NSEA 2012-13

1) If all nuclear reactions in the sun now were to suddenly stop for ever, then
   a) Distances between planets and sun would decrease.
   b) Angular momentum of planets would increase.
   c) Inner planets will be engulfed by the sun.
   d) Speed of rotation of the sun would increase

Solution: (d) Since mass of sun remains same, there will be no change in its gravitational field. No change in distance, angular velocity and angular momentum. Sun will start collapsing since there is no outward radiation pressure to halt gravitational collapse. This leads to decrease in moment of inertial and hence increase in angular rotation due to conservation of angular momentum.

2) If 6 points out of 12 in a plane are in the same straight line then the number of triangles formed by joining these points is

a) 185 b) 200 c) 205 d) 180

Solution: (b)

3) The second person to put his feet on the moon is

a) Neil Armstrong b) Edwin Aldrin c) Michael Collins d) Lyndon Johnson

Solution: (b)

4) The number of divisors of 58212 (excluding 1 and the number itself) is

a) 70 b)72 c)74 d) 84

Solution:(a)

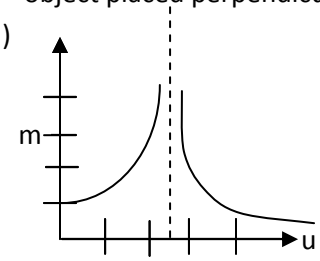
5) Distance of the moon from the earth is about

a) 1.3 light year b) 3.8 light minute c) 1.3 light second d) 4.6 light minute

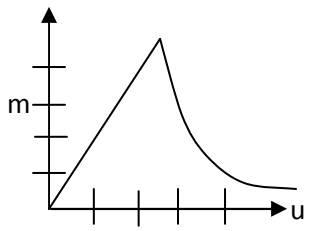
Solution: (c) $t = \frac{distance\ to\ moon\ rom\ earth}{speed\ of\ light} = \frac{3.844X10^8}{3X10^8} \approx 1.3s$

6) The variation of the magnitude of the magnification *m* with respect to the distance of a linear object placed perpendicular to the axis of a Convex lens is best represented by the diagram

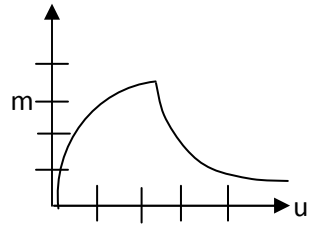
a)



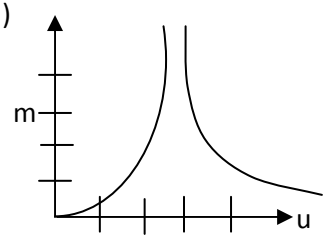
b)



c)



d)



Solution: (a) We know that $m = \frac{f}{u-f}$; When u=0 then m=1; When u=f then m = ∞ ; When u>f then m decreases continuously and becomes zero at u= ∞.

7) If x, 2x+2, 3x+3--------- are in geometric progression then the fifth term is

a) -9 b) $-\frac{27}{2}$ c) $-\frac{81}{4}$ d) $-\frac{36}{5}$

Solution: (c)

8) The areal velocity of the earth in the orbit around the sun is about (one astronomical unit is $1.5X10^{11}$m).

a) $2.8X10^{11}m^2s^{-1}$ b) $2.2X10^{15}m^2s^{-1}$ c) $1.1X10^{18}m^2s^{-1}$ d)$2.8X10^{13}m^2s^{-1}$

Solution: Areal velocity=$\frac{area}{period} = \frac{\pi(1.5X10^{11})^2}{365X86400} = 2.2X10^{15}\mathrm{m^2s^{-1}}$

9) Question Deleted

10) The number of vectors of unit length perpendicular to $\vec{a} = (1,1,0)$ and $\vec{b} = (1,1,1)$ is

a) None b) 0 c) two d) Infinite

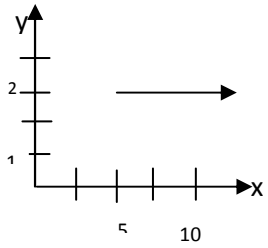
Solution: (c)

11) A particle of mass *m* is moving with a uniform velocity *v* along the line *v*=2 in the x-y plane. The angular momentum of the particle about the origin

a) Is zero b) steadily increases from its initial value of 2*mv*

c) steadily increases from its initial value of $\sqrt{29}mv$

d) remains constant equal to 2mv throughout its motion



Solution: (d) Angular momentum $\vec{L} = \vec{r}X(m\vec{v}) = mvXperpendicular\ distance\ from\ O = mvX2$

