the magnitude of B.
(c) With the same N, I and orientation of the loop, torque developed will increase if magnitude of B is decreased.
(d) With the same N and orientation of the loop, to get the same torque developed, current I and magnitude of B should be decreased.

Q21 Part A-1

Consider following statements:
Statement I: During heavy winters ponds freeze from top.
Statement II: Volume of water increases on heating as well as cooling starting at 4 degrees C.
Which of the following is correct conclusion.

(a) Both the statements are correct and statement II is the correct reason for statement I.

(b) Both the statements are correct but statement II is not the correct reason for statement I.

(c) Only statement I is correct.

(d) Only statement II is correct.

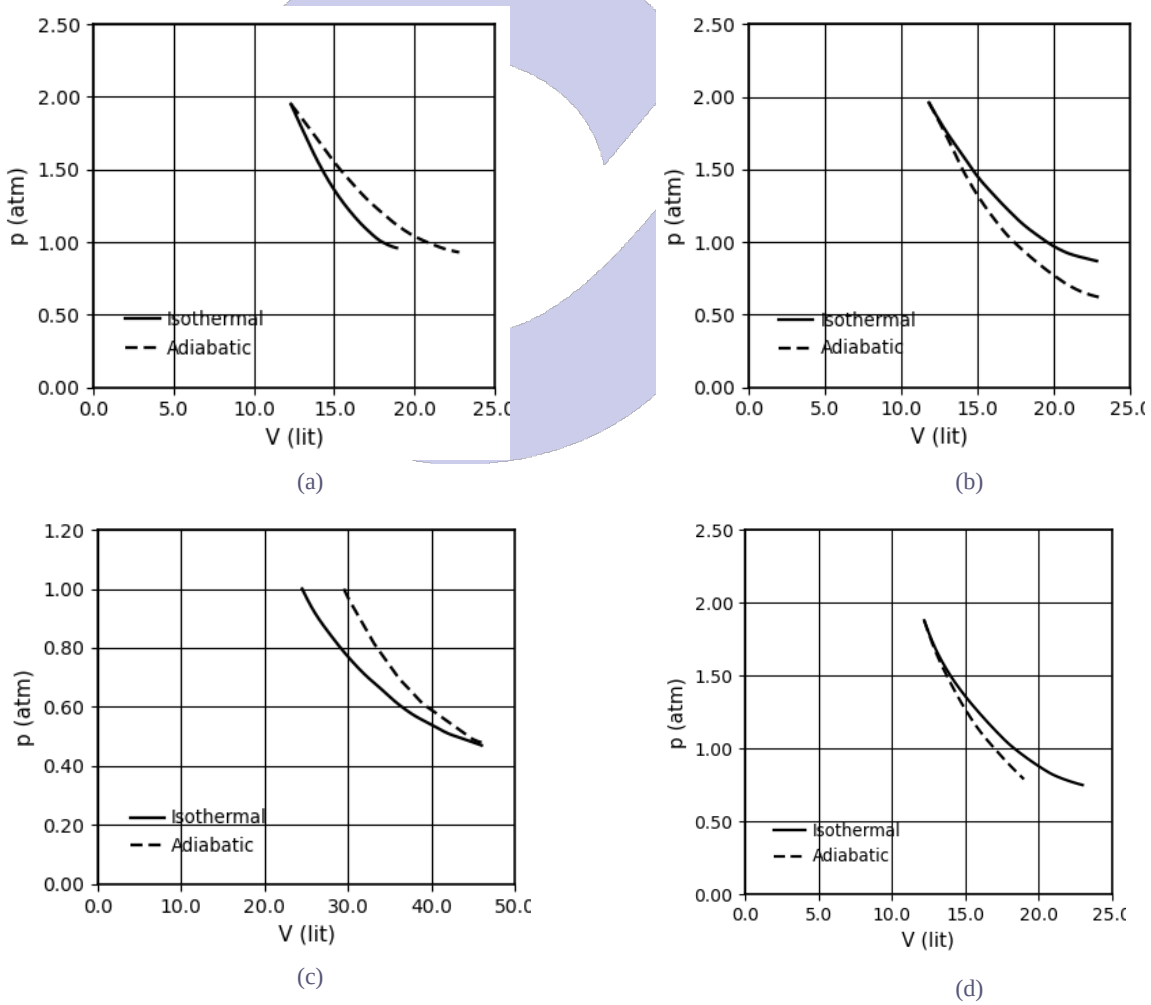
Q22 Part A-1

A moving coil galvanometer with a coil having resistance R_G, is being used as a current meter, connecting a shunt resistance $R_S << R_G$ parallel to the coil. The galvanometer now works with current sensitivity of 1 rad/microampere. Magnetic field of the MCG is now doubled and a resistance of 100 kΩ >> R_G is connected in series with its coil so that it can be used as a voltmeter. Voltage sensitivity of this voltmeter would be,

(a) 20 rad/mV (b) 2.0 rad/mV (c) 0.20 rad/mV (d) 0.020 rad/mV

Q23 Part A-1

