SET NO -01

Exam ID | | | | | | |

Candidates must write the Set No. on the title page of the answer book.

DAV PUBLIC SCHOOLS, ODISHA ZONE-I

PA-II EXAMINATION, 2021-22

- **Check the question paper contains 8 printed pages.**
- **Set number given on the right hand side of the question paper should be written on the OMR SHEET by the candidate.**
- **Check that this question paper contains 55 questions.**

CLASS- XI

SUBJECT-PHYSICS (042)

Time- 90 Minutes **Maximum Marks – 35**

General Instructions:

1. ***The Question Paper contains three sections.***
2. ***Section A has 25 questions. Attempt any 20 questions.***
3. ***Section B has 24 questions. Attempt any20 questions.***
4. ***Section C has 6 questions. Attempt any 5 questions.***
5. ***All questions carry equal marks.***
6. ***There is no negative marking***.

c = 3×10^8 m/s

h = 6.63×10^{-34} Js

e = 1.6×10^{-19} C

$\mu_0 = 4\pi\times 10^{-7}$ Tm/Amp

$\varepsilon_0 = 8.854 \times 10^{-12} C^2 N^{-1} m^{-2}$

$\frac{1}{4\pi\varepsilon_o} = 9 \times 10^9 Nm^2 C^{-2}$

$m_e = 9.1 \times 10^{-31}$ kg

mass of neutron = 1.675×10^{-27} kg

Mass of proton = 1.673×10^{-27} kg

Avogadro's number = 6.023×10^{23} per gm mole

Boltzmann constant = 1.38×10^{-23} J/K

SECTION-A

This section consists of 25 multiple choice questions with overall choice to attempt any 20 questions. In case more than desirable number of questions is attempted, ONLY first 20 will be considered for evaluation.

Q1. The ratio of strength of gravitational force, weak force, electromagnetic force & nuclear force is

(A)$1:10^{13}:10^{36}:10^{38}$ (B) $1:10^{25}:10^{36}:10^{38}$

(C) $1:10^{25}:10^{42}:10^{38}$ (D)$1:10^{25}:10^{36}:10^{25}$

Q2. The number of significant figures in 300 is

(A) 3 (B) 1 (C) 2 (D) 4

Q3. A vector $\vec{P}=3\hat{\imath}-2\hat{\jmath}+a\hat{k}$ is perpendicular to the vector $\vec{Q}=2\hat{\imath}+\hat{\jmath}-\hat{k}$. The value of a is

(A)2 (B) 1 (C) 4 (D) 3

Q4. The variation of its displacement, x with time (in seconds) is given by $x = (t^3 - 2t - 10)$ m. The velocity of the particle at t = 4s, is

(A)46m/s (B) 50m/s (C)100m/s (D) 36m/s

Q5. If momentum decreases by 20%, K.E. will decrease by

(A) 40% (B) 36% (C) 18% (D) 8%

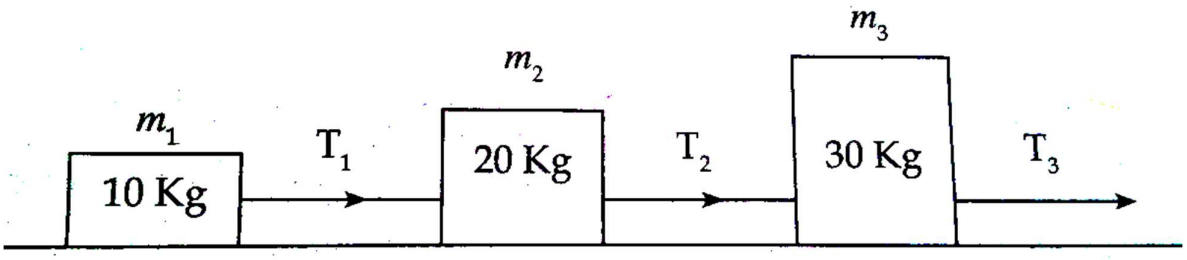
Q6. What is the torque of the force $\vec{F}=2\hat{\imath}-3\hat{\jmath}+4\hat{k}$ N acting at the point $\vec{r}=3\hat{\imath}+2\hat{\jmath}+3\hat{k}$m about origin ?

