Answer on Question 58096, Physics, Mechanics | Relativity

Question:

7. A driver does a round trip to Ibadan from Lagos, returning to his take-off point in five hours. The distance of Ibadan from Lagos is $130\ km$. What is his average velocity?

a) $52\ km/h$

b) $26\ km/h$

c) $0\ km/h$

d) $104\ km/h$

Solution:

The average velocity of an object is defined as the displacement per unit time:

$$v = \frac{displacement}{time\ taken}.$$

Because the driver returns to his take-off point, the displacement is equal to zero and we get:

$$v = \frac{displacement}{time\ taken} = \frac{0\ km}{5\ h} = 0\ \frac{km}{h}.$$

Answer:

c) $0\ km/h$

8. An object is thrown upward from the edge of a tall building with a velocity of $20\ ms^{-1}$. Where will the object be $5\ s$ after it is thrown? Take $g = 10\ ms^{-2}$.

a) $25\ m$ above the top of the building

b) $22\ m$ below the top of the building

c) $25\ m$ below the top of the building

d) $22\ m$ above the top of the building

Solution:

Let's write the equation of vertical motion of the object:

$$h = v_0 t + \frac{1}{2} g t^2,$$

here, h is the height, v_0 is the initial velocity of the object, $g = -10\, ms^{-2}$ is the acceleration due to gravity (we take the upwards to be the positive direction, thus g will be with sign minus).

Then, the height of the object at the time of 5.0 s will be:

$$h = v_0 t + \frac{1}{2} g t = 20\, ms^{-1} \cdot 5\, s + \frac{1}{2} \cdot (-10\, ms^{-2}) \cdot (5.0\, s)^2 = 100\, m - 125\, m = \\ = -25\, m.$$

The sign minus indicates that the object is $25\, m$ below the top of the building.

Answer:

c) $25\, m$ below the top of the building

9. A car accelerates from rest to a speed of $10\, ms^{-1}$ in a time of $8\, s$. What is the acceleration and how far will it go in this time?

a) $1.25\, ms^{-2}$, $40\, m$

b) $2.50\, ms^{-2}$, $40\, m$

c) $1.25\, ms^{-2}$, $30\, m$

d) $1.50\, ms^{-2}$, $30\, m$

Solution:

We can find the acceleration of the car from the kinematic equation:

$$v_f = v_i + at,$$

here, v_f is the final speed, $v_i = 0\, ms^{-1}$ is the initial speed (since the car accelerates from rest it is equal to zero), a is the acceleration of the car and t is the time.

From this formula we can find the acceleration of the car:

$$a = \frac{v_f}{t} = \frac{10\ ms^{-1}}{8\ s} = 1.25\ ms^{-2}.$$

We can find how far will car go in this time from the another kinematic equation:

$$d = v_i t + \frac{1}{2}at^2 = \frac{1}{2} \cdot 1.25\ ms^{-2} \cdot (8\ s)^2 = 40\ m.$$

Answer:

a) $1.25\ ms^{-2}$, $40\ m$