A reversible process is an infinitesimally slow process that can be reversed without leaving any change in the system. One mole of air at STP is compressed isothermally and reversibly to one-half of the original volume. It is then expanded adiabatically and reversibly to its original pressure. Which of the following graphs correctly shows these processes? *Figure: Four p-V graphs labelled (a) to (d). In each, pressure in atm is on the vertical axis and volume in litres on the horizontal axis, with a solid isothermal curve and a dashed adiabatic curve through the compressed state.*



Figures for Q23, options (a) to (d).

(a) Graph (a) (b) Graph (b) (c) Graph (c) (d) Graph (d)

Q24 Part A-1

Two rays A and B are light waves of equal wavelength λ and they are in phase. Ray A gets reflected at three mirrors and ray B at two mirrors as shown in the figure. Distance between consecutive reflecting faces for A is L_1 and that for B is L_2 such that $L_2 = L_1/3$. The smallest value of L_1 giving A' and B' in phase is *Figure: Ray A enters from the left and zigzags through three mirrors before leaving as A', with the distance between one reflecting face and the next equal to L_1. Ray B reflects off two mirrors and leaves as B', with face spacing $L_2 = L_1/3$.*

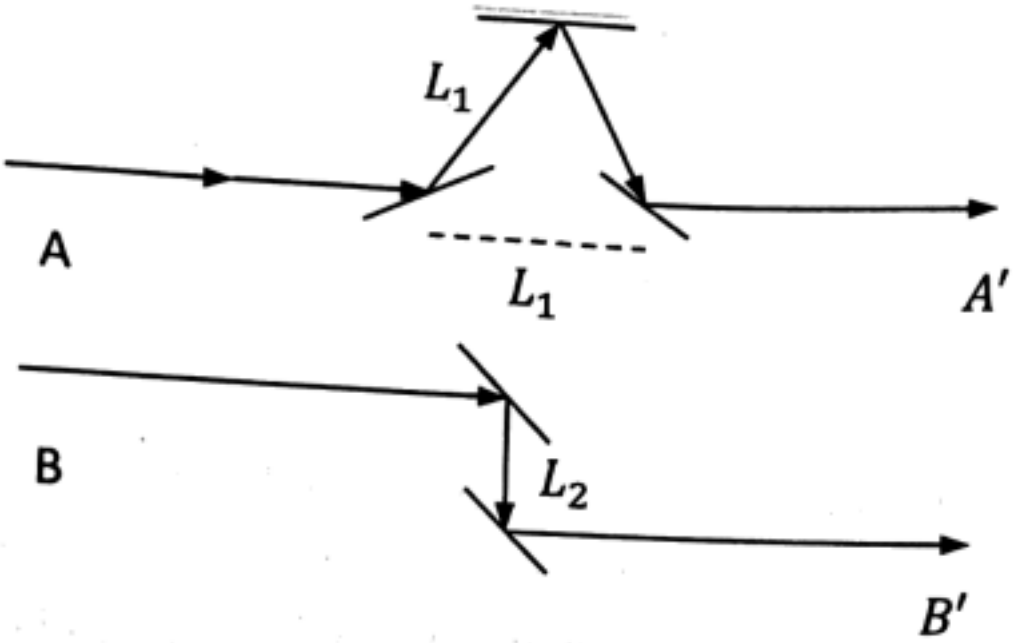


Figure for Q24.

