JEE-ADVANCE-2014-P1-Model

Time: 09:00 AM to 12:00 Noon **IMPORTANT INSTRUCTIONS** **Max Marks: 180**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 10)	Questions with Multiple Correct Choice	3	0	10	30
Sec – II(Q.N : 11 – 20)	Questions with Integer Answer Type	3	0	10	30
Total				**20**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 30)	Questions with Multiple Correct Choice	3	0	10	30
Sec – II(Q.N : 31 – 40)	Questions with Integer Answer Type	3	0	10	30
Total				**20**	**60**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 50)	Questions with Multiple Correct Choice	3	0	10	30
Sec – II(Q.N : 51 – 60)	Questions with Integer Answer Type	3	0	10	30
Total				**20**	**60**

PART-I_PHYSICS **Max Marks : 60**

Section-1
(One or More options Correct Type)

This section contains 10 multiple choice equations. Each question has four choices (**A**) (**B**),(**C**) and (**D**) out of which **ONE** or **MORE THAN ONE** are correct.

1. In Cambridge Massachusetts, large variety of experiments were conducted, on the time 't' it takes a body of mass 'm' to fall a distance 'x' from rest in an evacuated chamber. After performing experiments with numerous masses and distances, they found that if 't' is measured in seconds and 'x' in meters, all data leads to single equation $x = 4.91t^2$

   (A) This equation is valid and independent of chosen units

   (B) This is a dimensionally non homogenous equation

   (C) Coefficient 4.91 remains invariant when units are changed

   (D) The coefficient 4.91 is a physical quantity not a numerical constant

2. Two small toy cars 'A' and 'B' are at rest at reference line of straight two lane road. Car 'A' starts at t=0 with constant acceleration $1m/s^2$ attains a maximum velocity 8m/s and then moves on uniformly. Car 'B' starts at t=4sec and wants to overtake 'A' in minimum time. Maximum speed and maximum acceleration of car 'B' is 12m/s and $3m/s^2$ respectively.

   (A) Maximum lead of car 'A' over 'B' is 8m

   (B) Maximum lead of car 'A' over 'B' is 12m

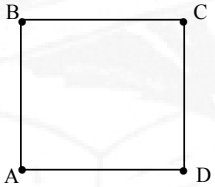
   (C) Car 'B' overtakes 'A' after moving for 10 sec

   (D) Car 'B' overtakes 'A' after moving for 6 sec.

3. Vernier callipers can be used for measuring volume of a small right circular uniform hollow cylinder. External diameter and total height can be measured by lower Jaws, Internal diameter and depth can be measured by using upper jaws and stem respectively. Stem is a thin rod which is fixed with vernier scale and slides over main scale along with vernier scale. In a vernier callipers when zero of main scale coincides to zero of vernier scale, lower jaws are open, upper jaws are perfectly closed and end of stem lies left to the right most end of main scale.
Select the correct option(s)

(A) In internal diameter measurement there is no zero error
(B) In external diameter measurement there is a negative zero error
(C) In depth measurement there is a positive zero error
(D) Magnitude of zero correction for external diameter and depth measurement is same

4. A farmer is standing just outside of the corner 'A' of muddy square field. He can run in outside of square region at a speed $\sqrt{2}$ times of his speed in the muddy field. He takes minimum time to reach opposite corner 'C' if he runs



(A) Upto midpoint of 'AB', then in field on a straight line upto midpoint of 'BC' and in last directly to 'C'

(B) Moves one third of 'AB' then moves on a straight line in field up to a point on 'BC' which is at one third distance of 'BC' from 'C', then to 'C'.

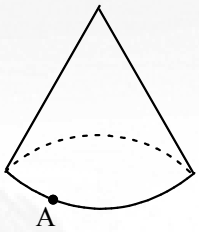
(C) Directly from 'A' to 'C' in the field

(D) From 'A' to 'B' then from 'B' to 'C' outside the field.

5. An insect is moving uniformly at speed 2cm/s on outer surface of a vertical, right circular cone. Without changing its sense of motion about axis of cone it completes a round trip and reaches to starting point 'A' in minimum time.

Given: Apex angle of cone = 60^o

Height of cone $= \sqrt{3}cm$



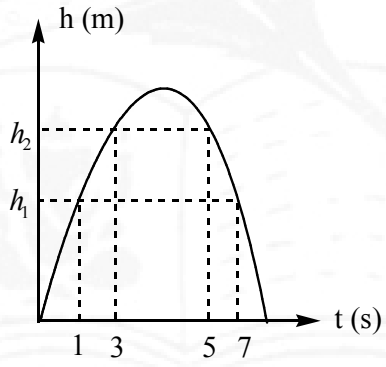
(A) time taken is 2 sec

(B) time taken is $2\sqrt{3}$ sec

(C) magnitude of acceleration of insect first increases then decreases

(D) net contact force on insect is constant and equal to its weight in magnitude

6. A ball is thrown vertically upwards at t=0. Its height varies with time as follows. Consider $g = 10m/s^2$



(A) Maximum height attained is 60m. (B) Time of flight is 8 sec

(C) Projection speed is 40 m/s (D) $h_2 - h_1 = 40m$

7. Least count of two screw gauge is same then.

(A) Number of circular divisions on them may be same

(B) Number of circular divisions on them may be different

(C) Pitch of screw gauge may be same

(D) Pitch of screw gauge may be different

8. The focal length (f) of a curved mirror is related to the object distance u and the image distance v in accordance with the mathematical relation, $\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$. The maximum relative error in calculating the focal length f of the mirror cannot be equal to