(A) $-6\hat{i}+6\hat{j}-12\hat{k}$ (B) $-17\hat{i}+6\hat{j}+13\hat{k}$ (C) $6\hat{i}-6\hat{j}+12\hat{k}$ (D) $17\hat{i}-6\hat{j}-13\hat{k}$

Q7. The radii of two planets are R and 2R respectively and their densities ρ and ρ/2 respectively. What is the ratio of acceleration due to gravity at their surface

(A) 1:1 (B) 1:2 (C) 1:3 (D) 2:1

Q8. Three blocks are connected as shown on a horizontal frictionless table, and pulled to the right with a force of T_3 = 60N.The value of tension T_2 is



(A)10N (B) 1N (C) 25N (D) 30N

Q9. From a uniform disc radius R a circular hole of radius R/2cut out . The center of hole is R/2 from the center of the original disc. The center of mass of the resulting flat body lies

(A) at a distance R/6 from centre of disc on diametrically same side to centre of hole
(B) at a distance R/2 from centre of disc on diametrically opposite side to centre of hole
(C) at a distance R/3 from centre of disc on diametrically opposite side to centre of hole
(D) at a distance R/6 from centre of disc on diametrically opposite side to centre of hole

Q10. A physical quantity X is calculated from the relation $X = \frac{a^{1/2}}{b^{3/2}}$. If the percentage error in 'a' is 12%, and that in 'b' is 2% the percentage error in X.

(A) 3% (B) 6% (C) 9% (D)2%

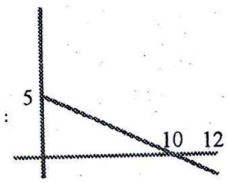
Q11. If P, Q, R are physical quantities, having different dimensions, which of the following combinations can never be a meaningful quantity ?

(A) $(P - Q)/R$ (B) $PQ - R$ (C) PQ/R (D) $(PR - Q^2)/R$

Q12. The time elapsed is plotted along the x – axis and the acceleration is plotted along the y – axis. The area between the graph and the t – axis gives:

(A) average velocity (B) distance covered
(C) difference in velocities (D) difference in accelerations

Q13. The velocity verses time graph is shown in figure where velocity is taken along y axis and time is taken along x axis. The displacement from the origin after 12sec is:



(A) 6m (B) 20m (C) 24m (D) 26m

Q14. A projectile of mass 50g is projected with a velocity of 10 ms^{-1} from the ground at an angle of 60^0 with the vertical. The magnitude of the change in its momentum between 'leaving' and 'arriving back' to the ground is

(A) $0.5\sqrt{3}$ kg.m/s (B) 0.5 kg.m/s (C)5kg.m/s (D)50kg.m/s

Q15. A car is travelling with velocity $\overrightarrow{V_1} = 6\hat{\imath}+2\hat{\jmath}-\hat{k}$ and a train is moving with a velocity $\overrightarrow{V_2} = -3\hat{\imath}+3\hat{\jmath}+2\hat{k}$. The velocity of the car relative to a passenger in the train is

(A) $-9\hat{\imath}+\hat{\jmath}+\widehat{3k}$ (B) $\hat{\imath}+2\hat{\jmath}-\hat{k}$ (C) $6\hat{\imath}+2\hat{\jmath}-\hat{k}$ (D) $9\hat{\imath}-\hat{\jmath}-\widehat{3k}$

Q16. A ball is thrown from a point with a speed of v_0 at an angle of projection θ with horizontal. From the same point and at the same instant, a person starts running with a constant speed of $v_0/2$ to catch the ball. If the person be able to catch the ball, the angle of projection should be

(A) 30^0 (B) 45^0 (C) 60^0 (D) 90^0

Q17. The radius of gyration of a uniform rod of length L about an axis passing through its centre of mass and perpendicular to its length is :

(A) $\frac{L}{\sqrt{12}}$ (B) $\frac{L^2}{12}$ (C) $\frac{L^2}{\sqrt{3}}$ (D) $\frac{L}{\sqrt{2}}$

