PHYSICS

BOOKS - CAREER POINT

UNIT TEST 1

Physics

1. If $x = a(\theta + \sin\theta)$ and $y = a(1 - \cos\theta)$, find dy/dx.

A. $\frac{\sin\theta}{1+\cos\theta}$

B. $\frac{\cos\theta}{1+\sin\theta}$

C. $\frac{1+\cos\theta}{\sin\theta}$

D. $\frac{\sin\theta}{1-\cos\theta}$

Answer: 1

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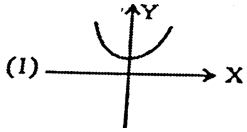
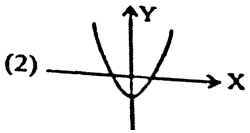
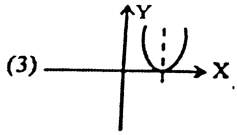
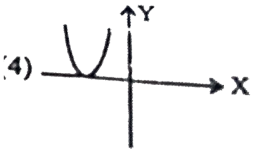
2. Correct graph of $y-1=x^2$ is -

A. 

B. 

C. 

D. 

Answer: 1

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3. $\int_2^5 \frac{1}{(2+3x)}dx$ is -

A. $\frac{15}{2}$

B. $\frac{7}{5}$

C. $\frac{1}{3}ln\frac{17}{8}$

D. $ln\frac{17}{8}$

Answer: 3

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4. A truck travelling due to north at $20ms^{-1}$ turns west and travels at the same speed. Find the change in its velocity.

A. 40 m/s N - W

B. $20\sqrt{2}$ m/s N - W

C. 40 m/s S - W

D. $20\sqrt{2}$ m/s S - W

Answer: 4

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5. The resultant of two vectors $\overrightarrow{P}$ and $\overrightarrow{Q}$ is $\overrightarrow{R}$. If the magnitude of $\overrightarrow{Q}$ is doubled, the new

resultant vector becomes perpendicular to $\overrightarrow{P}$.

Then, the magnitude of $\overrightarrow{R}$ is equal to

A. P + Q

B. P

C. P - Q

D. Q

Answer: 4

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6. In an equilateral triangle ABC, AL, BM, and CN are medians. Forces along BC and BA represented by them will have a resultant represented by

A. 2AL

B. 2BM

C. 2CN

D. AC

Answer: 2

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7. Write the dimensions of a/b in the relation $P = \frac{a - t^2}{bx}$, where P is the pressure, x is the distance, and t is the time.

A. $M^{-1}L^0T^{-2}$

B. ML^0T^{-2}

C. ML^0T^2

D. MLT^{-2}

Answer: 2

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8. If $E, M, J,$ and G , respectively , denote energy , mass , angular momentum , and gravitational constant , then $EJ^2 / M^5 G^2$ has the dimensions of

A. time

B. angle

C. mass

D. length

Answer: 2

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9. Out of the following the only pair that does not have identical dimensions is :

A. Angular momentum and Plank's constant

B. Moment of inertia and force

C. Work and torque

D. Impulse and momentum

Answer: 2

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10. The resistance $R = V/i$, where $V = 100 \pm 5V$ and $I = 10 \pm 0.2A$. What is the total error in R?

A. 5%

B. 7%

C. 5.2%

D. $\frac{5}{2}\%$

Answer: 2

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11. The period of oscillation of a simple pendulum in the experiment is recorded as $2.63s, 2.56s, 2.42s, 2.71s,$ and $2.80s.$ Find the average absolute error.

