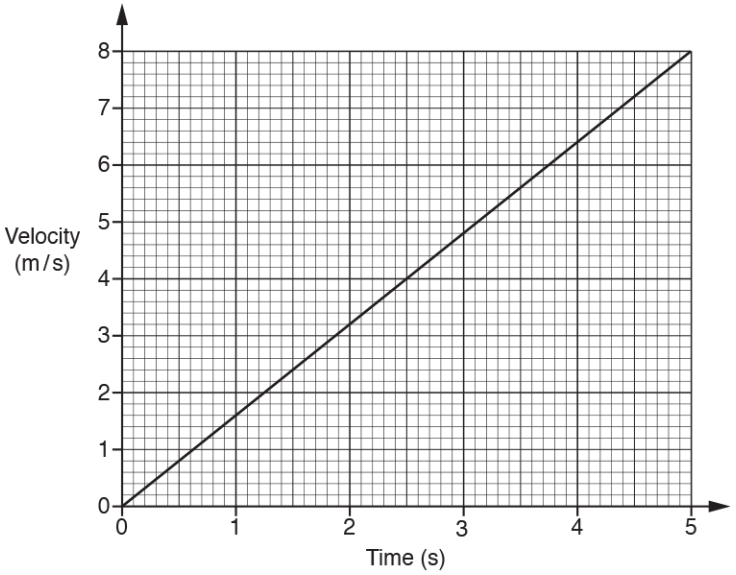
Motion (H)

1. Look at the velocity-time graph of an object.



What is the distance travelled by the object in 5s?

A 0.63 m
B 1.6 m
C 20 m
D 40 m

[1]

Your answer

2. Two cars head towards each other on a road.

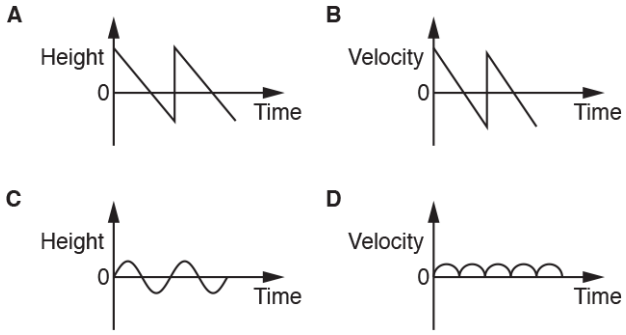
What velocity does the driver of car **Q** see car **P** travelling towards him at?

A 10 m/s
B 15 m/s
C 25 m/s
D 40 m/s

Your answer

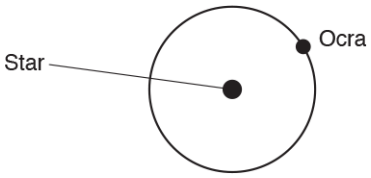
[1]

3. Which graph shows a bouncing ball?



Your answer ☐ **[1]**

4. Planet Ocra is in a circular orbit around a star.



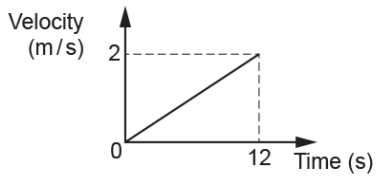
Which statement is correct?

A The acceleration of Ocra is zero.
B The speed of Ocra is changing.
C The velocity of Ocra is changing.
D The velocity of Ocra is zero.

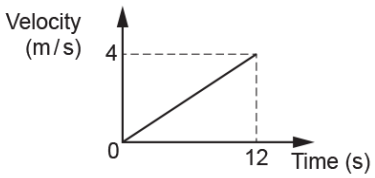
Your answer ☐ **[1]**

5. Look at the motion graphs.

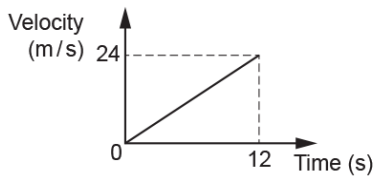
A



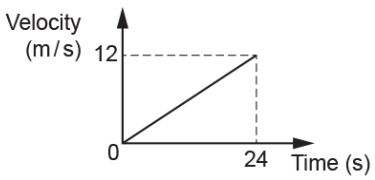
B



C



D

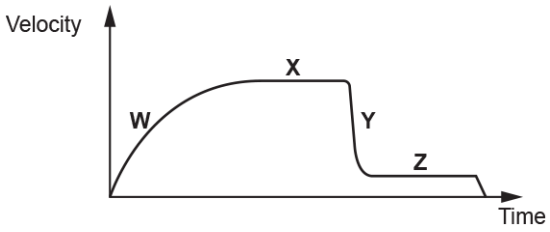


Which graph shows a journey with a distance of 24 m?