Q18. A ballet dancer stretches her hands out while dancing. This results in :

(A) an increase in her moment of inertia but decrease in her angular velocity
(B) a decrease in her moment of inertia but an increase in her angular velocity
(C) a decrease in both her moment of inertia as well as her angular velocity
(D) an increase in both her moment of inertia as well as her angular velocity

Q19. If spheres of same material and same radius r are touching each other, then that the gravitational force between them is :

(A)directly proportional to r^2 (B)directly proportional to r^4
(C)inversely proportional to r^2 (D)inversely proportional to r^4

Q20. An object of mass m, is released from a point at a height H above the surface of the earth. Its velocity (v), when it strikes the earth's surface, is given by:
(M = mass of earth, R = radius of earth and r = R + H)

(A) $v = \left[2\ GM\left(\frac{1}{R} - \frac{1}{r}\right)\right]^2$ (B) $v = \left[2\ GM\left(\frac{1}{R} - \frac{1}{r}\right)\right]^{1/3}$

(C) 0 (D) $v = \left[2\ GM\left(\frac{1}{R} - \frac{1}{r}\right)\right]^{1/2}$

Q21. A ball, whose kinetic energy is E, is projected at an angle of $45^0$to the horizontal. The kinetic energy of the ball at the highest point of its flight is

(A) E (B)E/$\sqrt{2}$ (C)E/2 (D)E/4

Q22. A body is initially at rest. It undergoes one-dimensional motion with constant acceleration. The power delivered to it at time t is proportional to

(A) $t^{1/2}$ (B) t (C) $t^{3/2}$ (D)t^2

Q23. If a force, $\vec{F}$= (- 2î + 3ĵ + k̂) , causes a displacement $\vec{D}$ = (ĵ − 2î + 4k̂) , of an object, the work done on the object, is:

(A) 12 units (B) - 4 units (C) 11units (D) zero

Q24. An impulsive force of 100 N acts on a body for a small time interval of (Δt) seconds. The change, in linear momentum of the body would be:

(A) (100 Δt) N/s (B) (100 Δt) N – s
(C) (100 / Δt) N/s (D) (100 / Δt) N – s

Q25. A body of mass M, moving with a velocity $\vec{V} = V\hat{\imath}$, breaks up into 2 equal parts. If one part comes to rest and the other part moves with a velocity $\vec{v'}$ we would have

(A) $\vec{v'} = \frac{V}{\sqrt{2}}\hat{\imath}$ (B) $\vec{v'} = V\hat{\jmath}$ (C) $\vec{v'} = 2V\hat{\jmath}$ (D) $\vec{v'} = 2V\hat{\imath}$

SECTION-B

This section consists of 24 multiple choice questions with overall choice to attempt any 20 questions. In case more than desirable number of questions is attempted, ONLY first 20 will be considered for evaluation.

Q26. A river is flowing from west to east at a speed 15m/s. A boy on the south bank of the river, capable of swimming at 30m/s in still water, wants to swim, cross the river in the shortest time. He should swim in the direction of.

(A) Due north (B) 30^0 east of north

(C) 30^0 west of north (D) 60^0 east of north

Q27. A, B, C, and D at the points in a vertical line such that AB=BC=CD. If a body falls from rest at A, then the times of descent through AB, BC and CD are in the ratio :

(A) $1:\sqrt{2}:\sqrt{3}$ (B) $\sqrt{2}:\sqrt{3}:1$

(C) $\sqrt{3}:1:\sqrt{2}$ (D) $1:(\sqrt{2}-1):(\sqrt{3}-\sqrt{2})$

Q28. Two particles start from rest simultaneously and are equally accelerated. Throughout the motion, the relative velocity of one w.r.t. other is :

A. Zero

B. Non – zero and directed parallel to the acceleration

C. Non – zero and directed opposite to acceleration

D. Directed perpendicular to the acceleration

Q29. When a body moves with constant speed in a circular path, then :

(A) Work done will be zero (B) Acceleration will be zero

(C) No force acts on a body (D) Its velocity remains constant

Q30. In circular motion:

(A) radical acceleration is non zero (B) radial velocity is zero

(C) body is in equilibrium (D) all the above

Q31. When we kick a stone, we get hurt. Due to which one of the following properties of the stone it happens?