A. 0.1 s

B. 0.11 s

C. 1.0 s

D. 0.01 s

Answer: 2

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12. A body travels uniformly a distance of $(10.0 \pm 0.5m)$ in a time (2.0 ± 0.1) sec. The velocity of the body within error limits is :

A. (5.0 ± 0.6) m/s

B. (5.0 ± 0.5) m/s

C. (5.0 ± 0.05) m/s

D. (5.0 ± 1.0) m/s

Answer: 2

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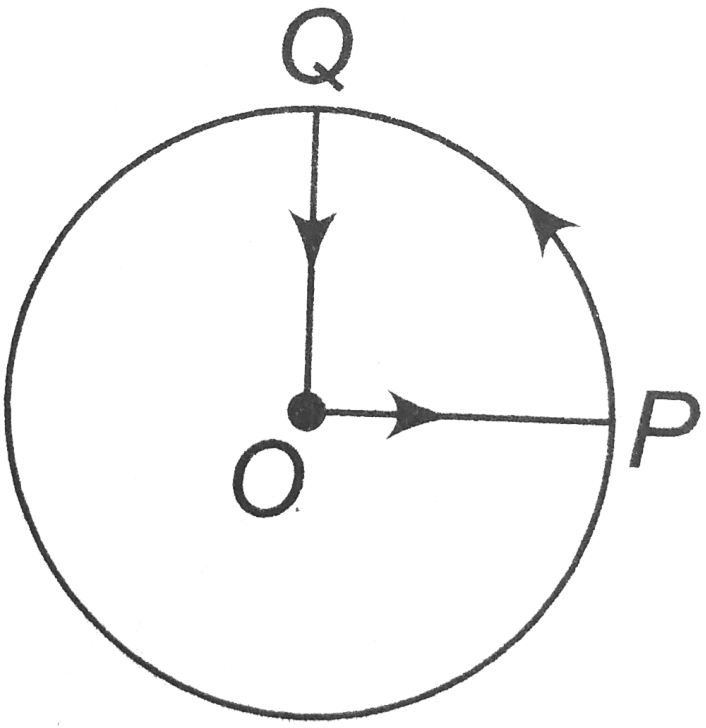
13. A cyclist starts from the centre O of a circular park of radius 1km, reaches the edge P of the park, then cycles along the PQ

cicumference and returns to the centre along OQ as shown in fig. If the round trip taken ten minute, the net displacement and average speed of the cylists (in kilometer and kinetic per hour) is



A. 0, 1

B. $\frac{\pi + 4}{2}, 0$

C. $21.4, \frac{\pi + 4}{2}$

D. 0, 21.4

Answer: 4

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14. A car , starting from rest, accelerates at the rate f through a distance S then continues at constant speed for time t and then

decelerates at the rate $\frac{f}{2}$ to come to rest . If the total distance traversed is $15S$, then

A. $S = \frac{1}{2}\text{ft}^2$

B. $S = \frac{1}{4}\text{ft}^2$

C. $S = \frac{1}{72}\text{ft}^2$

D. $S = \frac{1}{6}\text{ft}^2$

Answer: 3

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15. A boat which has a speed of $5km$ per hour in still water crosses a river of width 1 km along the shortest possible path in fifteen minutes. The velocity of the river water in km per hour is :-

A. 1

B. 3

C. 4

D. $\sqrt{(41)}$

Answer: 2

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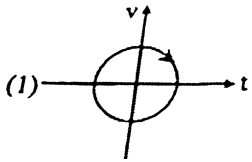
16. Look at the graphs (a) to (d) carefully and indicate which of these possibly represents one dimensional motion of a particle ?

A.



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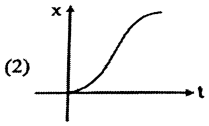
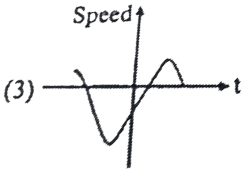
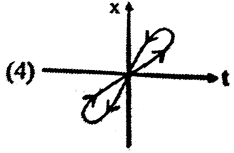


C.



D. 