Your answer ☐ **[1]**

6. A skydiver falls from a plane. His parachute opens and he lands safely.

Look at the velocity-time graph of his journey.



Which parts of the graph show balanced forces on the skydiver?

A **X** only
B **Y** and **Z**
C **X** and **Z**
D **Y** only

Your answer ☐ **[1]**

7. A car has a mass of 1000 kg and is travelling at a speed of 20 m / s.

Calculate the kinetic energy of the car.

A 10 000 J
B 20 000 J
C 200 000 J
D 400 000 J

Your answer ☐ **[1]**

8. A car travels at a speed of 70 mph (miles per hour).

1 mile is approximately 1600 metres.

Convert 70 mph into m / s (metres per second).

A 2.6 m / s
B 31 m / s
C 112 m / s
D 160 m / s

Your answer ☐ **[1]**

9. A student wants to find out the depth of a well.

She thinks that she can calculate this by dropping a stone into the well and timing how long it takes to hear the stone splash at the bottom.

i. Explain how she could use this measurement to find the depth of the well.

---

[3]

ii. It takes 2.2 seconds for the stone to drop from rest and splash into the water at the bottom.

What is the speed of the stone when it hits the water?

Answer = ... m/s **[2]**

10. A student watches a ball game on the school field.

The student sees the ball being hit with a bat but he hears the sound a short time after. This is because the speed of light is much greater than the speed of sound.

Describe an experiment which measures the speed of **sound** in air. In your answer describe the measurements, calculations and procedures needed to gather **accurate** and **reliable** results.

You may draw a diagram as part of your answer.

[5]

11 (a). A scientist uses different drivers to test the stopping distances of the same car.

Look at the results.

Driver	Speed (m/s)	Thinking distance (m)	Braking distance (m)
A	8	6	6
B	16	13	24
C	32	24	96
D	16	12	22
E	8	5	6
F	32	30	120

Which driver has the **quickest** reaction time?

Driver ..... has the **quickest** reaction time.

Calculate their reaction time.

Answer = _____ s **[3]**

(b). Give two drivers that have the **same** reaction time.

Drivers ..... have the **same** reaction time.

Explain your answer.

_____

_____

_____ **[2]**

(c). Driver **C** travels at 32 m/s on the road and then stops. The car has a mass of 1200 kg.

i. Show that the **kinetic energy** stored by the car at 32 m/s is 614 000 J.

[3]

ii. Describe what happens to the kinetic energy of the car as it brakes and stops.

_____

_____

_____

_____ **[2]**

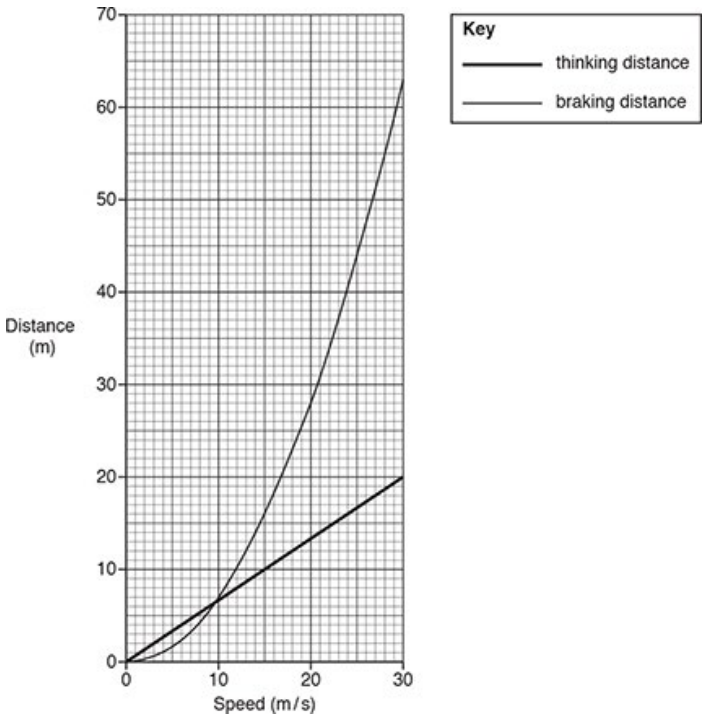
iii. The braking distance of the car is 96 m.

Calculate the **braking force** on the car.

Give your answer to **4** significant figures.

Answer = _____ N **[3]**

12. The graph shows thinking and braking distances for a car at different speeds.



i. Use the graph to find the **thinking distance** at 24 m / s.

Thinking distance =..... m **[1]**

ii. Calculate the **thinking time** at 24 m / s.

Use your answer to **(i)** and the equation: distance travelled = speed × time

Give your answer to **2** decimal places.

Thinking time =..... s **[3]**

13. Fig. 21.1 is a speed-time graph for car **P**.

The driver of car **P** reacts to a traffic light at time = 0.00 s, then presses the brakes at time = 0.50 s.

