MOTION ON A CIRCULAR TRACK

1 Fig. 1.1 shows a model car moving clockwise around a horizontal circular track.

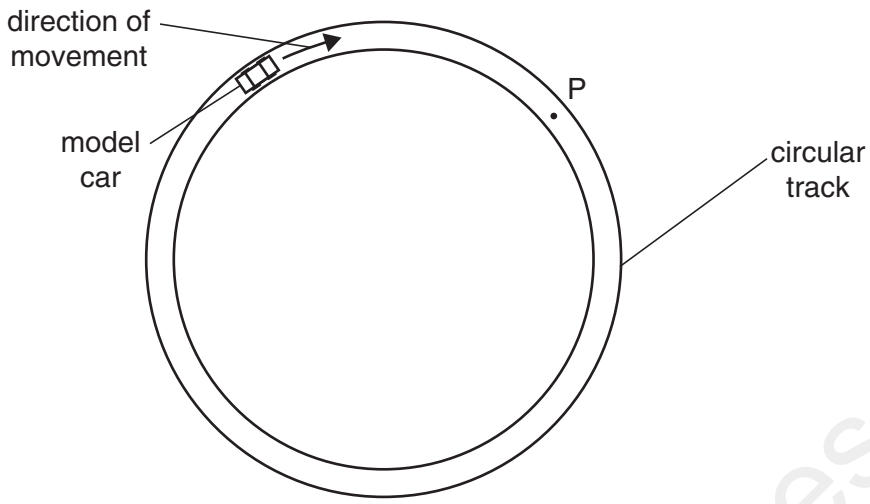

Fig. 1.1

(a) A force acts on the car to keep it moving in a circle.

(i) Draw an arrow on Fig. 1.1 to show the direction of this force. [1]

(ii) The speed of the car increases. State what happens to the magnitude of this force.

..... [1]

(b) **(i)** The car travels too quickly and leaves the track at P. On Fig. 1.1, draw an arrow to show the direction of travel after it has left the track. [1]

(ii) In terms of the forces acting on the car, suggest why it left the track at P.

.....

.....

..... [2]

(c) The car, starting from rest, completes one lap of the track in 10 s. Its motion is shown graphically in Fig. 1.2.

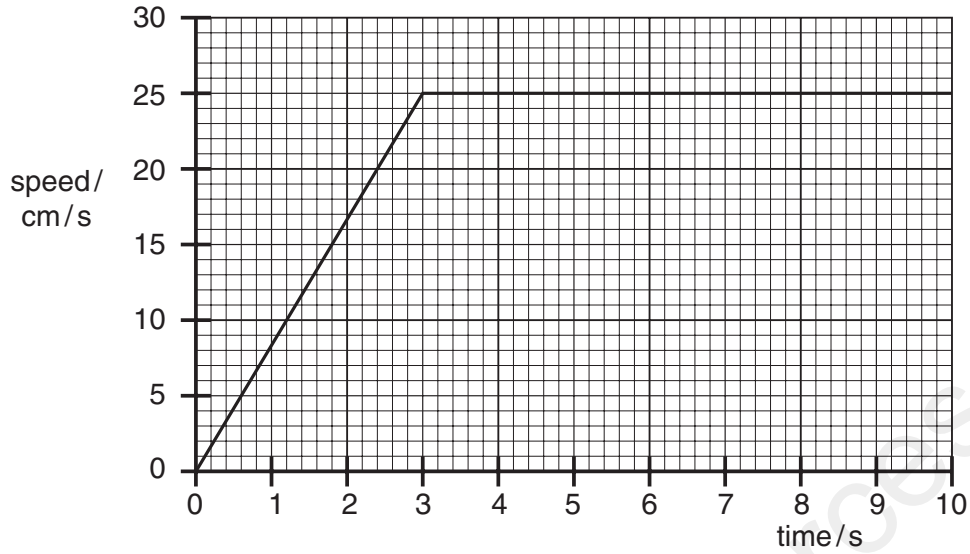

Fig. 1.2

(i) Describe the motion between 3.0 s and 10.0 s after the car has started.