Answer: 2

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17. A blind person after walking 10 steps in one direction, each oflength 80 cm, turns randomly to the left or to right by 90°. After walking a total of 40 steps,the maximum displacement of the person from its starting point can be :

A. 320 m

B. 32 m

C. $16/\sqrt{2}$ m

D. $16\sqrt{2}$ m

Answer: 4

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18. From a ballon rising vertically upwards at 5 m/s, a stone is thrown up at 10 m/s relative to

the balloon. Its velocity with respect to ground after 2 sec is - (assume g = 10 m/s^2)

A. 0

B. 20 m/s

C. 10 m/s

D. 5 m/s

Answer: 4

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19. A particle is released from rest from a tower of height 3h. The ratio of time intervals for fall of equal height h i.e. $t_1 : t_2 : t_3$ is :

A. $\sqrt{3} : \sqrt{2} : 1$

B. $3 : 2 : 1$

C. $9 : 4 : 1$

D. $1 : \left(\sqrt{2} - 1\right) : \left(\sqrt{3} - \sqrt{2}\right)$

Answer: 4

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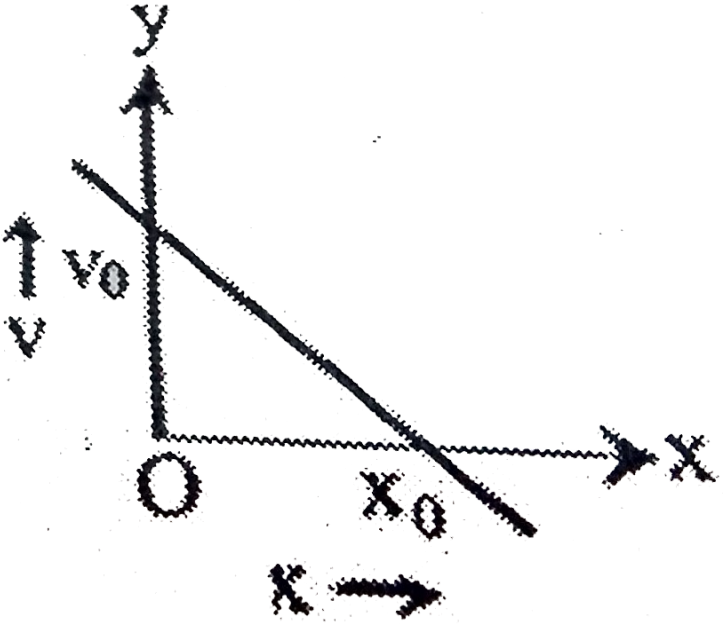
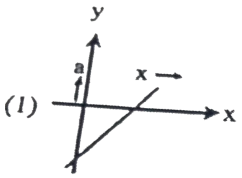
20. Depict the shown v-x graph in a-x graph :



A.



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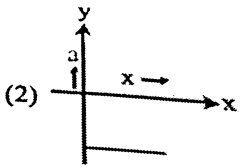
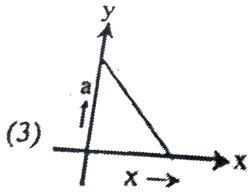
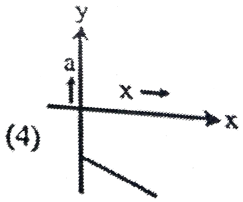


C.



D.



Answer: 1

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21. A body A starts from rest with an acceleration a_1. After 2 seconds, another body B starts from rest with an acceleration a_2. If

they travel equal distances in the 5^{th} second, after the start of A, then the ratio $a_1 : a_2$ is equal to :

A. $5:9$

B. $5:7$

C. $9:5$

D. $9:7$

Answer: 1

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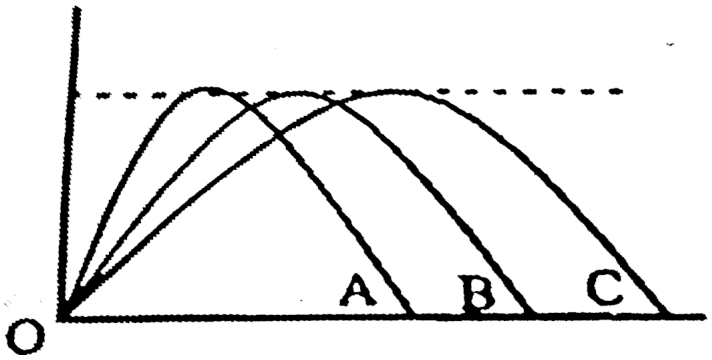
22. Three projectile A, B and C ar thrown from the same point in the same plane. Their trajectories are shown in the figure, Then which of the following statement is true -