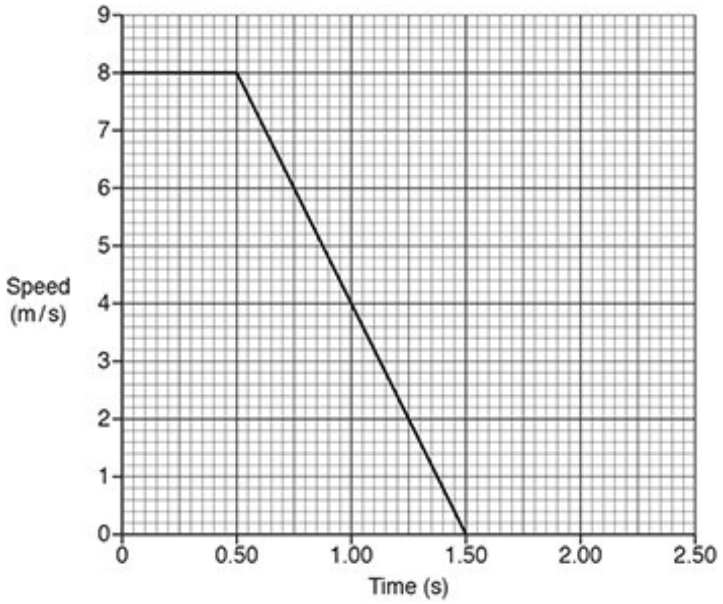


Fig. 21.1

i. The braking distance is the same size as the thinking distance.

Explain how the graph in **Fig. 21.1** shows this.

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[1]

ii. Add another line to the graph in **Fig. 21.1** to show the journey of car **Q**.

- Car **Q** is travelling at 8 m / s.
- The driver of car **Q** reacts, then presses the brakes after 0.75 s.
- Car **Q** decelerates at the same rate as car **P**.

[2]

14. Some students try to measure the speed of sound, as shown in **Fig. 24.1**.

One student makes a loud sound by clapping her hands.

The sound of the clap reflects from the gym wall causing an echo.

Another student measures the time between hearing the clap and hearing the echo.

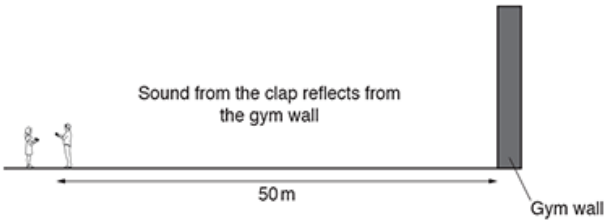

Fig. 24.1

They repeat the experiment three times and record their results in the table below.

Distance to wall (m)	Time 1 (s)	Time 2 (s)	Time 3 (s)	Mean time (s)
50	0.28	0.32	0.54	

i. The student did not pay attention when recording **time 3**.

Calculate the **mean** time taken for the sound of the clap to return, using suitable values from the table.

Mean time taken = ... s **[1]**

ii. Calculate the speed of sound for the clap.

Use your answer to **(i)** and the equation: distance travelled = speed × time

Give your answer to significant figures.

Speed of sound = ... m / s **[4]**

iii. Describe **two** ways to improve and develop their method.

1 ----------

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2 ----------

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[2]

15(a). A student investigates how the angle of a ramp affects the final speed of a trolley.

He uses light gates to record the speed of the trolley at the bottom of the ramp.

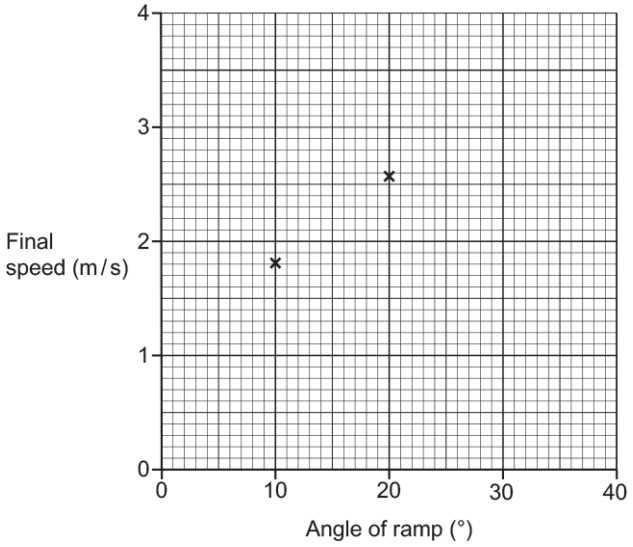
The student releases the trolley from rest at the same point on the ramp each time.

Look at his results.