(A) Inertia (B)Velocity (C) Reaction (D) Momentum

Q32. When a moving body collides with a stationary body of mass 1/m times its mass, then the part of its kinetic energy of moving body transferred to the stationary body is

(A)$\frac{m}{(1+m)^2}$ (B) 0 (C) 2 (D)$\frac{4m}{(1+m)^2}$

Q33. At a certain instant, a body of mass o.4 kg has a velocity of $(8\hat{\imath}+6\hat{\jmath})m/s$.The kinetic energy of the body is :

(A) 10J (B) 40J (C) 20J (D) None of these

Q34. A spring of force constant 800N/m has an extension of 5cm. The work done in extending it from 5cm to 15cm is :

(A) 16J (B) 8J (C) 32J (D) 24J

Q35. A body is projected with an escape velocity 11.2 km/s from the earth's surface. If the body is projected in a direction 30^0 angle to the vertical, its escape velocity in this case will be:

(A) 11.2 km/s (B) $11.2\times\frac{1}{2}km/s$ (C) $11.2(\frac{\sqrt{3}}{2})km/s$ (D) None of these

Q36. The change in the value of g at a height h above the surface of the earth is the same as at a depth d below the surface of the earth. When both d and h are much smaller than the radius of the earth, then which one of the following is correct?

(A) $d=\frac{h}{2}$ (B) $d=\frac{3h}{2}$ (C) d=2h (D) d=h

Q37. A person can balance easily a moving bicycle, but cannot balance a stationary bicycle. This statement is based upon :

(A) conservation principle of linear momentum
(B) conservation principle of angular momentum
(C) conservation principle of energy
(D) all of the above principles

Q38. If $v = \frac{A}{t} + Bt^2 + Ct^3$ where v is velocity, t is time and A,B and C are constants the dimensional formula of B is

(A) $[M^0LT^0]$ (B) $[ML^0T^0]$ (C) $[M^0L^0T]$ (D) $[M^0LT^{-3}]$

Q39. Which quantity is dimension less

(A) absolute error (B) mean absolute error
(C) relative error (D) gross error

Q40. What is the value of $(\vec{A}\times\vec{B}).(\vec{A}-\vec{B})$?

(A) 0 (B) A^2-B^2 (C) A^2+B^2+2AB (D) None of these

Q41. What is the component of $3\hat{\imath}+4\hat{\jmath}$ along $\hat{\imath}+\hat{\jmath}$

(A) $\frac{1}{2}(\hat{\imath}+\hat{\jmath})$ (B) $\frac{3}{2}(\hat{\imath}+\hat{\jmath})$ (C) $\frac{5}{2}(\hat{\imath}+\hat{\jmath})$ (D) $\frac{7}{2}(\hat{\imath}+\hat{\jmath})$

Q42. A particle traverses the first half distance with velocity v_0 and the remaining distance with velocity v_1 for the first half time and with velocity v_2 for the next half time. Find the average velocity averaged over the whole time.

(A) $\frac{2v_0(v_1+v_2)}{2v_0+v_1+v_2}$ (B) $\frac{v_0(v_1+v_2)+2v_1v_2}{2(v_1+v_2)}$
(C) $\frac{v_0+v_1+v_2}{3}$ (D) none

Q43. A projectile can have the same range R for two angles of projection. If t_1 and t_2 be the time of flight in the two cases, then

(A) $t_1t_2=\frac{2R}{g}$ (B) $t_1t_2=\frac{R}{g}$ (C) $t_1t_2=\frac{R}{2g}$ (D) $t_1t_2=0$

Q44. Angular velocity of second hand of a clock is

(A) $\frac{\pi}{30}$ rad (B) $\frac{\pi}{60}$ rad/s (C) $\frac{\pi}{45}$ rad/s (D) $\frac{\pi}{30}$ rad/s

Q45. Given below are two statements labeled as Assertion (A) and Reason (R)

Assertion (A): Total energy of a body may be negative
Reason (R): kinetic energy of a body may be negative.

