



Contextual questions

1. Name the seven fundamental units of the SI system as well as the quantities that may be measured using these units.
2. The CGS system is based on different fundamental units than that of the SI system. Name the two most important differences as well as one similarity that exists between the two systems in the field of mechanics.
3. Explain why the newton (N) is referred to as a derived unit in the SI system.
4. Simplify the following quantities as much as possible using prefixes.

4.1 35 000 g	4.2 0,000 000 004 m
4.3 586 000 000 000 kg	4.4 0,000 036 g
4.5 650 000 000 m	4.6 0,002 561 g
4.7 0,005 m	
5. Write the following quantities in the correct unit as defined by the SI system and the CGS system respectively.

5.1 300 mg	5.2 700 ton
5.3 0,063 km	5.4 240 μ g
5.5 0,69 nm	5.6 30 h
5.7 15 min	5.8 50 ms
6. Rewrite the following in scientific notation:

6.1 0,000 000 0467	6.2 0,002 59
6.3 4 350 000	6.4 271 000
6.5 3 000 000 000	6.6 0,005
6.7 0,034	6.8 3 582
7. Use one of the following formulae to calculate the unknown values.

$$E_p = mgh$$

$$E_k = \frac{1}{2}mv^2$$

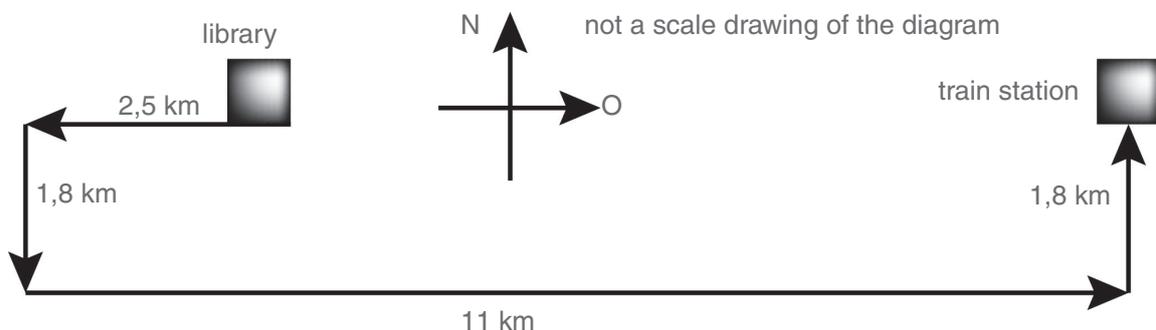
$$a = \frac{v_f - v_i}{\Delta t}$$

Calculate:

7.1 E_p if $m = 30 \text{ kg}$; $g = 9,8 \text{ m}\cdot\text{s}^{-2}$; $h = 15 \text{ m}$
7.2 E_k if $m = 43 \text{ kg}$; $v = 52 \text{ m}\cdot\text{s}^{-1}$
7.3 a if $v_f = 30 \text{ m}\cdot\text{s}^{-1}$; $v_i = 5 \text{ m}\cdot\text{s}^{-1}$; $\Delta t = 10 \text{ s}$
7.4 h if $E_p = 460 \text{ J}$; $m = 225 \text{ kg}$; $g = 9,8 \text{ m}\cdot\text{s}^{-2}$
7.5 m if $E_k = 2 440 \text{ J}$; $v = 12 \text{ m}\cdot\text{s}^{-1}$
7.6 Δt if $v_f = 15 \text{ m}\cdot\text{s}^{-1}$; $v_i = 3 \text{ m}\cdot\text{s}^{-1}$; $a = 3 \text{ m}\cdot\text{s}^{-2}$



- 8 Thomas has the habit of pacing up and down while talking on his cell phone. He starts at a point spot on the veranda and walks 5 steps to the right (from A to B). He then walks 8 steps to the left (from B to C) and lastly 7 steps to the right (from C to D). All this takes him 50 seconds. Assume 1 step is 1 m.
- 8.1 Present the three displacements in a vector diagram by making use of a scale drawing. Name all the vectors clearly and write down the true distances next to the vectors.
- 8.2 What is his position at B relative to A?
- 8.3 What is his position at C relative to A?
- 8.4 What is his position at D relative to A?
- 8.5 What was the total distance that he walked?
- 8.6 Calculate his net or resultant displacement.
- 8.7 Calculate his average speed.
- 8.8 Calculate his average velocity.
- 9 A large truck travels at a constant velocity of $30 \text{ m}\cdot\text{s}^{-1}$ east on a straight road. It then accelerates at $1,5 \text{ m}\cdot\text{s}^{-2}$ for 7 seconds.
- 9.1 What will the truck's velocity be after the 7 seconds?
- 9.2 How far did the truck travel during the 7 seconds?
- 10 Loyiso rides his bicycle at a constant velocity of $25 \text{ m}\cdot\text{s}^{-1}$ west. He realises that he is late for an appointment and accelerates constantly at $2 \text{ m}\cdot\text{s}^{-2}$ until his velocity is $35 \text{ m}\cdot\text{s}^{-1}$ west.
- 10.1 Calculate how long it took him to increase his velocity.
- 10.2 Calculate the distance that he covered in that time.
11. Spiderman, with a mass of 100 kg, stands on the railing of a bridge and he has to get away fast. He sees a truck filled with mattresses about to pass under the bridge and decides to jump from the bridge so that he lands on the mattresses. He steps off the railing before the truck with the mattresses passes underneath the bridge. Ignore air resistance and take gravitational acceleration to be $9,8 \text{ m}\cdot\text{s}^{-2}$ downwards. Calculate the total time from the moment Spiderman falls from rest until he lands on the mattresses, which are 20 m below.
- 12 Ashish is the driver of a delivery truck. He has to transport packages from the library to the station. He departs from the library, drives 2,5 km west, 1,8 km south, 11 km east and 1,8 km north to reach the station. The entire journey takes him 18 minutes. The following vector diagram is a representation of Ashish's route:



- 12.1 What is Ashish's final displacement relative to the library?
- 12.2 Calculate Ashish's average speed in kilometers per minute.
- 12.3 Calculate Ashish's average velocity in kilometers per hour

