

## Kinematics Test

Patrons are kindly reminded that  $vt$  graphs can be very helpful and

$$\text{Average Velocity} = \frac{\text{Total Distance}}{\text{Total Time}}.$$

1. A cyclist travels from  $A$  to  $B$ , a distance of 240 m. He passes  $A$  at 12 m/s, maintains this speed for as long as he can, and then brakes so that he comes to a stop at  $B$ . Illustrate his journey with a velocity-time graph.  
His deceleration when braking is  $3 \text{ m/s}^2$ .
  - (a) Find the time he takes, and the distance he covers while braking.
  - (b) What time does he take to get from  $A$  to  $B$ ?
2. A motorist travelling at  $u \text{ m/s}$  joins a straight motorway. On the motorway she travels with a constant acceleration of  $0.07 \text{ m/s}^2$  until her speed has increased by  $2.8 \text{ m/s}$ .
  - (a) Calculate the time taken for this increase in speed.
  - (b) Given that the distance travelled while this increase takes place is 1050 m, find  $u$ .
3. A man is running for a bus at  $3 \text{ m/s}$ . When he is 100 m from the bus stop, the bus passes him going at  $8 \text{ m/s}$ . If the deceleration of the bus is constant, at what constant rate should the man accelerate so as to arrive at the bus stop at the same instant as the bus?
4. An ice skater increases speed from  $4 \text{ m/s}$  to  $10 \text{ m/s}$  in 10 seconds at a constant rate.
  - (a) How far does she go in this time? What is her average velocity over this period?
  - (b) For what proportion of the time is she moving at less than her average velocity?
  - (c) For what proportion of the distance is she moving at less than her average velocity?
5. A woman stands on the bank of a frozen lake with a dog by her side. She skims a bone across the ice at a speed of  $3 \text{ m/s}$ . The bone slows down with deceleration  $0.4 \text{ m/s}^2$ , and the dog chases it with acceleration  $0.6 \text{ m/s}^2$ . How far out from the bank does the dog catch up with the bone?
6. A cyclist is free-wheeling down a long straight hill. The times between passing successive kilometre posts are 100 seconds and 80 seconds. Assuming her acceleration is constant, write down two equations connecting this acceleration and the speed as she passes the middle post. Hence find the acceleration.