A. the time of flight is the same for all the three

B. the launch speed is greatest for particle C

C. the horizontal velocity component is greatest for particle C

D. all of the above

Answer: 4

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23. A ball rolls off the top of a staircase with a horizontal velocity um/s. If the steps are h meter high and b meter wide, the ball will hit the edge of the nth steps, if:

A. $n = \frac{2hu}{gb^2}$

B. $n = \frac{2hu^2}{gb}$

C. $n = \frac{2hu^2}{gb^2}$

D. $n = \frac{hu^2}{gb^2}$

Answer: 3

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24. The friction of the air causes a vertical retardation equal to 10% of the acceleration due to gravity $\left(takeg = 10ms^{-2}\right)$ The maximum height will be decreased by:

A. $11\ \%$

B. $10\ \%$

C. $9\ \%$

D. $12\ \%$

Answer: 3

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25. A particle is projected with a velocity v such that its range on the horizontal plane is twice the greatest height attained by it. The range of the projectile is (where g is acceleration due to gravity)

A. $\frac{4v^2}{5g}$

B. $\frac{4g}{5v^2}$

C. $\frac{v^2}{g}$

D. $\frac{4v^2}{\sqrt{5}g}$

Answer: 1

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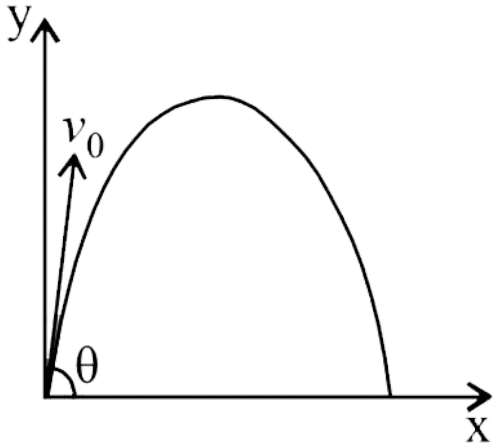
26. A small particle of mass m is projected at an angle θ with the x- axis with an initial velocity v_0 in the $x-y$plane as shown in the figure . At a time $t < \frac{v_0 \sin\theta}{g}$, the angular momentum of the particle is

where $\hat{i}, \hat{j}$ and $\hat{k}$ are unit vectors along x, y and z - axis respectively.



A. $-mgv_0t^2\cos\theta\hat{j}$

B. $mgv_0t\cos\theta\hat{k}$

C. $-\frac{1}{2}mgv_0t^2\cos\theta\hat{k}$

D. $\frac{1}{2}mgv_0t^2\cos\theta\hat{i}$

Answer: 3

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27. Two particles are projected simultaneously from the level ground as shown figure. They may collide after a time :

A. $\frac{x \sin \theta_2}{u_1}$

B. $\frac{x\cos\theta_2}{u_2}$

C. $\frac{x\sin\theta_2}{u_1\sin(\theta_2-\theta_1)}$

D. $\frac{x\sin\theta_1}{u_2\sin(\theta_2-\theta_1)}$

Answer: 3

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28. The trajectory of a projectile in a vertical plane is $y=ax-bx^2$, where a and b are constantsn and x and y are respectively horizontal and vertical distances of the

projectile from the point of projection. The maximum height height attained by the particle and the angle of projection form the horizontal are:

A. $\frac{b^2}{2a}, \tan^{-1}(b)$

B. $\frac{a^2}{b}, \tan^{-1}(2a)$

C. $\frac{a^2}{4b}, \tan^{-1}(a)$

D. $\frac{2a^2}{b}, \tan^{-1}(a)$

Answer: 3

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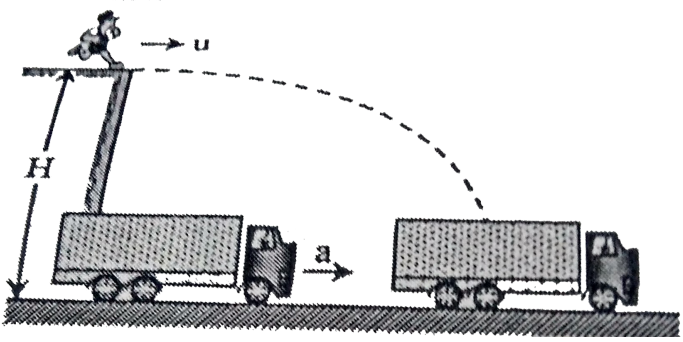
29. A stunt performer is to run and dive off a tall platform and land in a net in the back of a truck below. Originally the truck is directly under the plateform, it starts forward with a constant acceleration a at the same instant the performer leaves the plateform. If the platform is H above the net in the truck, then the horizontal velocity u that the performer

must have as he leaves the platform is -



A. $a\sqrt{2H/g}$

B. $a\sqrt{H/2g}$

C. $a\sqrt{g/2H}$

D. None of the above

Answer: 2

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30. A particle is projected from the ground with an initial speed of v at an angle θ with horizontal. The average velocity of the particle between its point of projection and highest point of trajectroy is :

A. $u\cos\theta$

B. $\frac{u}{2}\sqrt{1+\cos^2\theta}$

C. $\frac{u}{2}\sqrt{1+2\cos^2\theta}$

D. $\frac{u}{2}\sqrt{1+3\cos^2\theta}$

Answer: 4

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31. If the wavelength of photon emitted due to transition of electron from third orbit to first orbit in a hydrogen atom is λ then the wavelength of photon emitted due to transition of electron from fourth orbit to second orbit will be

A. $\frac{128}{27}\lambda$

B. $\frac{25}{9}\lambda$

C. $\frac{36}{7}\lambda$

D. $\frac{125}{11}\lambda$

Answer: A

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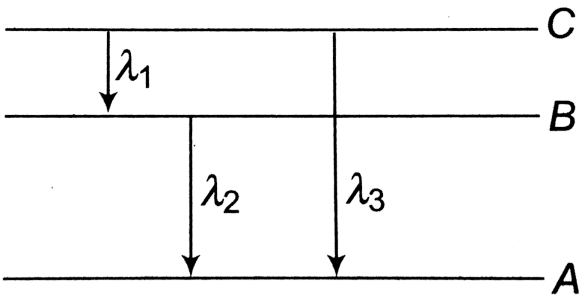
32. Energy levels A, B, C of a certain atom corresponding to increasing values of energy i.e., $E_A < E_B < E_C$. If $\lambda_1, \lambda_2, \lambda_3$ are the wavelengths of radiations correspnding to the

transitions C to B, B to A and C to A respectively, which o fthe following statements is correct?



A. $\lambda_3 = \lambda_1 + \lambda_2$

B. $\lambda_3 = \dfrac{\lambda_2 \lambda_1}{\lambda_1 + \lambda_2}$

C. $\lambda_1 + \lambda_2 + \lambda_3 = 0$

D. $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

Answer: B

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33. If, in a hydrogen atom, radius of nth Bohr orbit is r_n frequency of revolution of electron in nth orbit is f_n and area enclosed by the nth orbit is A_n , then which of the pollowing graphs are correct?

A. a,b

B. a,b,c

C. a,b,c,d

D. None of these

Answer: B

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34. A particle of mass m moves along a circular orbit in centrosymmetrical potential field $U(r) = kr^2/2$. Using the Bohr quantization condition, find the permissible orbital radii and energy levels to that particle.