12) Three well known stars (a) Sirius (b) Betelgeuse and (c)Pole star are in respectively in the constellation

a) Orion, Sagittarius and Scorpios b) Orion, Taurus and Ursa major c) Canis major, Orion and Ursa minor d) Scorpios, Canes minor and Leo

Solution: (c)

13) If (1-tanx)(1+sin2x)=1+tanx, then

a) $x = n\frac{\pi}{4}, \frac{\pi}{4}$ b) $x = n\pi - \frac{\pi}{4},\ n\pi$ c) $x = n\pi + \frac{\pi}{4}, \frac{\pi}{4}$ d) $x = 2n\pi + \frac{\pi}{4}, 2n\pi$

Solution: (b)

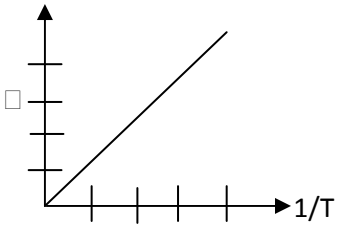
14) If a five digit number 4368x is divisible by 11, then x is

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

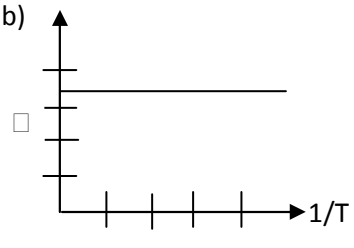
Solution: (a)

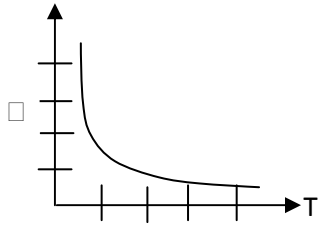
15) An ideal gas is at an initial temperature T and pressure P. If the pressure changes from P to P+dP when the temperature changes to T +dT at constant volume, the value of the pressure coefficient $\beta = \frac{1}{P}\frac{dP}{dT}$ varies with T as shown in the graph,

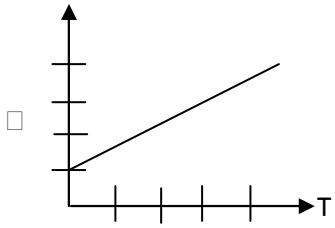
a)



b)



c) 

d) 

Solution: (a) PV=RT; $Vdp = RdT$; $\frac{RT}{P}dp = RdT$ or $\frac{1}{P}\frac{dp}{dT} = \frac{1}{T}$ that is $\beta = \frac{1}{T}$

16) The number of ways of arranging 8 men and 8 women around a table so that men and women sit alternatively is

a) $(8!)^2$ b) $(7!)^2$ c) (7!)(8!) d) 8!

Solution (c)

17) The wave length of H_α line from hydrogen discharge tube in a laboratory is 656 nm. The corresponding radiation received from two galaxies A and B have wavelengths of 648nm and 688nm respectively. Then

a) A is approaching the earth with a speed of $2.4X10^4$ kms^{-1}
b) B is approaching the earth with a speed of $1X10^4$ kms^{-1}
c) A is receding from the earth with a speed of $3.6X10^4$ kms^{-1}
d) B is receding the earth with a speed of $1.5X10^4$ kms^{-1}

Solution: (d); Apparent change in wavelength is due to Doppler effect $\frac{v}{c} = \frac{\Delta\lambda}{\lambda}$

$v = c\frac{\Delta\lambda}{\lambda}$; $v_a = 3X10^8\frac{656-648}{656} = 3.65X10^7 ms^{-1}$; $v_b = 3X10^8\frac{688-656}{656} = 1.5X10^7 ms^{-1}$

A is moving towards the earth and B is moving away from the earth.

18) On a full moon day spring tides (maximum rise of sea level) are observed at two places Chennai (P) and New York (Q) then the height of the sea level attains a

a) maximum at P and minimum at Q
b) minimum at Q and maximum at P
c) minimum at both Q and P
d) maximum at both Q and P

Solution: (d) Sea level rises to maximum level at all places during a full moon day or a new moon day.