(a) 3λ/4 (b) 3λ/5 (c) 3λ/10 (d) 3λ/15

Q25 Part A-1

When a person of average height stands on a smooth surface with clear horizons, the approximate distance to the horizon from the person is

(a) 500 km (b) 50 km (c) 15 km (d) 5 km

Q26 Part A-1

Imagine a new scale for measuring sound energy is designed. In this scale, 1 μJ energy incident per unit second per square meter, is denoted as 0 sonus. Every increase of 4 sonus increases the sound energy by 100 times. Two identical sound sources of rating 3.2 sonus are played simultaneously. It was observed that one of them has its frequency slightly shifted, so they create beats. What will be the highest level of beats?

(a) 3.2 sonus (b) 3.8 sonus (c) 4.4 sonus (d) 6.4 sonus

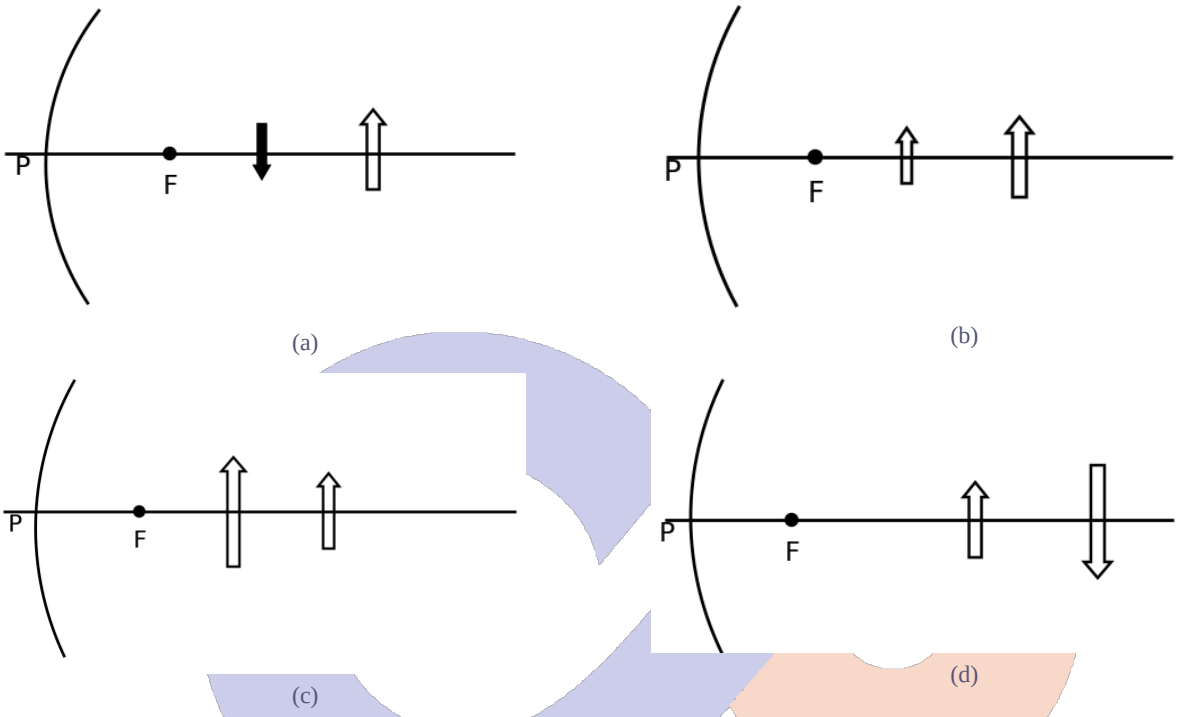
Q27 Part A-1

A radioactive sample of Na-24 used for irradiation of a patient is prepared exactly 6.0 hrs before it is to be used for a patient. It has half-life of 14.96 hrs. If it is expected to have activity of 40 kBq at the start of the treatment, what should be its mass when it is prepared?