A. $\frac{nh}{2\pi}\sqrt{\frac{K}{m}}$

B. $\frac{2nh}{\pi}\sqrt{\frac{K}{m}}$

C. $\frac{nh}{2}\sqrt{\frac{K}{m}}$

D. None of these

Answer: A

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35. In rutherford's experiment, the mumber of alpha-particles scattered through an angle of 90° is 28 per minute. Then,the number of

particles scattered through an angle of 60° per minute by the same nucleus is

A. 28 per minute

B. 112 per minute

C. 12.5 per minute

D. 7 per minute

Answer: B

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36. A Hydrogen atom and Li^{++} ion are both in the second excited state. If L_H and L_{Li} are their respective angular momenta, and E_H and E_{Li} their respective energies, then:

A. $l_H > l_{Li}$ and $E_H| > |E_{Li}|$

B. $l_H = l_{Li}$ and $|E_H| < |E_{Li}|$

C. $l_H = l_{Li}$ and $|E_H| > |E_{Li}|$

D. $l_H < l_{Li}$ and $|E_H| < |E_{Li}|$

Answer: B

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37. An e-m wave of wavelength λ is incident on a photo sensitive surface of negligible work function. If the photoelectrons emitted from this surface have the de-Broglie wavelength λ_1 . Find relation between $'\lambda'$ and $'\lambda_1$'-

A. $\lambda = \left(\frac{2mc}{h}\right)\lambda_1^2$

B. $\lambda = \left(\frac{mc}{2h}\right)\lambda_1^2$

C. $\lambda_1 = \left(\frac{2mc}{h}\right)\lambda^2$

D. None of these

Answer: A

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38. A 100 W light bulb is placed at the centre of a spherical chamber of radius 20cm. Assume that 60% of the energy supplied to the bulb is converted into light and that the surface of the chamber is perfectly absorbing. Find the pressure exerted by the light on the surface of the chamber.

A. $4.0 \times 10^{-6} Pa$

B. $4.0 \times 10^{-7} Pa$

C. $2.0 \times 10^{+7} Pa$

D. $4.0 \times 10^{+7} Pa$

Answer: B

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39. In Davisson-Germer experiment, the correct relation between angle of diffraction ϕ and glancing angle θ is-

A. $\theta = 90^\circ - \frac{\phi}{2}$

B. $\theta = 90^\circ + \frac{\phi}{2}$

C. $\theta = \frac{\phi}{2}$

D. $\theta = \phi$

Answer: A

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40. The longest wavelength that can be analysed by a sodium chloride crystal of spacing $d = 2.82\text{Å}$ in the second order is -

A. 2.82Å

B. 5.64Å

C. 8.46Å

D. 11.28Å

Answer: A

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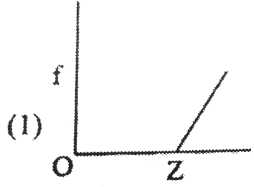
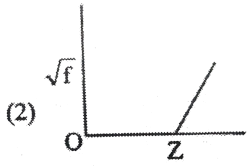
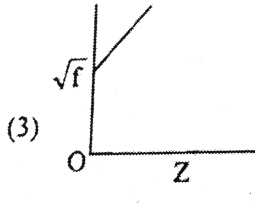
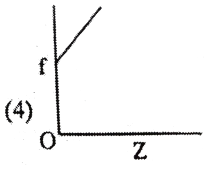
41. Identify the graph which correctly represent the Moseley's law-

A. 

B. 

C. 

D. 

