

## 4: Mechanics 1 – Topic questions

## Paper 3

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

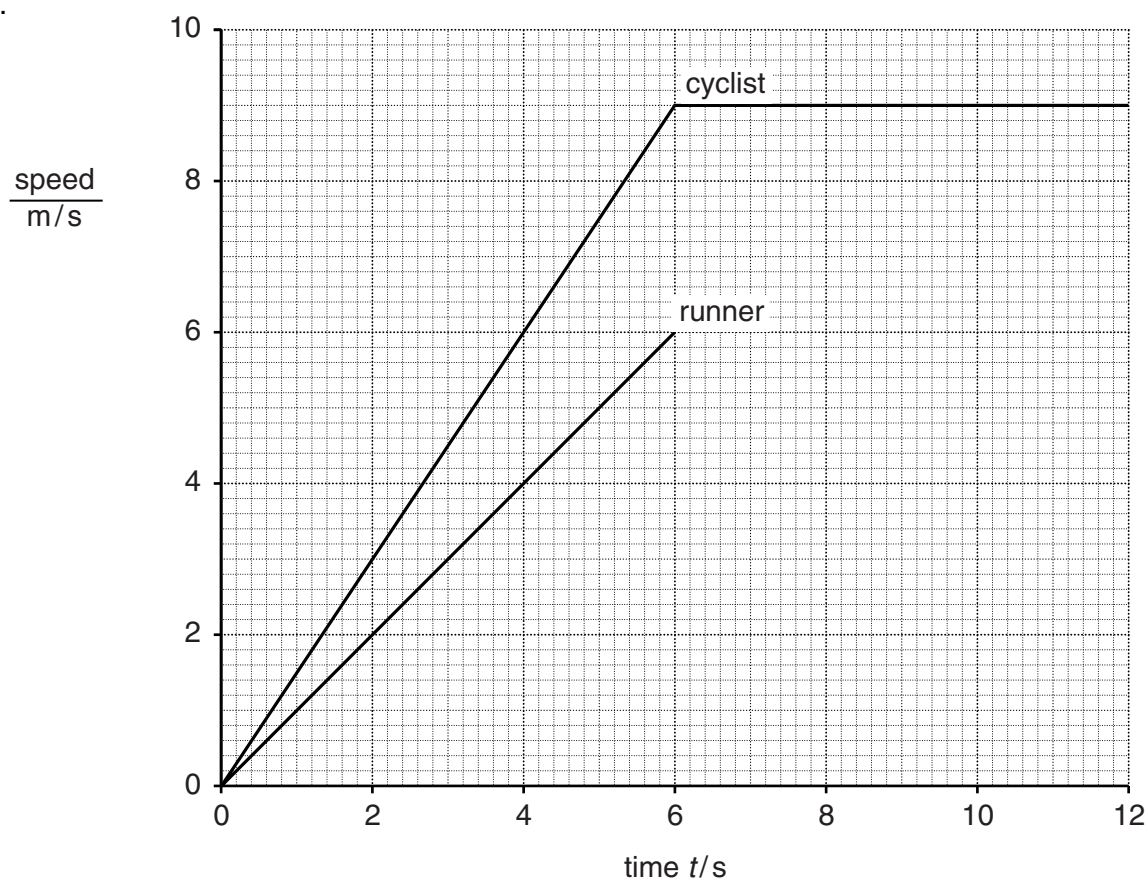
Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
1	2016	June	31
1	2016	March	32
2	2016	March	32

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at [www.cambridgeinternational.org/support](http://www.cambridgeinternational.org/support)

1 Fig. 1.1 shows part of the speed-time graphs for a cyclist and for a runner.



**Fig. 1.1**

- (a) Compare the motion of the cyclist and the runner during the first 6 seconds. Explain your answer.

.....  
 .....  
 .....  
 .....[3]

- (b) Describe the motion of the cyclist between time  $t = 6.0$  s and time  $t = 12.0$  s.

.....[1]

- (c) Calculate the total distance travelled by the cyclist between  $t = 0$  and  $t = 12.0$  s.

distance travelled = ..... m [4]

**(d)** After the first 6.0 seconds, the runner moves at constant speed for 4.0 seconds. He then slows down uniformly and stops in a further 2.0 seconds.