Select the most appropriate answer from the options given below:

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false and R is also false.

Q46. Given below are two statements labeled as Assertion (A) and Reason (R)

Assertion (A): Truck and car are moving with same momentum, then truck has more kinetic energy

Reason (R): kinetic energy is directly proportional to mass when momentum constant.

Select the most appropriate answer from the options given below:

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false and R is also false.

Q47. Given below are two statements labeled as Assertion (A) and Reason (R)

Assertion (A): If the ice on the polar caps of the earth melts, then length of day will increase

Reason (R): Moment of inertia of earth increases as ice on polar caps melts.

Select the most appropriate answer from the options given below:

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false and R is also false.

Q48. Given below are two statements labeled as Assertion (A) and Reason (R)

Assertion (A): Relative velocity of geo stationary satellite w.r.t. earth is zero

Reason (R): They have same velocity at every instant.

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false and R is also false.

Q49. Given below are two statements labeled as Assertion (A) and Reason (R)

Assertion (A): Gravitational force is a conservative force.

Reason (R): Potential energy is only associated with conservative force.

Select the most appropriate answer from the options given below:

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false and R is also false.

SECTION C

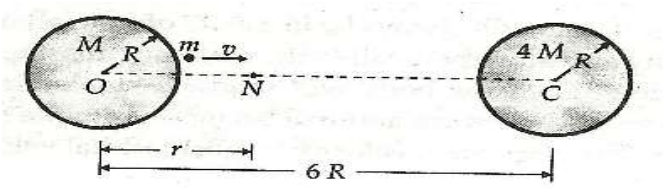
This section consists of 6 multiple choice questions with an overall choice to attempt any 5. In case more than desirable number of questions is attempted, ONLY first 5 will be considered for evaluation.

50. A ball rolls off the top of a stairway with a constant horizontal velocity u. If the steps are a meter high and b meter wide, the ball will just hit the edge of nth step if

(A)$n = \frac{2au^2}{gb^2}$ (B)$n = \frac{2au^2}{g}$ (C)$n = \frac{2au^3}{gb^2}$ (D) $n = \frac{2au^2}{gb^3}$

51. Two uniform solid spheres of equal radii R, but mass M and 4M have a centre to centre separation 6 R, as shown in fig. The two spheres are held fixed. A projectile of mass m is projected from the second sphere of mass M directly towards the centre of the second sphere. The minimum speed v of the projectile so that it reaches the surface of the second sphere is

(A)$\sqrt{\frac{GM}{R}}$ (B) $\sqrt{\frac{3GM}{2R}}$ (C) $\sqrt{\frac{3GM}{R}}$ (D)$\sqrt{\frac{3G}{5R}}$



CASE STUDY:

Read the following paragraph and answers the questions:

A lift is a device that moves up and down inside a tall building and carries people from one floor to another. There are three main types of elevators commonly used: traction with a machine room, machine-room-less traction, and hydraulic .If you stand on a scale in an elevator accelerating upward, you feel heavier because the elevator's floor presses harder on your feet, and the scale will show a higher reading than when the elevator is at rest. The force exerted by the scale is known as apparent weight; it does not change with constant speed. A man of mass 60 kg stands on a weighing scale in a lift .(g=9.8m s^{-2})

52. What would be the readings on the scale if the lift is moving (a) upwards with a uniform speed of 5 m s^{-1}.

(A) 60 (B) 91.8 (C)70 (D) 0

53. What would be the readings on the scale if the lift is moving downwards with a uniform acceleration of 5.2 m s^{-2}.

(A) 60 (B) 28.7 (C)26 (D) 0

54. What would be the readings on the scale if the lift is moving upwards with a uniform acceleration of 5.2 m s^{-2}.

(A) 60 (B) 91.8 (C)90 (D) 89.4

55. What would be the reading if the lift mechanism failed and it hurtled down freely under gravity.

(A) 60 (B) 70 (C) 0 (D) infinite

******** ALL THE BEST ********