Answer: B

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42. In X-ray tube , when the accelerating voltage V is halved, the difference between the wavelength of K_α line and minimum wavelength of continuous X-ray spectrum

A. remain constant

B. increases

C. becomes half

D. decreases

Answer: B

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43. Light of wavelength λ strikes a photoelectric surface and electrons are ejected with kinetic energy K. If K is to be increased to exactly twice its original value, the wavelength must be changed to λ' such that

A. $\lambda' < \lambda/2$

B. $\lambda > \lambda/2$

C. $\lambda > \lambda' > \lambda/2$

D. $\lambda' = \lambda/2$

Answer: C

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44. Photoelectric emission is observed from a metallic surface for frequencies v_1 and v_2 of the incident light rays $(v_1 > v_2)$. If the maximum values of kinetic energy of the photoelectrons emitted in the two cases are in the ratio of $1 : k$, then the threshold frequency of the metallic surface is

A. $\frac{v_1 - v_2}{n - 1}$

B. $\frac{nv_1 - v_2}{n - 1}$

C. $\frac{nv_2 - v_1}{n - 1}$

D. $\frac{v_1 - v_2}{n}$

Answer: B

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45. If K_1 and K_2 are maximum kinetic energies of photoelectrons emitted when light of wavelength λ_1 and λ_2 respectively are

incident on a metallic surface. If $\lambda_1 = 3\lambda_2$ then

A. $K_1 > \frac{K_2}{3}$

B. $K_1 < \frac{K_2}{3}$

C. $K_1 = 3K_2$

D. $K_2 = 3K_1$

Answer: B

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46. Given that a photon of light of wavelength 10,000 angstrom has an energy equal to $1.23eV$. When light of wavelengths 5000 angstrom and intensity I_0 falls on a photoelectric cell, the saturation current is 0.40×10^{-6} ampere and the stopping potential is 1.36 volt, then the work function is-

A. $0.43eV$

B. $1.10eV$

C. $1.36eV$

D. $2.47eV$

Answer: B

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47. In an α -decay, the kinetic energy of α-particles is $48MeV$ and Q value of the reaction is $50MeV$. The mass number of the mother nucleus is (assume that daughter nucleus is in ground state)

A. 96

B. 100

C. 104

D. none of these

Answer: B

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48. Carbon -14 decays with half-life of about $5,800$ years. In a sample of bone, the ratio of carbon -14 to carbon -12 is found to be $\frac{1}{4}$ of what it is in free air. This bone may belong

to a period about x centuries ago. Where x nearest to

A. 2×58

B. 58

C. $58 / 2$

D. 3×58

Answer: A

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49. A radioactive element decays by $\beta - emission$. A detector records n beta particles in $2s$ and in next $2s$ it records $0.75n$ beta particles. Find mean life correct to nearest whole number. Given ln $|2| = 0.6931$, ln $|3| = 1.0986$.

A. $17s$

B. $7s$

C. $5s$

D. $15s$

Answer: B

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50. Find the Q value of the reaction $P + .^{7} Li \rightarrow .^{4} He + .^{4} He.$ Determine whether the reaction is exothermic or endothermic. The atomic masses of $.^{1} H, .^{4} He$ and $.^{7} Li$ are $1.007825u, 4.002603u,$ and $7.016004u,$ respectively.

A. $17eV$

B. $17keV$

C. $17MeV$

D. $170MeV$

Answer: C

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51. A nuclear fission is represented by the following reaction: $U^{236} = X^{111} + Y^{122} + 3n$

If the binding energies per nucleon of

X^{111}, Y^{122} and U^{236} are $8.6MeV, 8.5MeV$ and $7.6MeV$ respectively, then the energy released in the reaction will be-

A. $200MeV$

B. $202MeV$

C. $195MeV$

D. $198MeV$

Answer: D

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52. The alongside is a plot of binding energy per nucleon E_b ,against the nuclear mass M,A,B,C,D,E,F correspond to different nuclei. Consider four reactions.

(i) A + B $\rightarrow$ C +ε (ii) C $\rightarrow$ A + B + ε

(iii) D + E $\rightarrow$ F + ε (iv) F $\rightarrow$ D + E + ε where ε is the energy released. In which reactions , is ε positive?

