6 **(a)** The resultant force applied to a body is zero.

Describe what Newton's law says about the body when:

(i) the body is at rest

.....

..... [1]

(ii) the body is moving.

.....

..... [1]

(b) A cyclist of mass 60.0 kg is initially at rest on a bicycle of mass 24.0 kg.

There is a constant forward force of 147 N on the bicycle due to the cyclist's pedalling.

Calculate the initial acceleration of the cyclist and bicycle.

acceleration = ... $m\,s^{-2}$ [2]

(c) The cyclist travels along a flat road and reaches a maximum speed of $12.0\,m\,s^{-1}$ after 10.0 s.

(i) Explain why there is a maximum speed.

.....

.....

.....

..... [3]

(ii) Sketch, on Fig. 6.1, a graph to show how the speed of the cyclist changes over the first 15.0 s of the journey. [2]

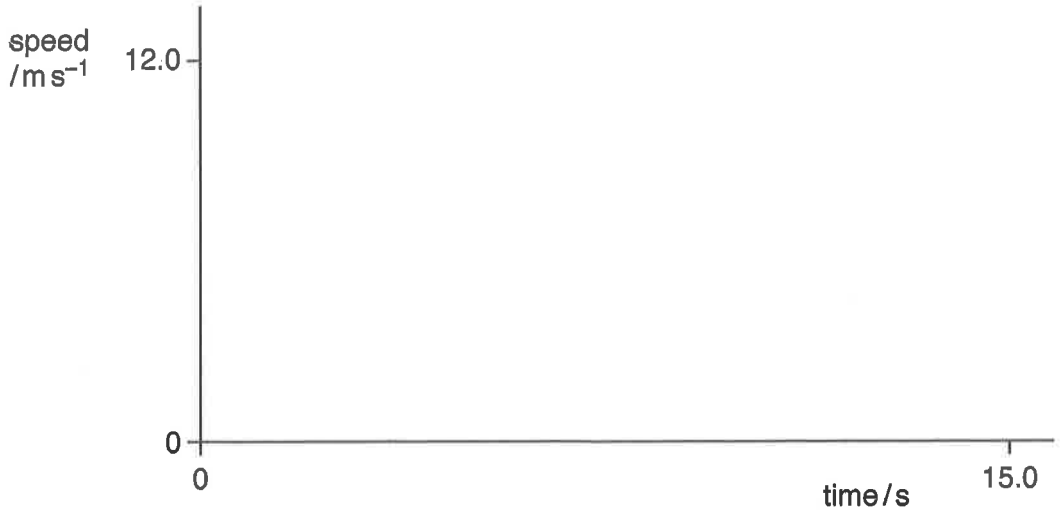

Fig. 6.1

(d) Fig. 6.2 is a graph that shows how the mass of carbon dioxide emitted per kilometre by a car depends on its speed.

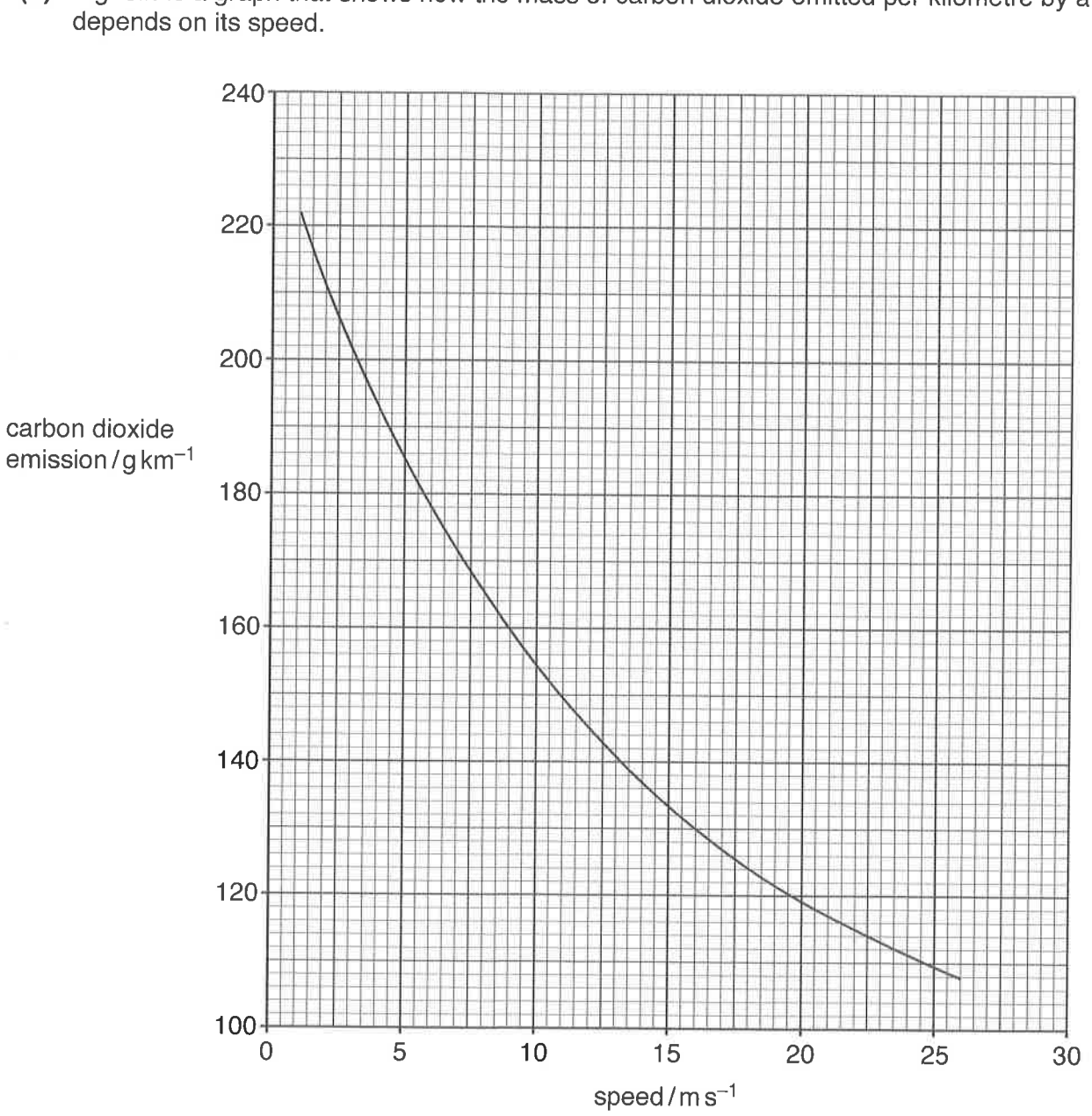

Fig. 6.2

(i) The speed of a car travelling just behind a cyclist is restricted to the speed of the cyclist.

Cars normally travel along a narrow road of length 5.76 km at a constant speed of $22.0\,m\,s^{-1}$.

Use information from the graph in Fig. 6.2 to determine the extra mass of carbon dioxide emitted by a car travelling at $12.0\,m\,s^{-1}$ rather than at $22.0\,m\,s^{-1}$ for the full length of the road.

extra mass of carbon dioxide = ... g [3]

(ii) On average, 5 cars follow behind the cyclist for the 5.76 km journey.

Each day the cyclist chooses whether to travel along the road by bicycle or by car.

Explain, showing your calculations, which choice leads to a lower total mass of carbon dioxide being emitted.

.....

.....

.....

.....

..... [3]

(iii) Suggest what change could be made to the layout of roads in general which would lead to lower total carbon dioxide emissions.

.....

.....

..... [1]

[Total: 16]