(a) 5.90×10^{-4} μg (b) 2.46×10^{-5} μg (c) 3.94×10^{-6} μg (d) 1.64×10^{-7} μg

Q28 Part A-1

A caterpillar is in front of a concave mirror of focal length f as shown in the diagram. It is located at a distance of 2.5 f from the pole of the mirror and its height, perpendicular to the axis is 1.2 cm. Select the correct image of caterpillar for this situation. Caterpillar is shown with an upright arrow at the same location in all images. The other arrow is the image. *Figure: Four panels (a) to (d). Each shows the concave mirror with pole P, focus F marked on the axis, the tall upright object arrow on the right, and a second arrow for the image. In (a) the second arrow is short and inverted, between F and the object. In (b) both arrows are upright. In (c) both arrows are tall and upright. In (d) the object arrow is upright and the second arrow is tall and inverted, far to the right.*



Figures for Q28, options (a) to (d).

(a) Panel (a): short inverted arrow between F and the object
(b) Panel (b): two upright arrows
(c) Panel (c): two tall upright arrows
(d) Panel (d): tall inverted arrow far to the right

Q29 Part A-1

A proton moves in variable electric field as shown in the graph. If original speed of proton is 2.00 km/s, what is its final speed? *Figure: Graph of electric field E in V/m (vertical axis, 0 to 30.0) against distance d in cm (horizontal axis, 0.0 to 16.0). E rises from 0 at d = 0 to about 12 at d = 2 cm, about 21 at d = 6 cm, peaks near 24 V/m at d = 8 cm, then falls to about 19 at d = 11 cm, about 6 at d = 13 cm, and back to 0 near d = 14.5 cm.*

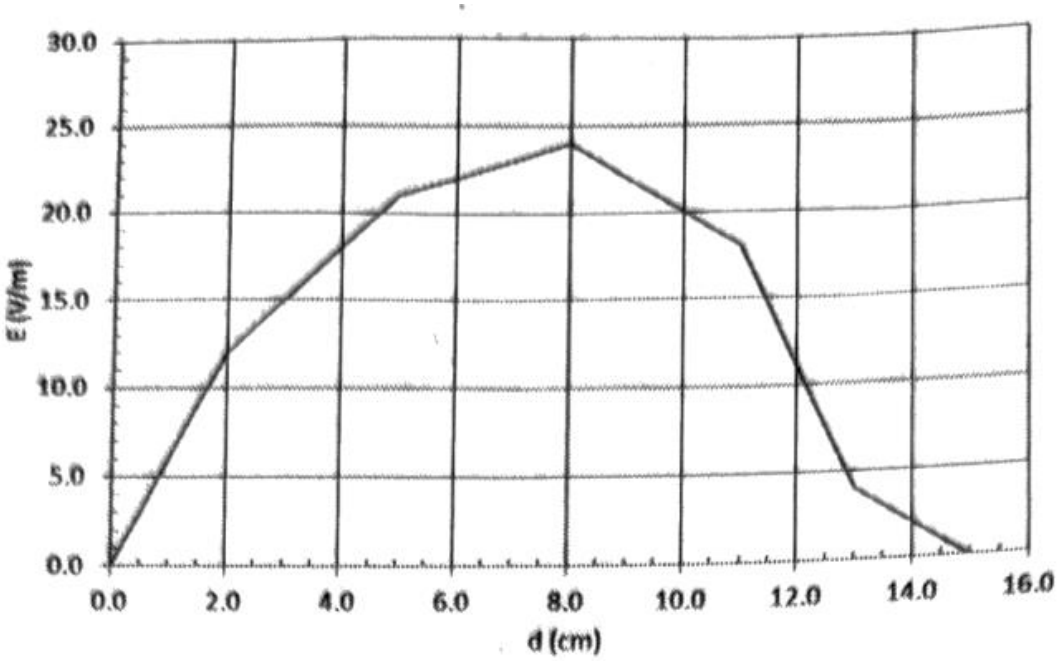


Figure for Q29.