19) One liter of water of density $1gcm^{-3}$ is mixed with certain amount of milk of density $1.05gcm^{-3}$. If the mass of the mixture is 5.0Kg, the volume of pure milk is

a) 3.5 liter b)3.8 liter c)3.0 liter d) 3.2 liter

Solution: (b) total mass = 5=1Kg of water +4Kg of pure milk; Volume of milk = $\frac{4.0}{1.05} = 3.8\ liter$

20) The center of the circle passing through (0,0) and (4,0) and touching $x^2+y^2=16$

a) (2,0) b) (0,2) c) (2,2) d) (2,4)

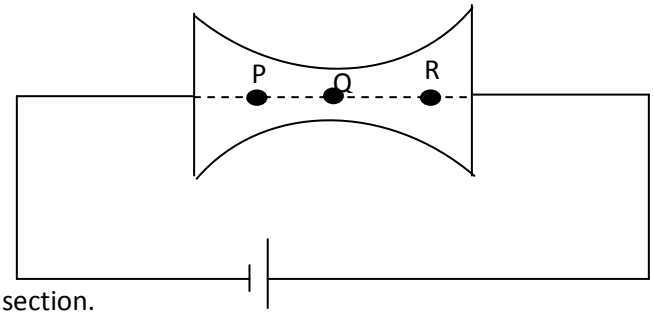
Solution: (a)

21) When $n!$ written in decimal system ends with exactly four zeroes, then the maximum value of n is

a) 20 b) 23 c) 24 d) 29

Solution: (c)

22) A conductor connected across the terminal of a cell of emf *V* is shown in the figure. I, J, v_d *and* μ represent the current, current density, drift velocity and mobility of the electron respectively then



a) $I_P = I_Q > I_R$

b) $J_Q > J_P > J_R$

c) $(v_d)_R < (v_d)_P < (v_d)_Q$

d) $\mu_P = \mu_Q > \mu_R$

Solution: (b) ; $J=nev_d$. $I=JA$; A is the area of cross section.

Total current passing through the conductor must be same at P, Q and R, therefore option (a) is wrong. Since $A_Q < A_P < A_R$. Therefore option (b) is correct and option (c) is wrong. The conductivity of the material which is constant Therefore option (d) is incorrect.

23) If a,b and c are in arithmetic progression, then the roots of the equation $ax^2 + 2bx + c = 0$ are

a) real and equal b) rational

c) real and may be irrational also d) imaginary

Solution: (b)

24) A satellite moving in a circular orbit at a height of 200km above the surface of the earth. If it is raised to an orbit at a height of 800 km above the surface of the earth, the correct statement is

a) Kinetic energy increases

b) Potential energy increases

c) Total mechanical energy decreases

d) Angular velocity increases

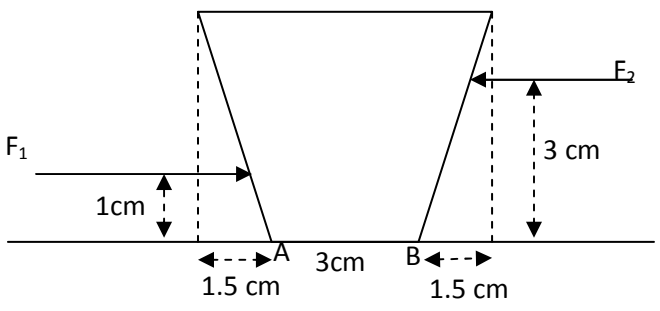
Solution: (b); In any orbit P.E $=\frac{-GMm}{R+h}$ $and\ K.E = \frac{GMm}{2(R+h)}; thus\ \ P.E = 2Total\ energy$; K.E= $|Total\ energy|$.

As ***h*** increases, the P.E and T.E increase (note the negative sign on them), while the K.E decreases. From Kepler's Law $T\alpha R^3$. Thus T.E increases and angular velocity decreases.

25) The number of 4 digit numbers that are divisible by 6 which can be formed by using the digits 1,3,4,6 and 7, no digit being used more than once in any number is

a) 18 b) 24 c) 36 d) 60

Solution: (a)



26) A solid of mass 6kg is kept on rough floor as shown in the figure. The coefficient of friction is 0.2. Indentify the correct statement.

a) F_2=32N acting alone, can tilt the object
b) F_2=10N acting alone can translate the object
c) F_1=40N acting alone can tilt the object
d) F_1=40N and F_2=30N acting together can translate the object

Solution: (a)

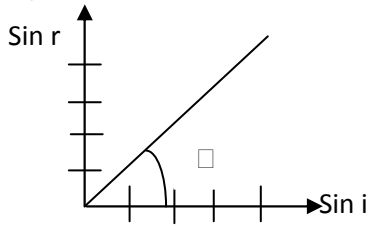
Consider only when F_2 is acting (F_1=0). Object will tilt if torque due to F_2 about axis passing through A is greater than the torque due to *mg* about A. $F_2X3 > 60X1.5$; implies $F_2 > 30N$. Thus option (a) is correct.

Similarly when F_2=0 and only F_1 is acting; we have $F_1X1 > 60X1.5$; implies$F_1 > 90N$. Thus option (c) is wrong.