On Fig. 1.1, complete the graph for the runner's motion.

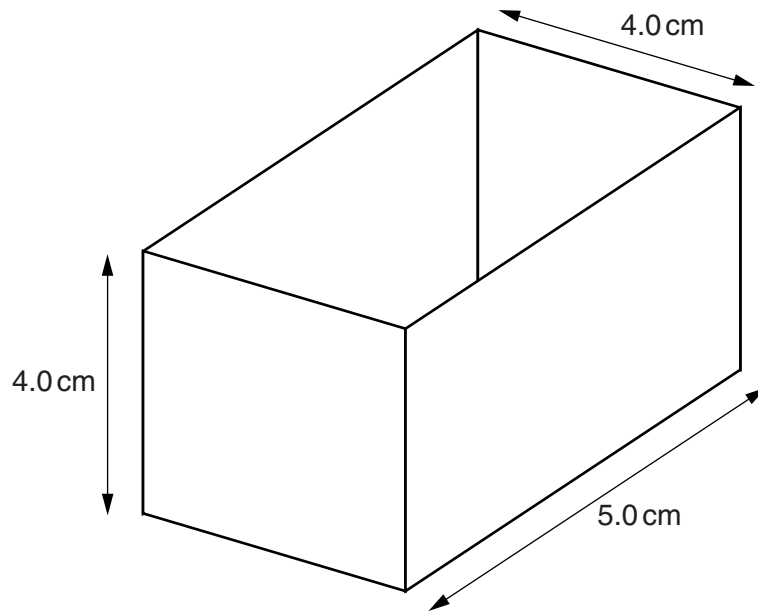
[2]

[Total: 10]

- 1 A student is investigating volume and density.

The student has a box, as shown in Fig. 1.1, a balance, a rule and some dry sand.

- (a) Fig. 1.1 shows the dimensions of the inside of the box.



**Fig. 1.1** (not to scale)

Calculate the volume of sand needed to fill the box.

volume of sand = .....  $\text{cm}^3$  [1]

- (b) The student measures the mass of the box when empty and when filled with sand.

quantity	mass/g
mass of box filled with sand	216.0
mass of empty box	40.0

Calculate the mass of the sand in the box, using her results.

mass of sand = ..... g [1]

(c) Calculate the density of the sand.

density of sand = ..... g/cm<sup>3</sup> [3]

(d) A miner has a bag containing a mixture of gold dust and sand. Gold has a density of 19.3g/cm<sup>3</sup>.

He heats the mixture until the gold melts.

Predict whether the sand will float on top of the molten gold. Explain your answer.

.....

.....

.....[2]

[Total: 7]

- 2 Three students walk together from school to a bridge. The students stand together on the bridge for three minutes and then return separately to school.

The distance-time graphs for student A, student B and student C are shown in Fig. 2.1.