..... [1]

(ii) Use Fig. 1.2 to calculate the circumference of the track.

circumference = ... [2]

(iii) Calculate the increase in speed per second during the time 0 to 3.0 s.

increase in speed per second = ... [2]

[Total: 10]

(a)	**(i)**	straight arrow towards centre, by eye	B1	[1]
	(ii)	force larger	B1	[1]
(b)	**(i)**	straight arrow along tangent at P clockwise, by eye	B1	[1]
	(ii)	friction between tyres and track provide centripetal force	B1	
		friction too small (to provide required force)	B1	[2]
(c)	**(i)**	constant speed/velocity OR uniform motion OR no acceln. NOT constant motion	B1	[1]
	(ii)	$(3 \times 25)/2 + (7 \times 25)$ OR area under graph	C1	
		212.5 cm any no s.f. $\geqslant 2$	A1	[2]
	(iii)	25/3 or increase in speed/time	C1	
		8.33 cm/s any no s.f. $\geqslant 2$ OR 8⅓ cm/s accept cm/s^2	A1	[2]
				[Total: 10]

2 Fig. 1.1 shows a cycle track.

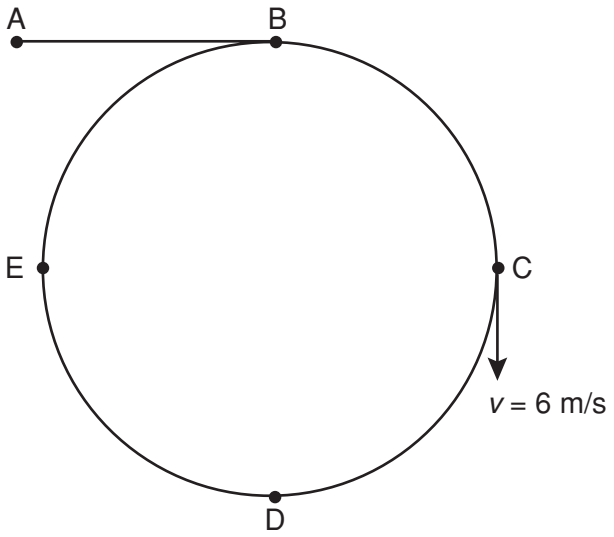

Fig. 1.1

A cyclist starts at A and follows the path ABCDEB.

The speed-time graph is shown in Fig. 1.2.

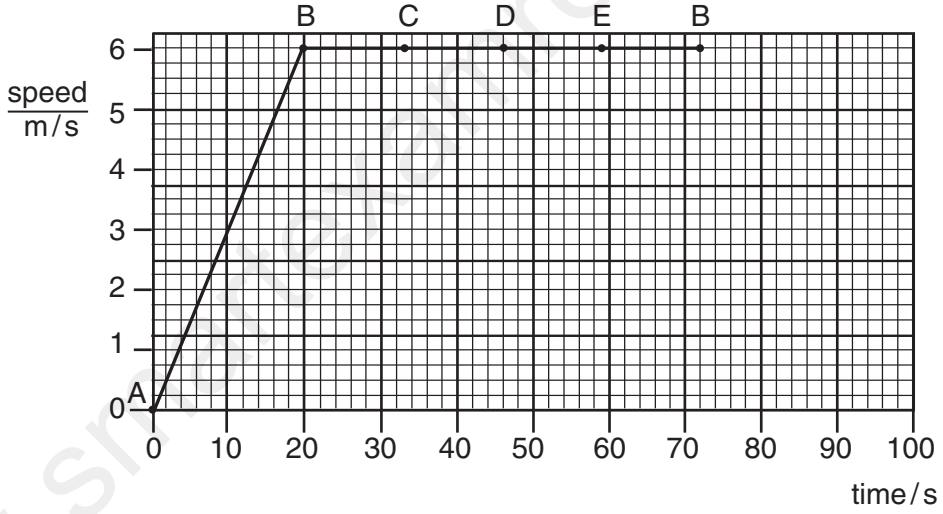

Fig. 1.2

(a) Use information from Fig. 1.1 and Fig. 1.2 to describe the motion of the cyclist

(i) along AB,

.....

(ii) along BCDEB.

.....

.....

[4]

(b) The velocity *v* of the cyclist at C is shown in Fig. 1.1.

State one similarity and one difference between the velocity at C and the velocity at E.

similarity .....

difference .....[2]

(c) Calculate

(i) the distance along the cycle track from A to B,

distance = ……

(ii) the circumference of the circular part of the track.

circumference = ……
[4]

(a)	**(i)**	Acceleration / increase in speed	**M1**	
		Uniform / constant or in a straight line	**A1**	
	(ii)	Uniform speed	**B1**	
		Velocity changes / motion in a circle / accelerates	**B1**	**4**
(b)		Similarity: same value / 6m/s or velocity changing	**B1**	
		Difference: opposite directions / up at E, down at C	**B1**	**2**
(c)	**(i)**	Average speed x time / area under graph / 3 x 20	**C1**	
		60 m	**A1**	
	(ii)	6 x 52	**C1**	
		312m	**A1**	**4**
				[10]