(a) 22.4 km/s (b) 20.5 km/s (c) 205 km/s (d) 880 km/s

Q30 Part A-1

A compressor designed to compress air is used to compress Helium instead of air near room temperature. Select correct statement regarding the functioning of this compressor with Helium. When the compressor is used for the same gauge reading, it will

(a) be overheated (b) develop less pressure than that for air

(c) be cooled (d) compress the gas to smaller volume

Q31 Part A-1

An athlete weighing 60 kg has participated in hammer throw. Weight of the hammer is 4.0 kg. It is connected to a non-stretchable wire. The distance between grip and the hammer head is 1.16 m. At the time of releasing the hammer, athlete stretches her hands such that the grip of the hammer is at 32 cm from the axis of rotation. To achieve the linear velocity of 27 m/s, the centrifugal force on the hammer and the time it should complete each rotation is,

(a) 36496 N, 0.36 s (b) 30512 N, 0.27 s (c) 1970 N, 0.34 s (d) 1906 N, 0.27 s

Q32 Part A-1

An astronomical telescope with a primary mirror of 600 mm focal length is focussed for distant object using an eyepiece of focal length 15 mm. When a concave lens of 30 mm focal length is introduced between the primary and eyepiece to triple magnification of the system by what distance eyepiece needs to be shifted when focussed for distant object?

(a) 15 mm (b) 30 mm (c) 40 mm (d) 45 mm

Q33 Part A-1

If $\alpha, \beta, \gamma \in (0, \pi/2)$ such that $\tan\alpha + \tan\beta + \tan\gamma = \tan\alpha \tan\beta \tan\gamma$, then the value of $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + 2\cos\alpha\cos\beta\cos\gamma$ is

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

Q34 Part A-1

If the determinant | 1+x 1 1 ; 1 1+y 1 ; 1 1 1+z | = 0, and xyz ≠ 0; then 1/x + 1/y + 1/z equals

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

Q35 Part A-1

The sum from k = 1 to n of 1 / [k (k + 1)(k + 2)] equals

(a) 1/4 + 1 / [2 (n + 1)(n + 2)] (b) 1/4 - 1 / [2 (n + 1)(n + 2)] (c) 1/2 - 1 / [(n + 1)(n + 2)] (d) 1 / [2 (n + 1)]

Q36 Part A-1

The area (in appropriate units) enclosed by $y = x^3 - 4x + 3$ and $y = 3 - x$ is

(a) 3/2 (b) 9/2 (c) 6 (d) 9

Q37 Part A-1

If $a_n = 1 / (\sqrt{n} + \sqrt{n+1})$, then the sum of a_n from n = 1 to 99 equals

(a) 9 (b) 10 (c) $\sqrt{99} - 1$ (d) 11

Q38 Part A-1

If $f(x) = x^x$, then f'(1) = ?

(a) 0 (b) 1 (c) 2 (d) e

Q39 Part A-1

The number of 5 digit numbers formed using 1, 2, 3, 4, 5 without repetition and divisible by 6 is

(a) 24 (b) 36 (c) 40 (d) 48

Q40 Part A-1

A number is chosen randomly from 1, 2, 3, ..., 100. The probability that it is divisible by neither 2 nor 5 is

(a) 2/5 (b) 1/2 (c) 3/5 (d) 5/2

Q41 Part A-1

If $z + 1/z = 2$, $z \neq 0$ and $z \in C$, then $z^{2026} + 1/z^{2026}$ equals

(a) 0 (b) 1 (c) 2 (d) 2026

Q42 Part A-1

The number of solutions of $\sin x + \sin 2x + \sin 3x = 0$ in $[0, 2\pi]$ is

(a) 4 (b) 5 (c) 6 (d) 7

Q43 Part A-1

If an integer n leaves remainder 1, when divided by 2 and 3, then $n^2 - 1$ is always divisible by

(a) 6 (b) 13 (c) 24 (d) 36

Q44 Part A-1

Consider $f(x) = \sin^{-1}(\sin x) + \cos^{-1}(\cos x)$ for $x \in [-\pi, 2\pi]$. Which of the following correctly describes f ?

