Question 1 (3 points)

An aeroplane starting from rest needs to reach a speed of 188 km/h to take off. On a 2.5 km runway, what is the minimum steady acceleration necessary for the plane to take flight?

A) 0.55 m/s^2 .

B) 20.8 m/s^2 .

C) 1.2 m/s^2 .

D) 0.1 m/s^2 .

E) 37.6 m/s^2 .

The aeroplane is accelerated from rest on a 2.5 km runway.
There are 1000 m in 1 km: the take-off speed is 188 × 1000 m/h .
There are 3600 s in 1 hour: the take-off speed is 188 × 1000 ÷ 3600 m/s = 52.222222 m/s.

The relevant information is

$\Delta x = 2500$ m

$v_i = 0$ m/s

$v_f = 52.222222$ m/s

$v_f^2 = v_i^2 + 2\,a\,\Delta x$

$a = v_f^2 \div (2\ \Delta x) = (52.222222\ \text{m/s})^2 \div (2 \times 2500\ \text{m}) = 0.545432\ \text{m/s}^2$.

Question 2 (3 points)

A motorbike initially traveling at 55 km/h accelerates at a constant rate of 1.5 m/s^2. How much time is required for the motorbike to reach a speed of 110 km/h?

A) 10.19 s

B) 73.3 s

C) 55.0 s

D) 36.7 s

We need

- Either everything in m/s and m/s^2,
- Or everything in km/h and km/h^2.

The first is more work, but probably easier.

The initial velocity is 55 km/h = 55 × 1000 ÷ 3600 m/s = 15.2777778 m/s.
The final velocity is 110 km/h = 110 × 1000 ÷ 3600 m/s = 30.5555556 m/s.

Acceleration = $a = (v_f - v_i) \div t$
Which gives: $t = (v_f - v_i) \div a$ = (30.5555556 – 15.2777778 m/s) ÷ 1.5 m/s^2 = 10.185185 s .

Question 3 (3 points)

An aeroplane starting from rest needs to reach a speed of 285 km/h to take off. On a 2.9 km runway, what is the minimum steady acceleration necessary for the plane to take flight?

A) $27.3\ m/s^2$.

B) $2.1\ m/s^2$.

C) $0.1\ m/s^2$.

➡ D) $1.08\ m/s^2$.

E) $49.1\ m/s^2$.

The learning management system automatically choses questions from a question bank. There is the possibility of getting similar questions.

The reasoning for this question is the same as the reasoning for the earlier question.

Question 4 (1 point)

A bird flies 30 m from its nest toward the EAST to point A. She then flies from point A 20 m more toward the EAST to point B. The bird's total displacement from the origin is

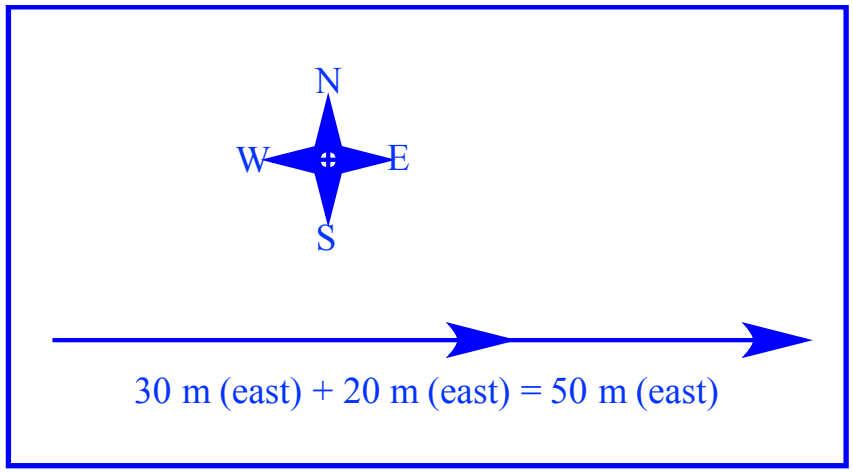
A) 10 m WEST.

B) 30 m WEST.

C) 20 m WEST.

➡ D) 50 m EAST.

E) 10 m EAST.


N
W
E
S
30 m (east) + 20 m (east) = 50 m (east)

Question 5 (1 point)

A deer travels 980 m from an origin toward the WEST to point A. It then travels from point A 670 m toward the EAST to point B. It then travels from point B 200 m toward the WEST to point C. The deer's total displacement from the origin to point C is

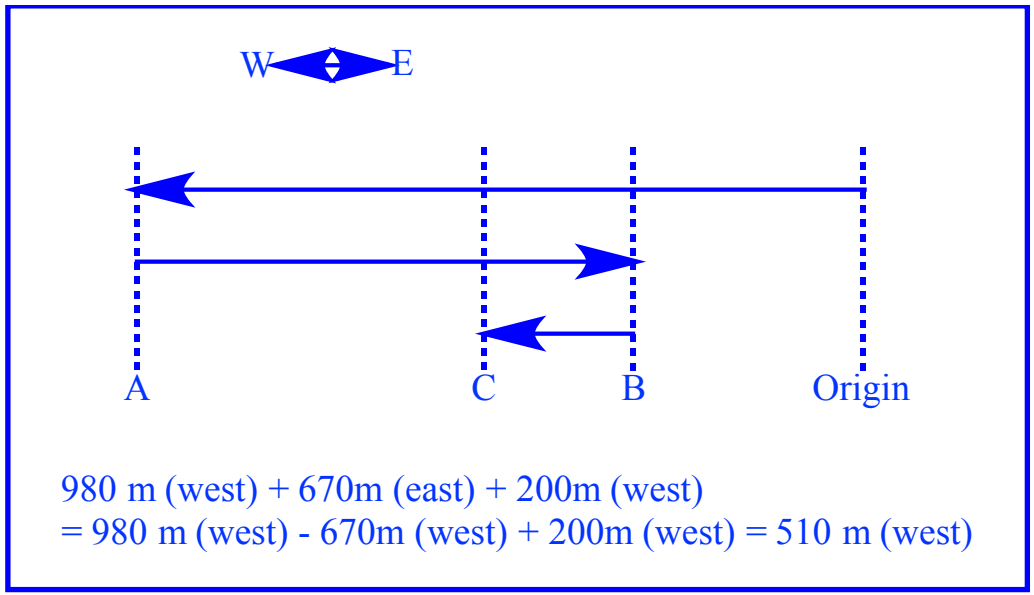
A) 0 m.

