KINEMATIC EQUATIONS FOR UNIFORMLY ACCELERATED MOTION

1. A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β and comes to rest. If the total time elapsed is t, then the maximum velocity acquired by the car is:
   (a) $\frac{\alpha\beta t}{\alpha+\beta}$ (b) $\frac{(\alpha+\beta)t}{\alpha\beta}$ (c) $\frac{(\alpha^2+\beta^2)t}{\alpha\beta}$ (d) $\frac{(\alpha^2-\beta^2)t}{\alpha\beta}$
2. A bullet moving with a velocity of 100 m/s can just penetrate two planks of equal thickness. The number of such planks penetrated by the same bullet, when the velocity is doubled, will be:
   (a) 4 (b) 6 **(c)** 8 (d) 10
3. A car is moving on a straight horizontal road with a speed v. When brakes are applied to give a constant retardation a, the car is stopped in a shortest distance s. If the car was moving on the same road with a speed 3v and the same retardation a is applied, the shortest distance in which the car is stopped will be:
   (a) 3s (b) 6s **(c)** 9s (d) 27s
4. A body starts from rest travels a distance x in first two seconds and a distance y in next two seconds. The relation between x and y is: (a) y = 4x (b) y = x **(c)** y = 3x (d) y = 2x
5. A stone with weight W is thrown vertically upward into air from ground level with initial speed u. If a constant force F due to air drag acts on the stone throughout its flight, the speed of stone just before impact with the ground is:
   (a) $u\left(\frac{W+F}{W-F}\right)^{1/2}$ **(b)** $u\left(\frac{W-F}{W+F}\right)^{1/2}$ (c) $u\left(\frac{W+F}{W}\right)^{1/2}$ (d) $u\left(\frac{W-F}{W}\right)^{1/2}$
6. A bus starts from rest with a constant acceleration of 5 m/s^2. At the same time a car travelling with constant velocity of 50 m/s passes the bus. Assuming that the car passes the bus at the instant the bus is starting when the bus overtakes the car, what is its speed?
   (a) 40 m/s (b) 60 m/s (c) 90 m/s **(d)** 100 m/s
7. A particle starts from rest and traverses a distance 2d with uniform acceleration, then moves uniformly over a further distance 4d and finally comes to rest after moving a further distance 6d under uniform retardation. Assuming entire motion to be rectilinear motion, the ratio of average speed over the journey to the maximum speed on its way is:
   (a) 1/5 (b) 2/5 **(c)** 3/5 (d) 5/2
8. A body starting from rest moves with constant acceleration. The ratio of distance covered by the body during the 5th second to that covered in 5 seconds is:
   (a) 9/25 (b) 7/25 (c) 4/25 (d) 3/25
9. A body falling freely under the action of gravity passes two points 9 m apart vertically in 0.2 s. From what height above the higher point did it start to fall?
   (a) 39 m (b) 49 m (c) 69 m **(d)** 99 m
10. Two cars travelling towards each other on a straight road at velocity 10 m/s and 12 m/s, respectively. When they are 150 m apart, both drivers apply their brakes and each car decelerates at 2 m/s^2 until it stops. How far apart will they be when they both have come to a stop?
    (a) 89 m (b) 99 m (c) 107 m (d) 135 m
11. A particle is projected vertically upwards and it reaches the maximum height H in time T seconds. The height of the particle at any time t will be:
    (a) H – g (t – T)^2 (b) g (t – T)^2 **(c)** H – $\frac{1}{2}$ g (t – T)^2 (d) $\frac{1}{2}$ g (t – T)^2

12. The velocity of a particle at an instant t is 10 m/s. After 5 s the velocity is 20 m/s. The velocity, 3 seconds earlier was:
    (a) 4 m/s (b) 3 m/s (c) 2 m/s (d) 6 m/s
13. A stone is dropped from the top of a cliff 100 m high and simultaneously a bullet of mass 20 g is fired from the foot of the cliff upwards with a velocity of 100 m/s. The bullet and stone will meet each other after a time:
    (a) 4 s (b) 3 s (c) 2 s **(d)** 1 s
14. A body covers 200 cm in the first 2 seconds and 220 cm in the next 4 seconds. The velocity of the body at the end of the 7th second is:
    (a) 5 cm/s **(b)** 10 cm/s (c) 20 cm/s (d) 30 cm/s
15. A body is thrown vertically up to reach its maximum height in t seconds. The total time from the time of projection to reach a point at half of its maximum height while returning (in seconds) is:
    (a) $\sqrt{2}$t **(b)** (1 + 1/$\sqrt{2}$)t (c) 5t/4 (d) t/$\sqrt{2}$
16. A body moving with uniform acceleration describes 12 m in the third second of its motion and 20 m in the fifth second. The velocity of the body after 10^{th} s is:
    (a) 22 m/s (b) 32 m/s **(c)** 42 m/s (d) 10 m/s
17. A body is thrown vertically up with a velocity u. It passes three points X, Y and Z in its upward motion with velocities u/2, u/3 and u/4 respectively. The ratio of the separation between points X and Y and between Y and Z, XY/YZ is:
    (a) 2 (b) 3 (c) 15/4 **(d)** 20/7
18. A particle moving with uniform acceleration has velocity of 6 m/s at a distance 5 m from the initial position. After moving another 7 m the velocity becomes 8 m/s. The initial velocity and acceleration of the particle are:
    (a) 3 m/s; 6 m/s^2 **(b)** 4 m/s; 2 m/s^2 (c) 2 m/s; 4 m/s^2 (d) 6 m/s; 1 m m/s^2
19. A ball is thrown vertically upwards with a speed of 10 m/s from the top of a tower 200 m high and another is thrown vertically downwards with the same speed simultaneously. The time difference between them in reaching the ground in seconds is (Take g = 10 m/s^2):
    (a) 2 (b) 6 (c) 8 (d) 1
20. A body travelling with uniform acceleration crosses two points X and Y with velocities 2 m/s and 14 m/s respectively. The speed of the body at the mid-point of X and Y is:
    (a) 5 m/s (b) 7.5 m/s **(c)** 10 m/s (d) 12 m/s