# Physics Mid-Topic Test – Revision

Name:Solutions

***Answer on file paper and show full working out.  
Use the “Physics Formulae and Data” page in your Booklet.***

1. What are scalar and vector quantities?

*Vectors are quantities that have magnitude and direction, scalars are quantities that have magnitude only.*

1. Explain the difference between distance and displacement. Define each term, identify each as either scalar or vector, and give one clear example to illustrate the differences between these concepts.

*Distance is the length of the pathway taken OR how far an object has moved*

*Distance is a scalar quantity,*

*Displacement is the straight line distance from the starting point to the finishing point with direction of that line.*

*Eg;*



1. Find the distance and displacement (include a vector diagram) of:
   1. a tennis ball which rolls 4 m to the left and then bounces back 6 m towards the right.



* 1. a student who walks 3 km south and then 2 km west.



1. Explain the difference between speed and velocity.

Speed is the rate of change in distance OR speed is the distance travelled per unit time.

Velocity is the rate of change in displacement OR the displacment of an object per unit time.

Speed is a scalar and velocity a vector quantity.

Speed requires magnitude only, Velocity requires magnitude and direction.

1. VvviA runner completes 3 laps of a 200 m circular track in 104 s. Calculate:
   1. the average speed.
   2. the average velocity.

v = 0

1. A puppy runs 16.5 m south in 2.0 s then 18.9 m north in 3.1 s.
   1. What is the distance travelled?
   2. What is the displacement?
   3. What is the average speed?
   4. What is the average velocity?

a) *35.4m b) 2.4m N 35.4 m N c) speed = 6.94 m/s d) v= 0.47 m/s N*

1. A soccer ball was kicked towards the goals 18 m away. If the ball reached the goalie in 1.2 s, what was the average speed of the ball?
2. A snail travelled in a straight line for 15 minutes. If the snail could maintain an average velocity of 0.01 m/s, how far did it travel?
3. A jet plane travels at a constant velocity of 580 m/s for 2 km. How long does this take?
4. Velocity is measured in ‘metres per second’ and acceleration is measured in ‘metres per second per second’. These units are written as m/s and m/s2 respectively. Use an example to illustrate the difference between these units.
5. A family car can reach a velocity of 60 km/h in 1 minute from a standing start. What is the car’s acceleration?

0.278 m/s2 forwards

1. A jet fighter is travelling horizontally at 31.0 m/s when it engages its after burners for 3.51 s. At the end of this time, its velocity is 273 m/s. Calculate the acceleration.

68.9 m/s2  forwards

1. How long would it take a car to change its velocity from 10 m/s to 20 m/s if it could accelerate at a rate of 2.5 m/s2?

1. What is deceleration? How would a deceleration be recognised in a calculation?

Deceleration is the rate at which the velocity decreases, ie object is slowing/braking.

Your acceleration answer will be NEGATIVE

1. What is the deceleration of a cyclist who slows down from 8 m/s and stops in 10 s?

a = - 0.8 m/s2

1. An object decelerates at a rate of 8 m/s2 over 5 s. If its initial velocity is 60 m/s, what is its final velocity?

1. The Apollo spacecraft missions in 1969 took astronauts to the Moon in a journey that took about 70 hours. A penny is dropped from the Empire State Building. Ignoring the effects of air resistance:
   1. How fast would it be travelling after 3 s?
   2. Sketch a labelled diagram showing the penny’s velocity after 0, 1, 2, and 3 s.
2. Convert:
   1. 16 m/s to km/h 57.6 km/h
   2. 110 km/h to m/s; and 30.6 m/s
   3. 340 ms to seconds. 0.340 s
3. In relation to vehicles, define the terms: reaction time, reaction distance, braking distance, and stopping distance.

* **Reaction time** is how long it takes a driver to start braking
* **Reaction distance** is how far the vehicle travels before the driver starts braking.
* **Braking distance** is how far the vehicle travels during braking to come to a complete stop.
* The total **stopping distance** is given by:

**stopping distance = reaction distance + braking distance**

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1. A distracted P-plate driver takes 0.7 seconds to respond to a hazard on the road. If the car’s velocity before braking was 75 km/h, calculate the reaction distance travelled before braking and express your answer in car lengths (1 car length = 4.5 m).



1. Calculate the stopping distance of a car initially travelling at 120 km/h where the sleepy driver takes 1.8 s to react and needs 5.1 s of braking time to stop the vehicle.

Reaction distance :



Braking distance:



Stopping distance = 60 + 85 = 145 m

***Answer the following questions on this handout.***

1. The following displacement-time graph represents David’s training run on the weekend.

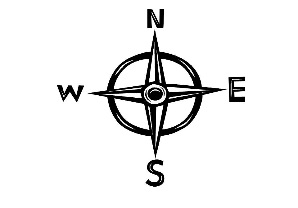
Chart, line chart

Description automatically generated

David ran fastest:

* 1. in the first 30 minutes.
  2. between 30 and 60 minutes.
  3. between 60 and 90 minutes.
  4. between 90 and 120 minutes. (1 mark)

1. The diagram below shows the journey taken by Wanesa on her way to work at Macca’s.



650 m

Start



Maccas

1200 m

800 m

1000 m

1. Determine the distance she travelled.

Distance = 1200 + 800 + 1000 + 650 = 3 650 m

(1 mark)

1. If Wanesa completed this journey in 1 h 30 min, calculate her average speed.

(2 marks)

1. Calculate Wanesa’s displacement.

s = 150 m E

(2 marks)

1. Calculate her average velocity.

East

(2 marks)

1. With reference to the “2-second rule”, explain why tailgaiting is so dangerous and what motorists can do to prevent rear-end accidents.

Tailgating means there is less than 2 seconds between the car in front of you and your car. If the car in front should suddenly stop due to hitting an object or braking hard, you will not have enough time to react (reaction time) and brake yourself. Your car will hit the car in front. (2 marks)

1. The graph below plots the motion of a toddler riding a tricycle up and down her driveway.
2. Describe the toddler’s motion for each section of the graph. (4 marks)

0-50 s : constant velocity forwards

50-60 s : constant velocity, backwards

60-90 s : stopped at 15 m from start position

90-110 s : constant velocity forwards.

1. What was the distance? 45 m; and final displacement? 25 m from start position down driveway\_ (2 marks)
2. This graph shows the motion of a man riding on a Segway along straight pathway.

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Which option correctly describes the motion during each stage? (1 mark)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | AB | BC | CD | DE |
| P | Decelerating | Constant speed | Accelerating | Stationary |
| Q | Accelerating | Stationary | Constant speed | Decelerating |
| R | Accelerating | Constant speed | Decelerating | Stationary |
| S | Decelerating | Stationary | Constant speed | Accelerating |