DPP - 2

Single Option Correct

Q.1 The position of a particle as a function of time t, is given by $x(t) = at + bt^2 - ct^3$ where a, b and c are anstants. When the particle attains zero acceleration, then its velocity will be

(A) $a + \frac{b^2}{4c}$ (B) $a + \frac{b^2}{3c}$ (C) $a + \frac{b^2}{2c}$ (D) $a + \frac{b^2}{c}$

Q.2 A particle is moving with speed $v = b\sqrt{x}$ along positive x-axis. Calculate the speed of the particle at time $t = \tau$ (assume that the particle is at origin at $t = 0$).

(A) $b^2\tau$ (B) $\frac{b^2\tau}{4}$

(C) $\frac{b^2\tau}{2}$ (D) $\frac{b^2\tau}{\sqrt{2}}$

Q.3 An object moving with a speed of 6.25 ms^{-1}, is decelerated 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, would be

(A) 1 s (B) 2 s

(C) 4 s (D) 8 s

Q.4 For a particle moving rectilinearly the displacement x depends on time t as $x = at^3 + bt^2 + ct + d$. The ratio of is initial acceleration to its initial velocity depends

(A) only on a and b (B) only on b and c

(C) only on a and c (D) only on a

Q.5 The velocity-time relation of an electron starting from rest is given by $u = kt$, where $k = 2\ m/s^2$. The distance traversed in 3 sec is :-

(A) 9 m (B) 16 m

(C) 27 m (D) 36 m

Q.6 A particle is moving along a circular path of radius 3 metre in such a way that the distance travelled measured along the circumference is given by $s = \frac{t^2}{2} + \frac{t^3}{3}$ The acceleration of the particle when $t = 2$ second

(A) 1.3 ms^{-2} (B) 3 ms^{-2}

(C) 10 ms^{-2} (D) 13 ms^{-2}

Q.7 The displacement of a particle is given by $y = a + bt + ct^2 - dt^4$ The initial velocity and acceleration are respectively

(A) b, −4 d (B) −b, 2c

(C) b, 2c (D) 2c, −4d

Q.8 The initial velocity of a particle is u(at $t = 0$) and the acceleration is given by $f = at$. Which of the following relations is valid?

(A) $v = u + at^2$ (B) $v = u + \frac{at^2}{2}$

(C) $v = u + at$ (D) $v = u$

Q.9 Two buses P and Q start from a point at the same time and move in a straight line and their positions are represented by $X_p(t) = \alpha t + \beta t^2$ and $X_Q(t) = ft - t^2$. At what time, both the buses have same velocity?

(A) $\frac{\alpha - f}{1+\beta}$ (B) $\frac{\alpha + f}{2(\beta - 1)}$

(C) $\frac{\alpha + f}{2(1+\beta)}$ (D) $\frac{f - \alpha}{2(1+\beta)}$

Q.10 The displacement of a particle starting from rest (at $t = 0$) is given by $s = 6t^2 - t^3$ The time which the particle will attain zero velocity again, is :

(A) 4 s (B) 8 s

(C) 12 s (D) 16 s

Multiple Correct Choice

Q.11 For a particle moving in a plane, if $\vec{v}$ and $\vec{a}$ be the instantaneous velocity and acceleration, then rate of change of speed, $\frac{dv}{dt}$, of the particle equal(s)

(A) $|\vec{a}|$

(B) the component of $\vec{a}$ perpendicular to $\vec{v}$

(C) $\frac{\vec{a} \cdot \vec{v}}{v}$

(D) the projection of $\vec{a}$ along $\vec{v}$

Q.12 The position of a particle travelling along x-axis is by $x_t = t^3 - 9t^2 + 6t$ where x_t is in cm and t is second. Then

(A) the body comes to rest firstly at $(3 - \sqrt{7})$s and then at $(3 + \sqrt{7})$s.

(B) the total displacement of the particle in travelling from the first zero of velocity to the second zero of velocity is zero.

(C) the total displacement of the particle in travelling from the first zero of velocity to the second zero of velocity is -74 cm.

(D) the particle reverses its velocity at $(3 - \sqrt{7})$s and then at $(3 + \sqrt{7})$s and has a negative velocity for $(3 - \sqrt{7}) < t < (3 + \sqrt{7})$

Statement Type

Q.13 Statement-1: A body having non-zero acceleration can have a constant velocity.

Statement-2: Acceleration is the rate of change of velocity.

(A) If both statements are TRUE and STATEMENT 2 is the correct explanation of STATEMENT 1.

(B) If both statements are TRUE but STATEMENT 2 is not the correct explanation of STATEMENT 1.

(C) If STATEMENT 1 is TRUE and STATEMENT 2 is FALSE.

(D) If STATEMENT 1 is FALSE but STATEMENT 2 is TRUE.

Q.14 Statement-1: The instantaneous velocity does not depend on instantaneous position vector.

Statement-2: The instantaneous velocity and average velocity of a particle are always same.

(A) If both statements are TRUE and STATEMENT 2 is the correct explanation of STATEMENT 1.

(B) If both statements are TRUE but STATEMENT 2 is not the correct explanation of STATEMENT 1.

(C) If STATEMENT 1 is TRUE and STATEMENT 2 is FALSE.

(D) If STATEMENT 1 is FALSE but STATEMENT 2 is TRUE.

Comprehension Q.15 to Q.17

The motion of a body falling initially from rest in a resistive medium is described by the differential equation

$$\frac{dv}{dt} = 6 - 3v$$

where v is the velocity of the body at any instant (in ms^{-1}). Based on the above facts, answer the following questions.

Q.15 The initial acceleration is of the body is

(A) 6 ms^{-2} (B) 3 ms^{-2}

(C) 2 ms^{-2} (D) 18 ms^{-2}

Q.16 The terminal velocity i.e., the velocity at which acceleration becomes zero is given by

(A) 6 ms^{-1} (B) 3 ms^{-1}

(C) 2 ms^{-1} (D) 18 ms^{-1}

Q.17 The instantaneous velocity of a particle moving in a straight line is given as $v = \alpha t + \beta t^2$, where α and β are constants. The distance travelled by the particle between 1 s and 2 s is

(A) $\frac{3}{2}\alpha + \frac{7}{3}\beta$

(B) $\frac{\alpha}{2} + \frac{\beta}{3}$

(C) $\frac{3}{2}\alpha + \frac{7}{2}\beta$

(D) $3\alpha + 7\beta$

ANSWER KEY

1.	(B)	**2.**	(C)	**3.**	(B)	**4.**	(B)	**5.**	(A)	**6.**	(D)	**7.**	(C)
8.	(B)	**9.**	(A)	**10.**	(D)	**11.**	(CD)	**12.**	(ACD)	**13.**	(D)	**14.**	(C)
15.	(A)	**16.**	(C)	**17.**	(A)								