(A) $\frac{\Delta f}{f}=\frac{\Delta u}{u}+\frac{\Delta v}{v}$

(B) $\frac{\Delta f}{f}=\frac{1}{\frac{\Delta u}{u}}+\frac{1}{\frac{\Delta v}{v}}$

(C) $\frac{\Delta f}{f}=\frac{\Delta u}{u}+\frac{\Delta v}{v}-\frac{\Delta(u+v)}{u+v}$

(D) $\frac{\Delta f}{f}=\frac{\Delta u}{u}+\frac{\Delta v}{v}+\frac{\Delta u}{u+v}+\frac{\Delta v}{u+v}$

9. The velocity, acceleration and force in two systems of units are related to each other as under

(i) $v' = \frac{\alpha^2}{\beta} v$ (ii) $a' = (\alpha\beta) a$ (iii) $F' = \left(\frac{1}{\alpha\beta}\right) F$

Where, all the primed symbols belong to one system of units and the unprimed symbols belong to the other system of units. Hence α and β are dimensionless constants. Which of the following is/are correct?

(A) The standard of length in each of these two systems are related to each other as $l' = \frac{\alpha^3}{\beta^3} l$

(B) The standard of mass in each of these two systems are related to each other as $m' = \left(\frac{1}{\alpha^2\beta^2}\right) m$

(C) The standard of time in each of these two systems are related to each other as $t' = \left(\frac{\alpha}{\beta^2}\right) t$

(D) The standard of momentum in each of these two systems are related to each other as $p' = \left(\frac{1}{\beta^3}\right) p$

10. Average velocity of a particle moving in a straight line, with constant acceleration a and initial velocity u and final velocity v in first t second is

(A) $\frac{u+v}{2}$ (B) $u + at$ (C) $\frac{1}{2}(u + at)$ (D) $u + \frac{1}{2}at$

Section-2
(Integer Value Correct Type)

This section contains 10 questions. The answer to each question is a **single digit integer, ranging** from 0 to 9 (both inclusive).

11. A particle moves in xy-plane with the velocity $\vec{v} = a\hat{i} + bt\hat{j}$. At the instant $t = a\sqrt{3}/b$ the magnitude of tangential and normal acceleration is a_T and a_N. The value of $\frac{a_T}{a_N} = \sqrt{p}$.

    Find p.

12. Speed of car moving with speed $1m/s$ at $t = 0$, increases at a rate $2m/s^2$ for time interval [0,3] sec. Space average and time average of velocity for given interval is v and v' respectively.

    Given : $v.v' = x \times 10 - y$. Fill x+y in OMR sheet. (x & y are positive integer)

13. If Energy 'E', velocity 'v' and time 'T' are taken as the fundamental units, then dimensional formula for surface tension is $\left[E^x v^y T^z\right]$. Find x-y+z ?

14. A particle is projected with 10m/s from a point on a plane inclined at an angle 7^o from plane along the line of greatest slope. Let R and R' be the maximum ranges for projection up and down the inclined plane. Angle of inclination of inclined plane is 30^o. Consider acceleration due gravity to be $10m/s^2$. Find $RR'/R + R'$.

15. The relative density of a ball can be found by hanging the ball from a spring balance and noting the reading. The balance reads $4.00 \pm 0.02\,\text{N}$ in air and $1.00 \pm 0.02\,\text{N}$ in water. The maximum percentage error in measurement of relative density is $\frac{P}{6}$.

    Fill the value of *'P'* (approximate) in OMR sheet.

16. Speed of an object moving with speed 6.25 m/s, is changing at a rate given by $\frac{dv}{dt} = -2.5\sqrt{v}$ where v is the instantaneous speed. The time taken by the object to come to rest (in second) is

17. A train starts from station 'A'. It has to stop at station 'B' 1.4km apart. The maximum possible speed and rate of change of speed of train is 40m/s and $2m/s^2$ respectively. The minimum time taken by it to reach station 'B' is 10T sec. Given that maximum rate of change of acceleration and retardation is 0.2 m/s^3. Find 'T'

18. A body is projected with certain initial velocity and certain angle with the horizontal ground $(at\, t = 0\,\text{sec})$ and projection point is taken as the origin then it's projectile path is represented by the equations $x = 50t, y = 624t - 5t^2$ where (x,y are in meters, t in sec) then the magnitude of initial velocity of the projectile is $(624 + x)$ m/sec then the value of x is

19. Distance between a frog and an insect on a horizontal plane is 9m. Frog can jump with a maximum speed of $\sqrt{10}m/s$. Minimum number of jumps required by the frog to catch the insect is (Take $g = 10m/s^2$)

20. A particle takes $\left(7+2\sqrt{6}\right)\text{sec}$ and $\left(7-2\sqrt{6}\right)\text{sec}$ to reach foot of the building when projected vertically upwards and downwards respectively with same speed from top of the building. How much time (in s) particle will take to reach foot of the building when it is dropped freely from top of the building.