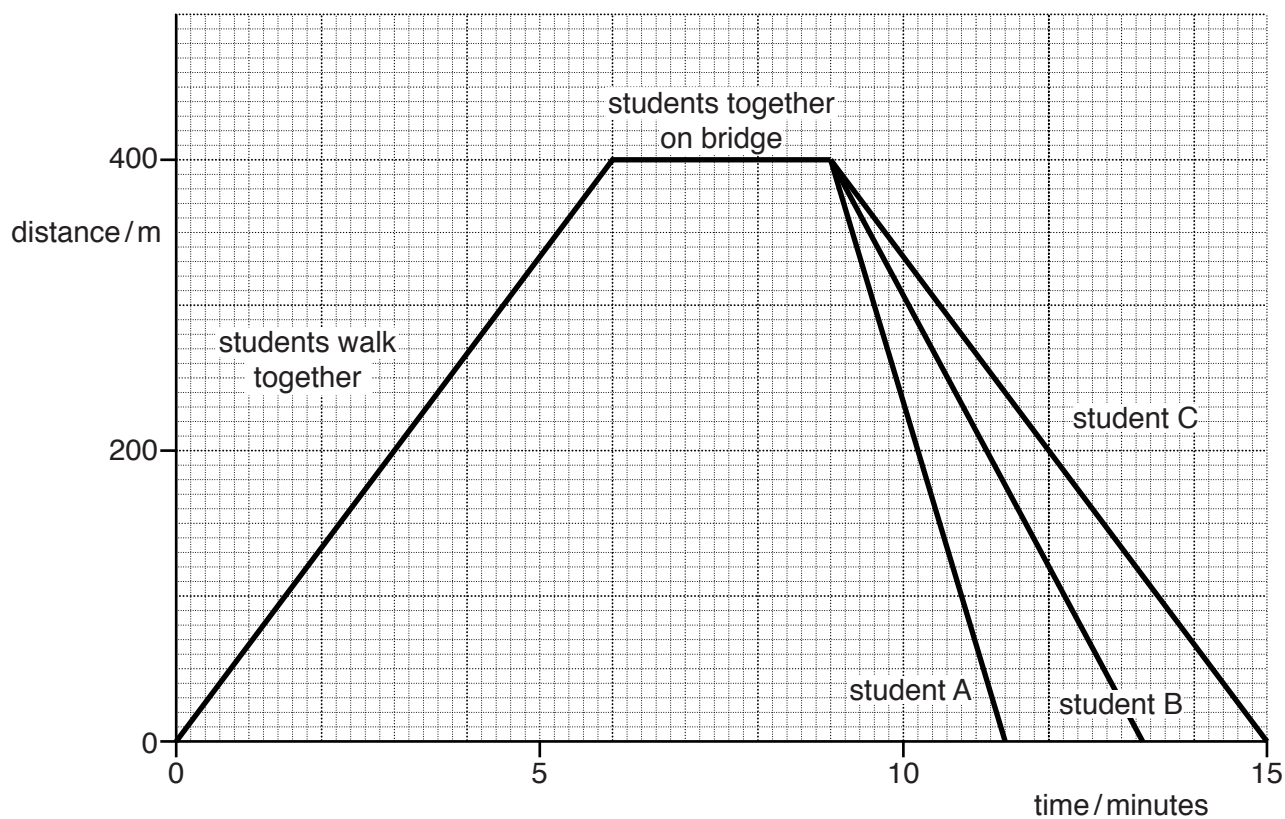


Fig. 2.1

- (a) (i) Determine the distance from the school to the bridge.

distance = ..... m [1]

- (ii) Calculate the average speed of the students when they are walking to the bridge. Give your answer in m/s.

average speed = ..... m/s [4]

**(b)** The students return to school at different speeds. One student walks slowly, one student walks quickly and the other student runs.

State which student runs. Explain how this is shown by the graph.

student .....

explanation .....

.....[2]

[Total: 7]

Question	Answer	Mark
1 (a)	cyclist accelerating <b>OR</b> moving faster <b>OR</b> cyclist has higher speed both (cyclist and runner) accelerating cyclists gradient steeper <b>OR</b> acceleration values calculated	B1 B1 B1
1 (b)	Constant <b>OR</b> steady <b>OR</b> uniform (speed or motion)	B1
1 (c)	indication of an area calculated $6 \times 9 = 54(\text{m})$ $\frac{1}{2} (6 \times 9) = 27(\text{m})$ <u>81(m)</u>	C1 C1 C1 A1
1 (d)	horizontal line finishes at 10 seconds straight line to time zero in two seconds	B1 B1
		Total: 10
1 (a)	80 (cm <sup>3</sup> )	B1
1 (b)	176.0 (g)	B1
1 (c)	D = M / V in words, numbers or symbols $176 \div 80$ 2.2 (g / cm <sup>3</sup> )	C1 C1 A1
1 (d)	(sand) will float sand is less dense than gold	C1 A1
		Total: 7
2 (a) (i)	400 (metres)	B1
2 (a) (ii)	evidence of 6 minutes speed = distance / time in any form (e.g. $400 \div 360$ or <b>(a)(i)</b> / 6) $6 \times 60 = 360 \text{ s}$ 1.1(1) (m / s)	C1 C1 C1 A1
2 (b)	A shortest time (to return)/steepest gradient	B1 B1
		Total: 7

Notes about the mark scheme are available separately.