(a) f(x) = 2x for all $x \in [-\pi, 2\pi]$.

(b) f is piecewise linear and takes the value π on the interval $[\pi/2, \pi]$.

(c) $f(x) = 0$ for all $x \in [0, \pi]$.

(d) The range of f on $[-\pi, 2\pi]$ is $[0, 2\pi]$.

Q45 Part A-1

Bag X contains 3 red and 4 black balls; Bag Y contains 5 red and 3 black balls. One ball is transferred at random from X to Y, and then one ball is drawn at random from Y. The probability that the drawn ball is red equals:

(a) 38/63 (b) 5/9 (c) 37/63 (d) 17/28

Q46 Part A-1

The maximum area of a quadrilateral with sides 1.0 cm, 4.0 cm, 7.0 cm, 8.0 cm is

(a) $\sqrt{(799)}$ cm^2 (b) 3.5 cm^2 (c) 18.0 cm^2 (d) 11.06 cm^2

Q47 Part A-1

A sequence is defined by $a_1 = 1$, $a_{n+1} = a_n + 1/a_n^2$. Choose the correct option from the following.

(a) $\lim a_n = 0$ as n tends to infinity

(b) $\lim a_n$ is a finite number as n tends to infinity

(c) $a_{3000} > 30$

(d) $a_{3000} < 30$

Q48 Part A-1

Consider the following functional equation for a real valued function on real numbers: $f(x + y) + f(x - y) = 2f(x)f(y)$, and f is not identically zero function. Choose the correct option from the following:

(a) f is an odd function

(b) f is always differentiable on the set of real numbers

(c) f is always a periodic function

(d) $f(0) = 1$

Q49 Part A-2

A current carrying conductor is kept horizontal along North - South. It carries current from South to North. A small magnetic needle, free to rotate about vertical axis can be held in the neighbourhood of the conductor. If the needle is held

PART A-2

(a) above the conductor, its North pole deflects towards East.

(b) below the conductor, its South pole deflects towards East.

(c) East of the conductor in the same horizontal plane, North pole deflects towards East.

(d) West of the conductor in the same horizontal plane, South pole deflects towards East.

Q50 Part A-2

A charge given to a solid copper sphere, kept on insulator stand, distributes uniformly on its surface only. Which of the following principles is/are involved in this fact?

(a) Like charges repel each other.

(b) Copper is a good conductor.

(c) Shape of the conductor is sphere.

(d) Every system tries to minimize its potential energy.

Q51 Part A-2

Assume Earth as a sphere with density radially increasing from surface (3 g/cc) to the core (>15 g/cc). Which of the following statements is/are correct statements?

(a) Gravitational field at height h above the surface will never be greater than field on the surface.

(b) Gravitational field at some depth d below the surface can be greater than field on the surface.

(c) Gravitational potential will always decrease as one moves towards the centre from surface.

(d) Gravitational potential near the centre of the Earth can be taken zero for calculations.

Q52 Part A-2

If the Planck's constant increases by 1 order of magnitude and speed of light reduces by one order of magnitude, without changing any other constants, which of the following will hold true?

(a) Energy of hydrogen atoms will reduce by 2 orders of magnitude

(b) Wavelength of hydrogen spectral lines will increase by 2 orders of magnitude

(c) Electron's rest mass energy will reduce by 2 orders of magnitude

(d) Moment of inertia of diatomic molecules will increase by 2 orders of magnitude.

Q53 Part A-2

Let $a_n = x^n + 1/x^n$, where $x + 1/x = 3$. Which of the following are correct?

(a) $a_n = 3a_{n-1} - a_{n-2}$ (b) $a_2 = 7$ (c) $a_4 = 49$ (d) $a_6 = 322$

Q54 Part A-2

Let Δ be the determinant $| a+b\ c\ c\ ;\ c+a\ b\ a\ ;\ b+c\ a\ b |$. Which of the following are correct?