A. i and iv

B. i and iii

C. ii and iv

D. ii and iii

Answer: A

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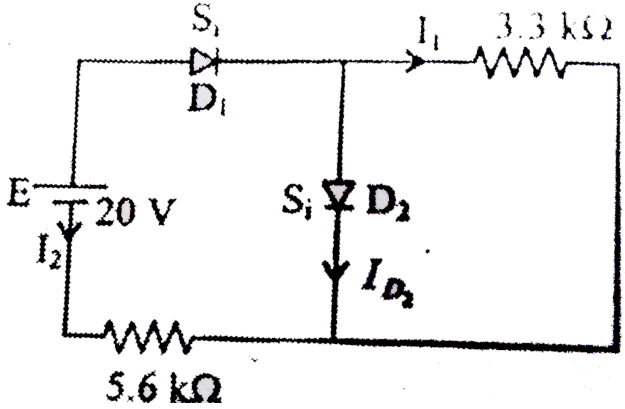
53. In the circuit shown in figure I_1, I_2 and I_{D_2} are respectively-



A. $0.212MA, 3.32mA, 3.108mA$

B. $2.12mA, 3.32mA, 3.108mA$

C. $0.212mA, 0.332mA, 3.108mA$

D. None of these

Answer: A

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54. In a common emitter amplifier, using output resistance of 5000 ohm and input resistance of 2000 ohm, if the input signal voltage is $10mV$ and $\beta = 50$, calculate output volatge & power gain

A. $1.25V, 6250$

B. $3V, 6250$

C. $1.5V, 3050$

D. None of these

Answer: B

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55. In semiconductor the concentrations of electron and holes are $8 \times 10^{18} / m^3$ and $5 \times 10^{18} / m$ respectively. If the mobilities of electrons and hole are $2.3 m^2 /$ volt-sec and $0.01 m^2 /$ volt-sec respectively, then semicondutor is

A. n-type and its resistivity is $0.34 \Omega - m$

B. p-type and its resistivity is $0.034 \Omega - m$

C. n-type and its resistivity is $0.034 \Omega - m$

D. p-type and its resistivity is $3.4\Omega - m$

Answer: A

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56. If $\alpha = 0.98$ and current through emitter $i_e = 20mA$, the value of β is

A. 4.9

B. 49

C. 96

D. 9.6

Answer: B

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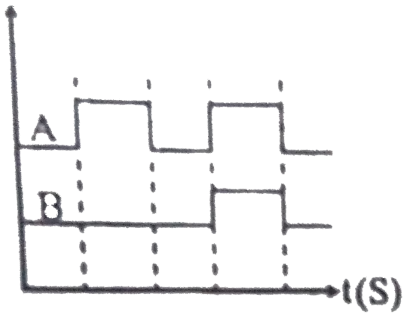
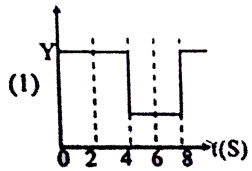
57. The real time variation of input signals A & B are as shown below. If the inputs are into NAND gate, then select the output signals

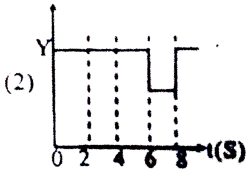
from the following-



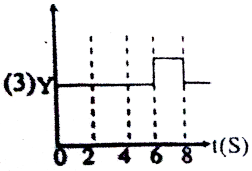
A.



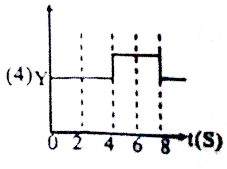
B.



C.



D.



Answer: B

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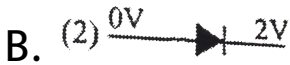
58. Which of the following is forward biased?

A. 

B. 

C. 

D. None of these

Answer: C

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59. If α and β are the current gain in the CB and CE configuration respectively of the transistor circuit, then $(\beta - \alpha)/\alpha\beta =$ .....

A. ∞

B. 1

C. 2

D. 0.5

Answer: B

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60. A screw gauge has a least count of 0.005 mm and its head scale is divided into 200 equal division. The distance between consecutive threads on the screw is:

A. $0.25mm$

B. $0.5mm$

C. $1.00mm$

D. $2.00mm$

Answer: C

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