* A balloon is moving vertically upwards with a velocity of 29 m/s. A stone is dropped from it and it reaches the ground in 10 sec. The height of the balloon when the stone was dropped is (take g = 9.8 ms^{-2})

(a) 100 m **(b) 200 m** (c) 400 m (d) 150 m

Alternate problem to be attempted by the student:

A balloon is rising vertically upwards at a velocity of 10 m/s. When it is at a height of 45 m a parachutist bails out from it. After three seconds he opens his parachute and decelerates at a constant rate of 5 ms^{-2}. What was the height of the parachutist from the ground when he had opened his parachute? (g = 10 ms^{-2})

(A) 15 m **(B) 30 m** (C) 45 m (D) 60 m

* From the top of a tower two stones whose masses are in the ratio 1 : 2 are projected, one straight up and the other straight down, both with the same speed. Neglecting air resistance,

(a) Heavier stone hits the ground with greater speed
(b) Lighter stone hits the ground with greater speed
(c) Both the stones will have the same speed while hitting the ground
(d) The speed cannot be determined with the given data

* A body is projected vertically upwards. The times corresponding to height h while ascending and while descending are t_1 and t_2 respectively. The velocity of projection is (g is acceleration due to gravity)

(a) $g\sqrt{t_1 t_2}$ (b) $\frac{g t_1 t_2}{t_1 + t_2}$ (c) $\frac{g\sqrt{t_1 t_2}}{2}$ **(d)** $\frac{g(t_1 + t_2)}{2}$

* A body of mass m moving along a straight line covers half the distance with a speed of 2 m/s. The remaining half of the distance is covered in two equal intervals of time with a speed of 3 m/s and 5 m/s respectively. The average speed of the particle for the entire journey in m/s is

(a) **8/3** (b) 4/3 (c) 16/3 (d) 3/8

Alternate problem to be attempted by the student:

The velocity v of an object moving in a straight line varies with time t as $V = at - bt^2$ where a and b are constants. The average velocity of the object in the time interval t = 0 to t = 2 sec is

(A) $\frac{1}{3}(3a - 4b)$ (B) $\frac{2}{3}(a - 4b)$ (C) (a – 2b) (D) (2a – 3b)

A body is projected from the ground with a velocity of u at an angle θ with the horizontal. The average velocity of the body in the time interval it takes to reach the highest point of its trajectory from the point of projection is

(A) $\frac{u}{2}(1+\cos\theta)$ (B) $\frac{u}{2}(1+\cos^2\theta)^{\frac{1}{2}}$ (C) $\frac{u}{2}(1+2\cos^2\theta)^{\frac{1}{2}}$ **(D)** $\frac{u}{2}(1+3\cos^2\theta)^{\frac{1}{2}}$

* A motor boat covers a given distance in 6 hr moving downstream in a river. It covers the same distance in 10 hr upstream. The time it takes to cover the same distance in still water is

(a) 6.5 hr (b) 8 hr (c) 9 hr **(d) 7.5 hr**

(If v is the velocity of boat w.r.t water, v + w is the downstream velocity)

* The height y and the distance x along the horizontal plane of a projectile on a certain planet with no atmosphere are given by $y = 8t - 5t^2$ meter and $x = 6t$ meter where t is in seconds. The velocity with which the projectile is projected in m/s is

(a) 6 (b) 8 **(c) 10** (d) 14

Alternate problem to be attempted by the student:

*The ceiling of a tunnel is 5 m high. What is the maximum horizontal distance that a ball thrown with a velocity of 20 m/s can go without hitting the ceiling of the tunnel? Take g = 10 ms^{-2}

(A) 10√3 m **(B) 20√3 m** (C) 30√3 m (D) 40 m

(Only because he has said maximum horizontal distance do not make range maximum. If you do so, you may get 4 th option.)

Alternate problem to be attempted by the student:

Water drops from a leaky tap are falling at regular intervals on the ground 125 cm below the tap. The first drop strikes the ground when the sixth drop just begins to fall. What is the height of the third drop from the ground when the first drop strikes the ground? (g = 10 ms^{-2})

(A) 50 cm (B) 60 cm (C) 70 cm **(D) 80 cm**

* In a lift moving up with an acceleration of 5 ms^{-2} a ball is dropped from a height of 1.25 m. The time taken by the ball to hit the floor of the lift is nearly (g = 10 ms^{-2})

(a) 0.3 s (b) 0.2 s (c) 0.16 s **(d) 0.4 s**

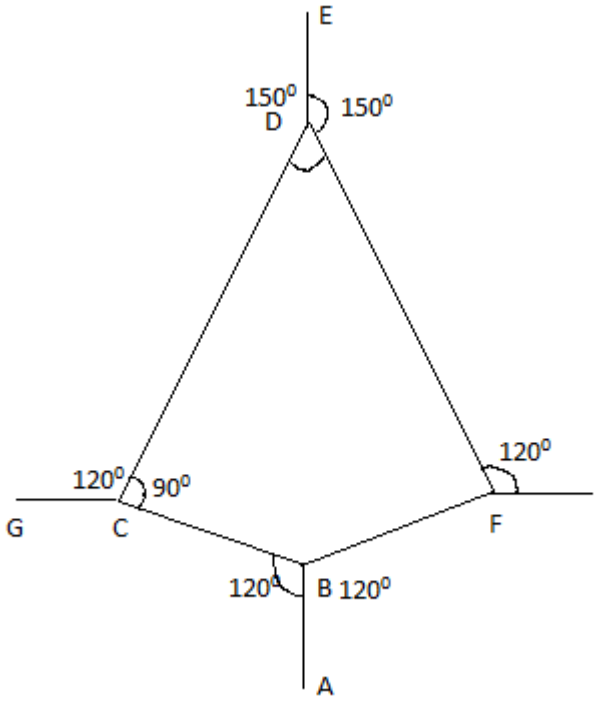
Alternate problem to be attempted by the student:

A block is placed on top of a smooth inclined plane of inclination θ with the horizontal kept on the floor of a lift. When the lift is descending with a retardation a, the block is released. The acceleration of the block relative to the incline is

(A) g sinθ (B) asinθ (C) (g – a) sinθ **(D) (g + a) sinθ**

* A projectile is projected at 10 m/s at an angle of 60^0 with the horizontal. After some time its velocity makes an angle of 30^0 with the horizontal. Its speed at that instant in m/s is

(a) $\underline{\frac{10}{\sqrt{3}}}$ (b) $10\sqrt{3}$ (c) $\frac{5}{\sqrt{3}}$ (d) $5\sqrt{3}$



* The adjacent figure is a part of horizontally stretched net. The tension in the part AB is 10 N. What are the tensions in BC and BF?

(a) 10 N, 11 N (b) 10 N, 6 N **(c) 10 N, 10 N** (d) can't calculate

(You can answer this just by the argument of symmetry)

Alternate problem to be attempted by the student:

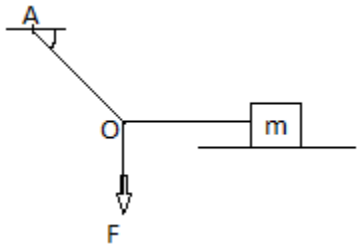


*Figure shows a block of mass m placed on a horizontal table. The coefficient of static friction between the block and the table is μ. The maximum force F that can be applied at the point O such that the block does not slip on the surface is (take the angle made by the string OA with the ceiling as θ)

(A) $\mu mg \sin\theta$ (B) $\mu mg \cos\theta$ **(C)** $\mu mg \tan\theta$ (D) μmg

* A shell of mass 20 kg at rest explodes into two fragments whose masses are in the ratio 2: 3. The smaller fragment moves with a velocity of 6 m/s. The kinetic energy of the larger fragment is

(a) 360 J (b) 144 J (c) 216 J **(d) 96 J**

* A mass of 10 kg is suspended by a spring balance. It is pulled aside by a horizontal string so that it makes an angle of 60^0 with the vertical. The new reading of the balance is

(a) 20 kg.wt (b) 10 kg.wt (c) $10\sqrt{3}$ kg.wt (d) $20\sqrt{3}$ kg.wt

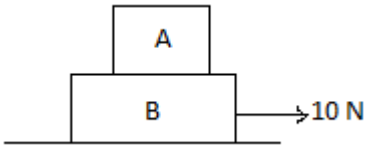
* A body of mass 0.05 kg is found to fall with an acceleration of 9.5 ms^{-2}. The opposing force of air (assumed to be constant) on the body is (g = 9.8 ms^{-2})

(a) 0.15 N (b) 0.03 N (c) zero **(d) 0.015 N**

* If the linear momentu of a body increases by 50 %, then the kinetic energy increases by

(a) 225 % (b) 25 % (c) 100 % **(d) 125 %**

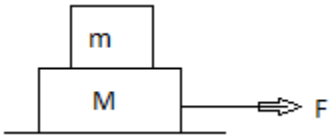
(Do not use $\frac{dE}{E} = 2\frac{dp}{p}$ or else you will get option c.)



* A block A of mass 2 kg is placed over block B of mass 8 kg. The combination is placed over a rough horizontal surface. Coefficient of friciton between B and the floor is 0.5 and between A and B is 0.4. A horizontal force of 10 N is applied on B as shown. The force of friciton between A and B is

(a) 100 N (b) 40 N (c) 50 N **(d) zero**

Alternate problem to be attempted by the student:



M = 5 kg and m = 3 kg are placed on the horizontal surface as shown. μ between the blocks is 0.5 and that between M and horizontal surface is 0.7. What is the maximum horizontal force F that can be applied so that both move without slipping? Take g = 10 ms^{-2} What do you think is the minimum force? How much is the frictional force between the blocks in both cases? Also think of the situation with the force applied on 3 kg body.

(A) 4 N (B) 16 N (C) 24 N **(D) 96 N**

Alternate problem to be attempted by the student:

* Shell is fired from the cannon with a speed of 100 m/s at an angle 30^0 with the vertical. At the highest point of its trajectory, the shell explodes into two fragments of masses in the ratio 1: 2. The lighter fragment moves vertically upwards with an initial speed of 200 m/s. what is the speed in m/s of the heavier fragment at the time of explosion?

(A) 125 (B) 150 (C) 175 (D) 200

* An aeroplane executes a horizontal loop at a speed of 720 kmph with its wings banked at 45^0. What is the radius of the loop? Take g = 10 ms^{-2}

(a) 4 km (b) 4.5 km (c) 7.2 km (d) 2 km

Alternate problem to be attempted by the student:

A boy whirls a stone in a horizontal circle 2 m above the ground by means of a string 1.25 m long. The string breaks and the stone flies off horizontally, striking the ground 10 m away. What is the magnitude of the centripetal acceleration in ms^{-2} during circular motion? Take g = 10 ms^{-2}.

(A) 100 **(B) 200** (C) 300 (D) 400

* The combined mass of a rider and his bike is 200 kg. What is the necessary frictional force in N if he has to negotiate a curve 80 m radius at a speed of 72 kmph? Take g = 10 ms^{-2} you can also think of the angle with the vertical by which the rider has to lean to avoid friction and falling & still negotiate the curve.

(A) 500 (B) 750 **(C) 1000** (D) 1250