The frictional force acting on the object =$\mu mg = 0.2X60 = 12$N. In option (b) F_2<12N hence it is incorrect. In option (d) F_1-F_2=10N is lesser than 12N and hence it is wrong.

27) A ray of light incident on the surface of a medium *X* at an angle i gets refracted into the other medium *Y* at an angle of refraction *r*. From the graph shown, the correct statement is

a) Speed of light in X is $\sqrt{3}$ times greater than in Y
b) Speed of light in Y is $\sqrt{3}$ times greater than in X
c) Total internal reflection will take place.
d) Refractive index increases with angle of incidence.



Solution: (b); $\frac{Sin(r)}{Sin(i)} = tan60 = \sqrt{3}; \frac{n_x}{n_y} = \frac{v_y}{v_x} = \sqrt{3}$; v_y=$v_x\sqrt{3}$; sinr>sini; Y is rarer medium. Thus total internal reflection may (not will) take place.

28) If $x = 3 - 2i$, then $x^2 - 7x + 13 =$

a) 0 b) $2i - 3$ c) $3 + 2i$ d) $-3 - 2i$

Solution: (b)

29) The locus of the point (x,y) which moves such that $\sin^{-1} 2x + \sin^{-1} y = \frac{\pi}{2}$ is

a) a circle b) a hyperbola c) a straight line d) an ellipse

Solution: (d)

30) If $f(x) = (x+1)(x^2+2)(x^3+3)(x^4+4)(x^5+5)(x^6+6)$, then $f'(-1) =$

a) 720 b) 540 c) 840 d) 360

Solution: (c)

31) If $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & -1 & -1 \\ 1 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$ then $A^{-1}B =$

a) $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ b) $\begin{bmatrix} 1 \\ 2 \\ -3 \end{bmatrix}$ c) $\begin{bmatrix} -1 \\ 2 \\ 3 \end{bmatrix}$ d) $\begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}$

Solution: (d)

32) A polar satellite at a height of about 600km above the earth makes 15 revolutions per day. It crosses a place P on the equator of longitude 80^0E at 9 am, it is moving from north to south. The time at which it crosses a place Q on the equator at 8^0E is

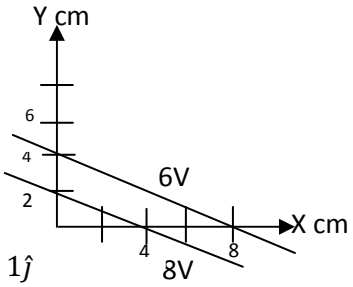
a) 1.48 pm IST
b) 10:0 am local time at Q
c) 11:24 am IST
d) 10:36 local time at Q

Solution: (a); Period of revolution of the satellite = 24/15=1.6 hour. If it makes *n* revolutions time taken is 1.6n hours. Earth rotates by an angle of 1.6nX15=24n towards east.

Time taken to rotate by 80-8=72^0 is 3 periods the satellite appears over Q, at 9 hr +4hr.48 min IST or 9 hour local time at Q.

33) Equipotential lines in a uniform electric field in the x-y plane at a certain place are shown in the diagram. Then

a) magnitude of the electric field is $\sqrt{2}$X10^2Vm^{-1}
b) magnitude of the electric field is 500Vm^{-1}
c) electric field vector is $\vec{E} = (0.5\hat{\imath} + 1.0\hat{\jmath})$Vm^{-1}
d) electric field at P is along PO.



Solution: (c); $E = -\frac{dV}{dr} = -\frac{\partial V}{\partial x}\hat{\imath} - \frac{\partial V}{\partial y}\hat{\jmath} = -\frac{-2}{4}\hat{\imath} - \frac{-2}{2}\hat{\jmath} = 0.5\hat{\imath} + 1\hat{\jmath}$

34) If $\log_4 5 = a,\ \log_5 6 = b,\quad then\ \log_3 2 =$

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

Solution: (a)

35) Question Deleted

36) A 70 kg box is dragged across floor by pulling on a rope attached to box inclined at 15^0 above horizontal. If coefficient of kinetic friction is 0.35, magnitude of initial acceleration is (take tension along the rope to be 300 N)

a) 4.3 ms^{-2} b) 1.1 ms^{-2} c) 9.8 ms^{-2} d) 0

Solution: b); Along the vertical $F_y = 300sin(15) + N - 70g = 0$; The normal force N = 608.35N. The frictional force is given by $f = \mu N = 0.35X608.35 = 212.9N$. along the horizontal $F_x = Fcos(15) - f = ma$ that is $a = \frac{300\cos 15 - 212.9}{70} = 1.097ms^{-2}$

