Give all answers in SI units (m, s, $ms^{-1}$ and $ms^{-2}$) unless otherwise indicated.

1. An athlete completes a 100 m sprint in 10 s. What is the athlete's average speed for this sprint?

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2. A car travels at an average speed of 108 $kmh^{-1}$ for 30 minutes.

   (a) Convert the speed to $ms^{-1}$.

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   (b) How far will the car travel in 30 minutes?

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3. Light travels at $3.0 \times 10^8$ $ms^{-1}$ in space. How far will it travel in

   (a) 1.0 s?

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   (b) 1.0 minutes?

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   (c) 1.0 years?

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4. In 1978, Tracey Wickham swam the 800 m freestyle event at the Commonwealth Games at an average speed of 1.58 $ms^{-1}$. Determine her time for the race.

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5. A rocket travels at a steady speed of 500 $kmh^{-1}$. How far in metres can the rocket travel in 24 minutes?

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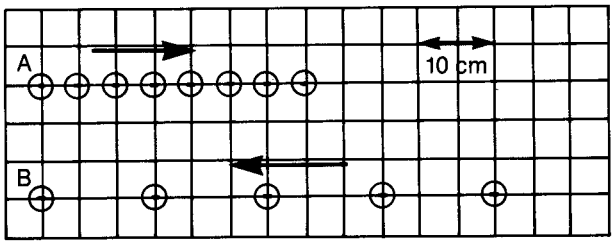
6. The drawing below shows a representation of a multi-flash photograph where two pucks A and B are moving across an air table. The time interval between flashes is 0.10 s and the drawing is one-tenth the actual size.




(a) Describe the motion of each puck.

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(b) Determine the average speed of each puck.

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(c) How many intervals are shown for each puck?

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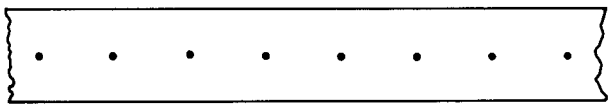
(d) Draw another multi-flash photograph representation for another puck (C) which is travelling at twice the speed of puck B.

7. This piece of ticker tape represents constant speed. The time between hammer blows for the ticker timer is 1/50 s.



(a) What length of time does the tape represent?

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(b) What is the average speed of motion?

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8. An athlete completes a distance of 300 m in 45 s and then 500 m in 65 s. What was her average speed for the race?

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9. A train has travelled to town X, 120 km away, in a time of 2.0 h to be on schedule. The first 60 km of the journey was slow, averaging 40 $kmh^{-1}$. How fast did the train go over the rest of the journey in order to reach town X on time?

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10. Jason can run at 6.0 $ms^{-1}$ while Kylie can run at 8.0 $ms^{-1}$. They are to race over a distance of 1200 m. To make the race more even, Jason is given a head start of *t* seconds. How long is *t* if they finish the race in a tie?

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11. A truck is travelling along a straight highway at a speed of 30 $ms^{-1}$. Ahead of it is a car travelling at 28 $ms^{-1}$. The truck driver wishes to pass the car but notices an oncoming car which he estimates to be 1.0 km away. The truck driver assumes that the oncoming car is also travelling at 30 $ms^{-1}$. If the car is 3.0 m long, the truck 15 m long and two car lengths are allowed as clearance before and after passing:

    (a) Assuming that the truck driver's assumptions are correct, does the truck make it? Give reasons for your answer.

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    (b) The truck driver's distance estimate is correct but the oncoming car is travelling at a speed greater than 30 $ms^{-1}$. What is the maximum speed that the oncoming car can travel and still avoid a collision?

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12. An aeroplane travels 200 km in 50 minutes. Assuming it maintains a constant speed, how long will it take to travel a distance of 360 km?

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13. A vehicle moves from rest to a velocity of 6 $ms^{-1}$ in a time of 3 seconds. Calculate its acceleration.

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14. A ball rolls down an incline and reaches a velocity of 0.8 $ms^{-1}$. It starts from rest and takes 0.5 seconds to go down. What is its acceleration?

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15. In 10 seconds a truck accelerates from 2 $ms^{-1}$ to 10 $ms^{-1}$. Calculate its acceleration.

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16. A tennis ball leaving a racket accelerated from rest to 20 $ms^{-1}$ in 0.75 seconds. What was the acceleration?

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17. A sailing boat is moving at 3 $ms^{-1}$ and is hit by a stronger wind. The velocity of the boat increases to 8 $ms^{-1}$ in 2.8 seconds. Calculate the acceleration that the wind produced.

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18. A bike rider speeding along at 40 $kmh^{-1}$ slams on the brakes and slows down to 10 $kmh^{-1}$ in 1.4 seconds. Calculate the acceleration in $ms^{-2}$.

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19. A car moving at 60 $kmh^{-1}$ brakes to a halt in 3 seconds. Calculate the acceleration that brought it to a halt.

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20. A motor-cycle racer brakes from 55 $ms^{-1}$ on a straight down to 25 $ms^{-1}$ in 4.1 seconds. Calculate the acceleration of the bike.

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21. A conveyor belt travelling at 5 $ms^{-1}$ slows to 2.7 $ms^{-1}$ in 0.6 seconds. What was the acceleration needed to slow it down?

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22. An object thrown upwards (vertically) slows down at a rate of 9.8 $ms^{-1}$ every second. If it leaves the hand at a velocity of 15 $ms^{-1}$, how long will it take to come to rest?

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23. A diver's body hits the water at 8 $ms^{-1}$ and accelerates in the opposite direction of motion at a rate of 1.5 $ms^{-2}$. Calculate how long it will take for the diver to come to rest.

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24. A ball is hit vertically upwards with a velocity of 11 $ms^{-1}$. It is accelerated by gravity in the opposite direction to the motion at 9.8 $ms^{-2}$. What time will it take to slow down to 2 $ms^{-1}$?

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## Answers

1. 10 $ms^{-1}$

2. (a) 30 $ms^{-1}$

   (b) 5400 m

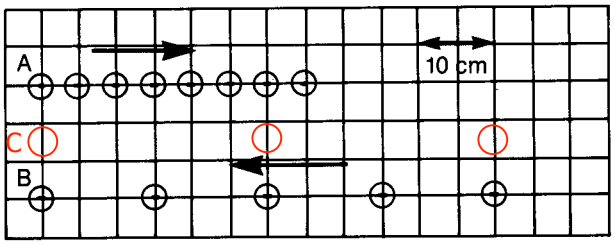
3. (a) $3.0 \times 10^{8}$ m

   (b) $1.8 \times 10^{10}$ m

   (c) $9.5 \times 10^{15}$ m

4. 506 s

5. $2.0 \times 10^{5}$ m

6. 


   (a) A: Constant slow velocity, B: Constant fast velocity

   (b) A: 0.5 $ms^{-1}$, B: 1.5 $ms^{-1}$

   (c) A: 7, B: 4

   (d) See diagram above.

7. (a) 0.14 s

   (b) 0.5 $ms^{-1}$

8. 7.3 $ms^{-1}$

9. 33 $ms^{-1}$

10. 8.3 s

11. (a) Yes by 100 m

    (b) 36.7 $ms^{-1}$

12. 5400 s

13. 3 $ms^{-2}$

14. 1.6 $ms^{-2}$

15. 0.8 $ms^{-2}$

16. 27 $ms^{-2}$

17. 1.8 $ms^{-2}$

18. 6 $ms^{-2}$

19. 5.6 $ms^{-2}$

20. 7.3 $ms^{-2}$

21. 3.8 $ms^{-2}$

22. 1.5 s

23. 5.3 s

24. 1.1 s