Angle of ramp (°)	Final speed (m / s)			
	Attempt 1	**Attempt 2**	**Attempt 3**	**Mean**
10	1.81	1.80	1.81	1.81
20	2.58	2.56	2.57	2.57
30	3.1	3.11	3.11	3.11
40	3.52	3.51	3.50	3.51

i. Plot the results on the graph and draw a line of best fit.

Two results have been plotted for you.



[2]

ii. Describe the pattern shown by the results.

Use data from the table or graph in your answer.

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[3]

iii. Explain why the final speed changes when the angle of the ramp increases.

In your answer use ideas about energy.

---

[2]

iv. The student made a mistake when recording one of his results.

Identify the mistake **and** explain what he should have done.

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[2]

v. The student thinks this data shows that his results are **reproducible**.

He is **not** correct.

Explain why.

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[2]

(b).

i. The mean final velocity for the ramp at a 40° angle is 3.51 m / s. The distance from the top of the ramp to the light gate at the bottom is 1.0 m.

Calculate the acceleration of the trolley when the ramp is at a 40° angle.

Give your answer to decimal places.

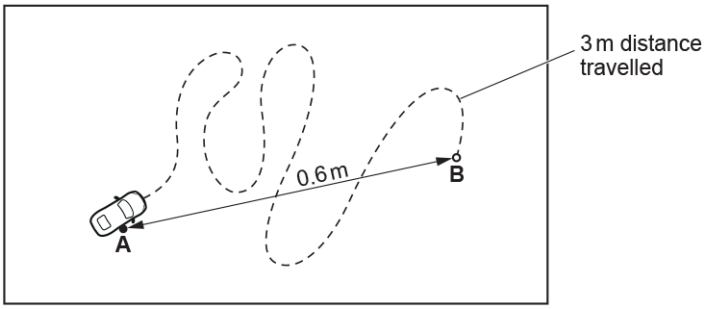
Acceleration = ... m / s^2 **[5]**

ii. The trolley has a mass of 2.0 kg.

Calculate the kinetic energy of the trolley at a speed of 3.0 m / s.

Kinetic energy = ... J **[3]**

16. * A toy car moves randomly on a table.



It moves from position **A** to position **B** in 0.5 minutes, covering a distance of 3.0 m. The start and finish positions are 0.6 m apart.

Explain why the average speed and average velocity of the moving toy car are different from one another.

You should include calculations in your answer.

_____

_____

_____

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_____

_____ **[6]**

17. The boy dives vertically into the swimming pool. The water in the pool is 3.2 m below the diving board.

Calculate the velocity of the boy when he enters the water.

Use an equation from the data sheet to help you.

Gravitational field strength on Earth = 10 N / kg.

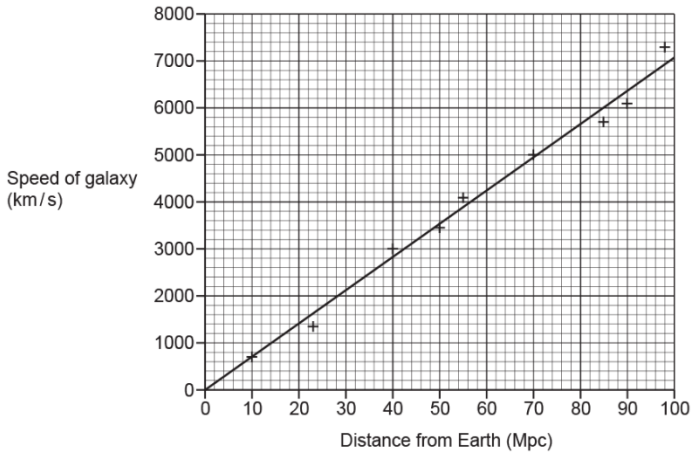
Velocity = ... m / s **[4]**

18(a). Edwin Hubble discovered that all distant galaxies were moving away from the Earth.

Explain how he could tell that all distant galaxies were moving away from the Earth.

---**[2]**

(b). This graph shows how the speed of a galaxy changes with distance from the Earth.



i. Use data from the graph to show that the speed of the galaxy is proportional to the distance from the Earth.

---**[2]**

ii. Explain how data from the graph provides evidence for the Big-Bang.

_____

_____

_____ **[1]**

(c). Before Edwin Hubble could publish his results, his work was peer reviewed.

Suggest why peer review is important.

_____

_____ **[1]**

(d). The parsec (pc) is a unit used for measuring large distances in the Universe.

i. A galaxy is at a distance of 82 Mpc from the Earth.

Use the graph to determine the speed of this galaxy.

Give your answer in metres per second (m / s).

Speed = ... m / s **[2]**

ii. Calculate the time it takes for the galaxy to travel 2.53×10^{24} m.

Use your answer to **(i)** to help you.

Time = ... s **[3]**

END OF QUESTION PAPER