37) A solid sphere of radius 60cm is melted and recast into a solid cylinder of height 7.2m. The diameter of this cylinder in cm is

a) 20 b) 40 c) 15 d) 80

Solution: (b)

38) If Q is the image of the point (2,-3) in the line 3x-4y+2=0, then the length of PQ=

a) 8 units b) 4 units c) 12 units d) 4$\sqrt{3}$ units

Solution: (a)

39) Question Deleted

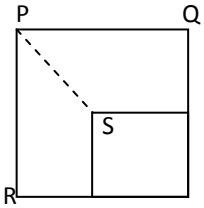
40) Question Deleted

41) For a square uniform metal plate 25% of it was cut. Rotational inertia of the plate through perpendicular axis about the three points shown in figure is

a) equal at points P, Q and R b) equal at points P, and R

c) equal at points R and Q d) equal at points P, and Q

Solution: c);



42) Which one of the following triplets cannot be the angles made by a line in space with the three coordinate axes?

a) $\left(\frac{\pi}{4},\frac{3\pi}{4},\frac{\pi}{2}\right)$ b) $\left(\frac{\pi}{4},\frac{\pi}{3},\frac{2\pi}{3}\right)$ c) $\left(\frac{\pi}{3},\frac{3\pi}{4},\frac{\pi}{3}\right)$ d) $\left(\frac{\pi}{4},\frac{\pi}{3},\frac{\pi}{4}\right)$

Solution: (d)

43) In a small village with a population of 2000 people, 950 take coffee, 825 take tea and 225 take both coffee and tea. The number of persons who take neither coffee nor tea is

a) 350 b) 450 c) 550 d) 650

Solution: (b)

44) The range of the function f(x)= $^{8-x}C_{x-3}$ is

a) $\{3,4,5\}$ b) $\{1,2,3,4\}$ c) $\{1,3,4\}$ d) $\{2,3,4\}$

Solution: (c)

45) Mean diameter of Mars and Earth are 6900 km and 13000km respectively. Mass of Mars is 0.11 times earth mass. Then the ratio of the mean density of Mars to that of earth is

a) 0.53 b) 0.74 c) 1 d) 0.81

Solution: b); Ratio of densities is $\frac{(m/r^3)_{mars}}{(m/r^3)_{earth}} = 0.11X\frac{13000^3}{6900^3} = 0.735$

46) The equation $y^2 = 4a(x+a)$ represents different parabolas for different values of a. All these parabolas have same

a) Vertex and focus b) focus and directrix

c) axis and vertex d) focus and axis

Solution: (d)

47) A loud speaker produces a musical sound by means of oscillations of a diaphragm whose amplitude is limited to 1.0 micrometer. The frequency at which magnitude of acceleration of diaphragm becomes equal to acceleration due to gravity is

a) 3127 Hz b) 399 hz c) 498 Hz d) 271 Hz

Solution: c); Maximum Acceleration of the diaphragm ; $a = (2\pi f)^2 A$. Thus

$f = \frac{1}{2\pi}\sqrt{\frac{9.8}{1X10^{-6}}}$=498.2Hz

48) A system is taken from initial state I to final state f along two paths. For path one heat supplied Q = 50 J and W = 20 J what is the work along path two if Q = 36J.

a) 36J b) 30 J c) 6 J d) 70 J

Solution: c); The change in internal energy remains constant for any path between the two states. Thus $Q_1 - W_1 = Q_2 - W_2$ That is $50 - 20 = 36 - W_2$. Thus W_2=6 J

49) A particle of charge 1C and another particle of charge 4C are held at separation of 9 cm on X- axis. Position of third particle of charge - 0.44C to be located on the same line if all three particles have to remain in same place is

a) 6cm from first particle b) 3cm from first particle
c) 3cm from second particle d) any position between the two particles

Solution: b); Let 0.44C charge be at a distance of x from 1C charge on the line joining 1C and 4C charges. For charge 0.44C to be in equilibrium is $\frac{1X0.44}{4\pi\varepsilon_0 x^2} = \frac{4X0.44}{4\pi\varepsilon_0(9-x)^2}$; $\frac{9-x}{x} = 2$. Thus x=3cm.

50) A 100 pF capacitor is charged to potential difference of 50 V and battery is disconnected. Now the capacitor is connected to an uncharged capacitor. If potential difference of first capacitor drops to 35 V, capacitance of second capacitor is

a) 50 pF b) 35 pF c) 40 pF d) 43 pF

Solution: d); Common potential after combining them in parallel, $V = \frac{C_1V_1}{C_1+C_2}$; $35 = \frac{100X50}{100+C_2}$; Thus C_2= 42.85 pF.