(a) $\Delta = 0$

(b) $a + b + c = 0$ implies $\Delta = 0$

(c) Δ changes sign, if a and b are interchanged

(d) Δ is divisible by $(a - b)$

Q55 Part A-2

Let a, b and c be the three non-coplanar vectors to define other three vectors p, q and r such that $p = (b \times c)/[a\ b\ c]$, $q = (c \times a)/[a\ b\ c]$ and $r = (a \times b)/[a\ b\ c]$, where $[a\ b\ c]$ is the scalar triple product. Which of the following is/are necessarily true?

(a) $a \cdot p + b \cdot q + c \cdot r = 3$ (b) $a \cdot q = 0$ (c) $[p\ q\ r] = 1/[a\ b\ c]$ (d) p, q, r are coplanar

Q56 Part A-2

An ellipse has foci at F_1 (1, 0) and F_2 (-1, 0) and passes through the point P $(1, 1/\sqrt{(2)})$. Which of the following are correct?

(a) $a^2 = 2$, $b^2 = 1$

(b) The eccentricity is $e = 1/\sqrt{(2)}$

(c) The length of the minor axis is 2

(d) The directrices of the ellipse are $x = \pm 2$

Q57 Part A-2

Inside the core of star,

(a) the p-p chain of nuclear fusion creates He from H in a solar mass or a less massive star

(b) the CNO cycle creates the nuclei of elements N and O

(c) all heavy nuclei till Fe are created if star is massive and evolved

(d) the triple α process creates the nuclei of C

Q58 Part A-2

For an observer located at the equator of the Earth, moving in an elliptical orbit around the Sun,

(a) duration between two sunrises is always the same

(b) the sun passes over zenith every 24 hours

(c) a star can rise twice on a particular date

(d) if two stars rise together, they also set together

Q59 Part A-2

Two planets, A and B, move around the same star with exactly the same time period. Planet A and planet B will

(a) always be exactly on opposite sides of the star

(b) sweep out exactly equal areas in equal intervals of time

(c) always have the same distance of closest approach to the star

(d) have the same distance of farthest approach from the star

Q60 Part A-2

A hypothetical planet-star system, behaves exactly like the Earth-Sun system (rotation and revolution period of the planet are the same as that of Earth), with only one difference - the axis of the rotation of the planet is in the orbital plane.

(a) The star will appear always on the zenith to the observer at north pole

(b) When the star sets (or rises) for the observer at the poles, the star will be at the zenith at mid-day for the observer at the equator

(c) The star will always appear at the horizon to the observer at the equator

(d) An observer on either of the poles of the planet will see the sun rise once and set once in one year cycle

ANSWER KEY

1. Disputed	**2.** (c)	**3.** (a)	**4.** (d)	**5.** (b)	**6.** (c)	**7.** (b)
8. (d)	**9.** (b)	**10.** (c)	**11.** (d)	**12.** (c)	**13.** (b)	**14.** (b)
15. (b)	**16.** (a)	**17.** (b)	**18.** (c)	**19.** (c)	**20.** (b)	**21.** (a)
22. (d)	**23.** (d)	**24.** (a)	**25.** (d)	**26.** (c)	**27.** (d)	**28.** (a)
29. (b)	**30.** (a)	**31.** (c)	**32.** (c)	**33.** (b)	**34.** (c)	**35.** (b)
36. (b)	**37.** (a)	**38.** (b)	**39.** (d)	**40.** (a)	**41.** (c)	**42.** (d)
43. Disputed	**44.** (b)	**45.** (a)	**46.** (c)	**47.** (d)	**48.** (d)	**49.** (a, b)
50. (a, b, c, d)	**51.** (a, b, c, d)	**52.** (a, b, c)	**53.** (a, b, d)	**54.** (b, c, d)	**55.** (a, b, c)	**56.** (a, b, c, d)
57. (a, c, d)	**58.** (c, d)	**59.** (b)	**60.** (b, d)			

Questions 1 and 43 carry no key: the published key contradicts its own solution. Check the official IAPT key for these questions.