B) 200 m toward the WEST.

C) 510 m toward the WEST.

D) 1850 m toward the WEST.

E) 670 m toward the EAST.



980 m (west) + 670m (east) + 200m (west)
= 980 m (west) - 670m (west) + 200m (west) = 510 m (west)

Question 6 (1 point)

A deer travels 500 m from an origin toward the EAST to point A. It then travels from point A 800 m toward the WEST to point B. It then travels from point B 40 m toward the WEST to point C. The deer's total displacement from the origin to point C is

A) 40 m toward the WEST.

B) 0 m.

C) 840 m toward the WEST.

➡ D) 340 m toward the WEST.

E) 1340 m toward the WEST.

The learning management system automatically choses questions from a question bank. There is the possibility of getting similar questions.

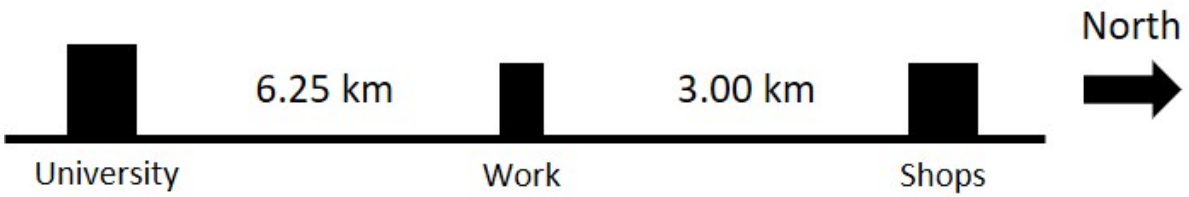
The reasoning for this question is the same as the reasoning for the previous question.

Question 7 (2 points)

If, in the figure, you start from shops, travel to the university, and then to work in a total of 5.00 hours, what is your average velocity (in km/h)?

Hint: Only enter the numerical part of the answer to two decimal places. Use positive (+) for north and negative (−) for south.

Hint: Answer to two decimal places.



Your Answer:

-0.60

Total displacement is from the shops to work, which is 3.00 km south.
Using positive (+) for north and negative (−) for south, the total displacement is −3.00 km.

The total time is 5.00 hours.

Average velocity = total displacement ÷ total time = −3.00 km ÷ 5.00 hours = −0.60 km/h.

The numerical part of the average velocity (in km/h), to two decimal places, is −0.60.
Note the minus sign is essential to indicate the southerly direction.

Question 8 (2 points)

After feeding, an arctic tern is flying back to its nest at 17 km/h for 119 kilometres. It then starts to snow so the bird slows to 11 km/h. The bird arrives back at the nest after flying for a total of 11 hours and 40 minutes. How far is the nest from the feeding ground?

A) 200 km

B) 140 km

C) 119 km

D) 190 km

➡ E) 170 km

Average velocity = displacement ÷ time

In the first time period:
Average velocity = displacement ÷ time
(17 km/h) = (119 km) ÷ time
time = 7 hours

first time period + second time period = total time
(7 hours)+ second time period = (11 hours and 40 minutes) = 11.6666667 hours
second time period =4 hours and 40 minutes = 4.6666667 hours

In the second time period:
Average velocity = displacement ÷ time
(11 km/h) = displacement ÷ (4.6666667 hours)
displacement = 51.3333337 km

total distance = 119 km + 51.3333337 km = 170.3333337 km

Question 9 (2 points)

In slow juggling, the aim is to throw the balls as high as possible to have the minimum possible hand-ball contacts in one minute. A juggler throws a ball vertically upward and it returned to its starting position in 5.2 s. What is the magnitude of the initial vertical velocity (in m/s)of the ball? Hint: Enter only the numerical value of your answer to zero decimal places.

Your Answer:

25

Presuming no air resistance, the ball will go up for half the time and fall for half the time.

Just considering the upward motion, and taking positive to be the upward direction:
Rising time = 5.2 ÷ 2 s = 2.6 s.
Final speed is $v_f = 0$ m/s , before it starts to fall.

Acceleration = $a = (v_f - v_i) \div t$ = gravitational acceleration = $g = (v_f - v_i) \div t$
Which gives: $v_i = v_f - g \times t = = 0$ m/s – (–9.8 m/s^2) × (2.6 s) = 25.48 m/s.

The numerical part of the initial velocity (in m/s), to zero decimal places, is 25.

Question 10 (2 points)

If a truck accelerates at a steady 4.4 m/s^2, how long will it take to reach a speed of 55 km/h, starting from rest?

A) 0.29 s

B) 12.5 s

C) 3.5 h

D) 0.08 s

➡ E) 3.5 s

The final speed is 110 km/h = 55 km/h = 55 × 1000 ÷ 3600 m/s = 15.2777778 m/s.
The initial speed is 0 km/h = 0 m/s.

Acceleration = $a = (v_f - v_i) \div t$
Which gives: $t = (v_f - v_i) \div a$ = (15.2777778 – 0 m/s) ÷ 4.4 m/s^2 = 3.47222223 s .