51) Question Deleted

52) Question Deleted

53) Question Deleted

54) A point object O is kept at a distance of $OP = u$. The radius of curvature of the spherical surface APB is $CP = R$. The refractive indices of the two medium are n_1 and n_2 which are as shown in the diagram. Then,

1) if $n_1 > n_2$, image is virtual for all values of u.
2) if $n_2 = 2n_1$, image is virtual when $R > u$.
3) the image is real for all values of u, n_1 and n_2.
Here, the correct statement/s is/are.

a) only 1 b) 1, 2 and 3
c) only 2 d) both 1 and 2

Solution: Ans (d); In the first case the surface acts like a concave surface (towards rarer medium) and hence real image cannot be formed. In the second case the surface behaves as a convex surface. The virtual image is formed if u<R.

55) Question Deleted

56) Question Deleted

57) Question Deleted

58) A variable capacitor in LC circuit has a range from 10 to 365pF. Ratio of the maximum frequency to minimum frequency is

a) 0.165 b) 6.0 c) 1 d)1.8

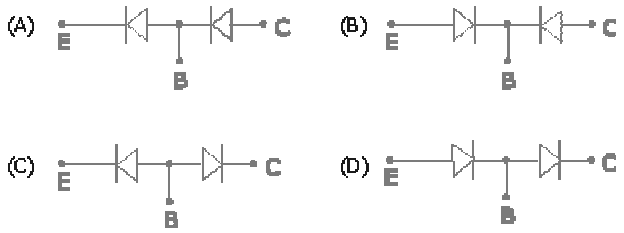
Solution: ans (b)

59) The kinetic energy of electron at which its de Broglie wavelength becomes equal to 590 nm is.

a) 4.33eV b) 33.5eV c) 4.33 eV d)4.36μeV

Solution: ans (d); $=4.36X10^{-6}eV$

60) An n-p-n transistor can be considered to be equivalent to two diodes, connected. Which of the following figures is the correct one?



Solution: Ans (c). In transistor the emitter-base junction is in forward bias and collector-base junction is in reverse bias.

61) Aldebaron the brightest star in the constellation Taurus rises at local time 7:00 pm on 1st of October. On November 1st the star will rise at

a) 5:00 pm b) 6:00 pm c) 9:00 pm d) 8:34 pm

Solution: a) Mean Stellar time period is 4 m lesser than mean Solar time period. As result star rises 4 m earlier than the previous day. In two months it will rise (4X30=120s) earlier. That is it will rise at 7-2=5:00pm

62) When astronaut observes Earth from moon he will see

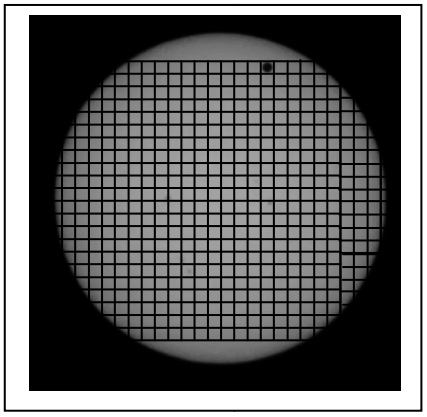
a) Earth rising in the west and setting in the east.

b) Earth neither setting nor rising but stays at one position through out.
c) Earth rising in the east and setting in the west.
d) Earth will have a complex motion, sometime rising in the east and sometime in the west.

Solution: b) From earth we can see only one face of the moon, since the rotational period of the moon around the earth is same as the period of its spin. Thus from the moon we earth appears to be at one position in the sky.

63) Question Deleted

64)The photograph of the Venus transit (seen as small dot) on June 6th 2012 is shown in the adjacent figure. Gridlines are drawn in front of the sun disc to measure the relative size of Venus with respect to Sun. If the mean distance to Earth and Venus from Sun are 1 AU and 0.72 AU respectively. An approximate value of the radius of Venus is (radius of sun is 6.9X10^{8}m)



a) 12.8X10^{6} m b) 8.05X10^{6} m
c) 2.38 X10^{6} m d) 18.98 X10^{6} m

Solution: b); With the help of the grid lines we can find the ratio of the angular size of Sun to that of Venus. This is equal to 24;

65) Question Deleted

66) Question Deleted

67) Solar constant is the amount of solar radiation incident on earth per unit area per second. Its mean value is given by 1.38kWm^{-2}. An important property of a star called Luminosity is defined as the amount of radiation emitted by star in one second. If the mean distance between earth and sun is 1.49X10^{11} km, the luminosity of sun is given by

a) 3.85X10^{26} W b) 4.85X10^{26} W c) 3.85X10^{25} W d) 6.56X10^{24} W

Solution: a): Solar constant is given by

68) An acceleration vector

a) Tells us how fast an object is going.
b) Is constructed from two velocity vectors.
c) Points in the direction of motion.
d) Is parallel or opposite to the direction of motion.

