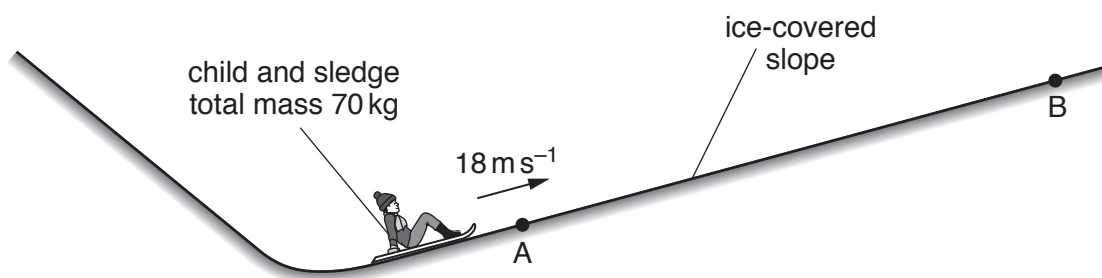


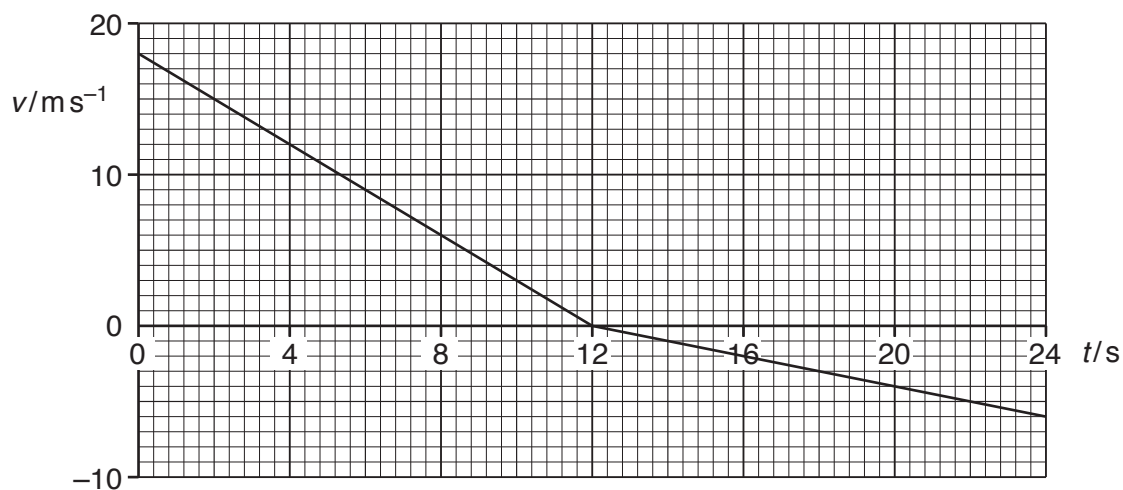
- 3 A child on a sledge slides down a steep hill and then travels in a straight line up an ice-covered slope, as illustrated in Fig. 3.1.



**Fig. 3.1** (not to scale)

The sledge passes point A with speed  $18 \text{ m s}^{-1}$  at time  $t = 0$  and then comes to rest at point B. The child applies a brake to the sledge at point B. The brake does not keep the sledge stationary and it immediately slides back down the slope towards A.

The variation with time  $t$  of the velocity  $v$  of the sledge from  $t = 0$  to  $t = 24 \text{ s}$  is shown in Fig. 3.2.



**Fig. 3.2**

- (a) State the time taken for the sledge to travel from A to B.

time = ..... s [1]

- (b) Determine the displacement of the sledge up the slope from point A at time  $t = 24$  s.

displacement = .....m [3]

- (c) Show that the acceleration of the sledge as it moves from B back towards A is  $0.50 \text{ m s}^{-2}$ .

[2]

- (d) The child and sledge have a total mass of 70 kg. The component of the total weight of the child and sledge that acts down the slope is 80 N.

Determine

- (i) the frictional force on the sledge as it moves from B towards A,

frictional force = ..... N [2]

- (ii) the angle  $\theta$  of the slope to the horizontal.

$\theta =$  ..... $^{\circ}$  [2]

- (e) The child on the sledge blows a whistle between  $t = 4.0\text{ s}$  and  $t = 8.0\text{ s}$ . The whistle emits sound of frequency  $900\text{ Hz}$ . The speed of the sound in the air is  $340\text{ m s}^{-1}$ . A man standing at point A hears the sound.

Fig. 3.2 to

- (i) determine the initial frequency of the sound heard by the man,

initial frequency = ..... Hz [2]

- (ii) describe and explain qualitatively the variation, if any, in the frequency of the sound heard by the man.

.....  
.....[1]

[Total: 13]