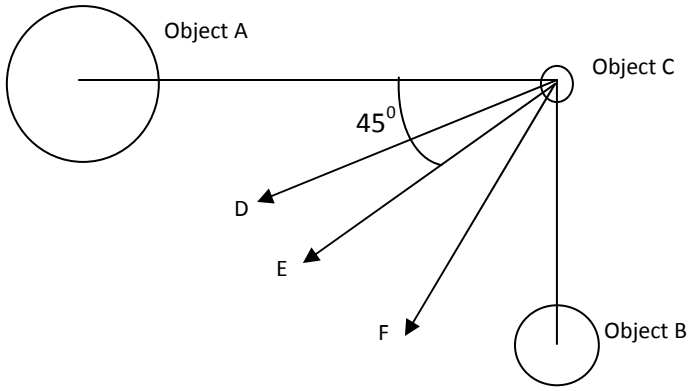
Solution: b): $\vec{a} = \frac{\vec{u}-\vec{v}}{t}$

69) Ram and his skate board have a combined mass of 50kg. Krishna and his skate board total to 100kg. Both of them are pushed with the same force. Ram is pushed for 2 seconds and Krishna for 1 second. After the pushes

a) Ram is moving twice as faster than Krishna.
b) Krishna is moving four times faster than Ram.
c) Both have the same speed.
d) Ram is moving four times faster than Krishna.

Solution: d); In case of Ram $FX2 = 50v_R$ and in case of Krishna $FX1 = 100v_k$; $v_R = 4v_k$

70) Object **A** has four times the mass of object **B.** The objects A and B are fixed in space and cannot move. The small object 'C' is located as shown in the figure at an instant of time t. Which arrow in the diagram best shows the direction in which 'C' would be accelerated by A and B at the instant under consideration due to their gravitational force?



a) Arrow D
b) Arrow E
c) Arrow F
d) Arrow D, E, F, depending on whether A/or B are also free to move.

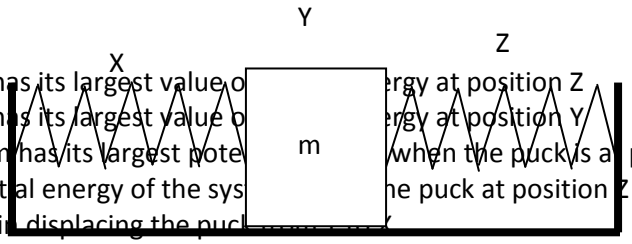
Solution: a); The force experienced by C due to A is more than that due to B. The resultant force should be closer to line OC.

71) If the distance *S* travelled by a particle in time *t* is proportional to the square root of its velocity, then its acceleration is

a) a constant b) proportional to S^3 c) b) proportional to S^2 d) proportional to $\frac{1}{S^3}$

Solution: (b)

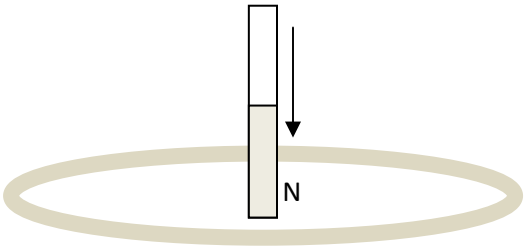
72) A frictionless puck of mass *m* mounted between identical springs as shown, can slide back and forth on the level frictionless surface. The springs have negligible mass relative to the mass of the puck. The puck is displaced by hand from its equilibrium position at Y to position X , at which point it is released from rest. It is then oscillates back and forth between positions X and Z. choose the correct statement about the oscillatory motion.



a) The puck has its largest value o ergy at position Z
b) The puck has its largest value o ergy at position Y
c) The system has its largest pote when the puck is a position Y
d) The potential energy of the sys e puck at position Z is not same as the work that was done in displacing the puck

Solution: b); Potential energy is maximum and equal at position X and Z. Kinetic energy is maximum at mean position Y.

73)If the north pole of a magnet is thrust downward into a horizontally oriented copper ring as shown in the following figure. The ring will experience



a) A downward force
b) An upward force
c) Zero force
d) A clock wise torque as seen from above

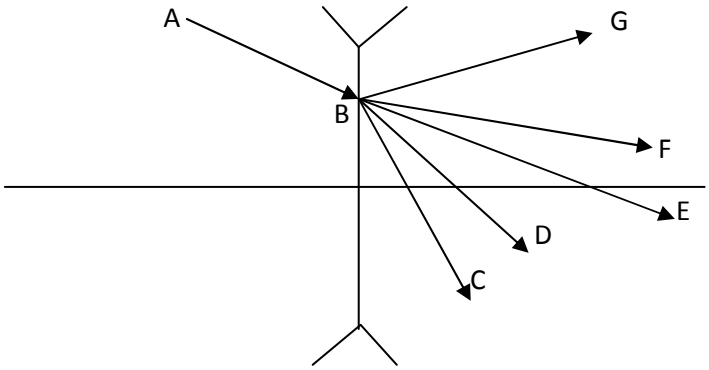
Solution: a); According to Lenz law, the induced current opposes the cause that is the movement of the magnet.

74) Which of the following mathematical expressions would most conveniently describe the standing wave pressure variation in an open pipe with respect to x and t as independent variables.

a) $\Delta P = \Delta P_m cos\left(\frac{2\pi x}{\lambda} + \omega t\right)$
b) $\Delta P = \Delta P_m sin\frac{2\pi x}{\lambda} sin\omega t$
c) $\Delta P = \Delta P_m cos\frac{2\pi x}{\lambda} sin\omega t$
d) $\Delta P = \Delta P_m sin\frac{2\pi x}{\lambda}$

Solution: b);

75)A diverging lens has principle foci at F_1 and F_2. A ray of light AB is incident from left at point B on the lens. The emerging ray is best represented by



a) May be Ray BC or BF
b) May be Ray BF or BG
c) May be Ray BE or BD
d) May Ray BG or BC

Solution:b); Since the lens is diverging.

76) A particle having initial velocity of $10ms^{-1}$ travels in a straight line. It experiences a retardation of $2ms^{-2}$. The distance traveled by the particle after 8s is

a) 16m b) 8m c) 34m d) 32m

Solution: c); The particle comes to rest momentarily at t=5s (0=10-2t). After this it starts moving in opposite direction. Thus distance traveled will not be equal to displacement. Distance traveled in 5 s is d_1=10X5+1/2 (-2)25=25m. The distance traveled in the remaining 3s d_2=1/2(2)9=9. Thus total distance = 25+9=34m

77) A spring has an unstretched length l and has force constant k, It is cut into two pieces of force contacts k_1 and k_2 such that the length of first piece l_1 is n times the length of second piece $l_2 (n > 1)$

(a) $k_1 = nk_2$ b) $k_2 = nk_1$ (c) $k_2 = (n+1)k$ d) $k_1 l_1 = k_2 l_2 = kl$

Solution: b and d); The spring constant is given by $k = \frac{YA}{l}$. Where Y is Young's modulus and A is cross sectional area. In this case Y and A is same for all the springs. Hence *kl* remains constant. Substituting $l_1 = nl_2$ gives answer (b)

78)A wire of length L_0 is supplied heat to raise its temperature by T. If γ is the coefficient of volume expansion of the wire and Y is the Young's modulus of the wire then the energy density stored in the wire is

(a) $\frac{1}{2}\gamma^2 T^2 Y$ (b) $\frac{1}{3}\gamma^2 T^2 Y$ (c) $\frac{1}{18}\frac{\gamma^2 T^2}{Y}$ (d) $\frac{1}{18}\gamma^2 T^2 Y$

Solution: a); The energy stored in the wire, when extended by ΔL is given by $E = \frac{1}{2}k(\Delta L)^2 = \frac{1}{2}\frac{YA}{L_O}(\Delta L)^2$

The change in length due to increase in the temperature T is given by $\Delta L = L_o\gamma T$; $E = \frac{1}{2}\frac{YA}{L_O}(L_O\gamma T)^2$; $\frac{E}{AL_O} = \frac{1}{2}\gamma^2T^2$

79) $\int \left(1+\frac{1}{x}\right)\left(1+\frac{1}{x+1}\right)\left(1+\frac{1}{x+2}\right)\left(1+\frac{1}{x+3}\right)------\left(1+\frac{1}{x+n}\right)dx =$

a) $loge^x x^{n+1} + C$ b) $log(x+n)^{n+1} + C$

c) $1 + (n+1)logx + C$ d) $x + (n+1)\log(x+n) + C$

Solution: (a)

80) In a grocery shop, there is a stock of 440kg of rice and 605 kg of dhal. They are to be packed in bags separately containing same quantity (weights) of rice or dhal. The minimum number of bags required to pack is

a) 19 b) 24 c) 22 d) 18

Solution: (a)

------ooOoo------