H2 Physics Topical Test

Topic: Kinematics

Name: _____

Class: _____

14

Duration: 21 mins

Instructions:
Write your answers in the spaces provided. All working for numerical answers must be shown.

1 A car starts from rest and move in a straight line. Its velocity is plotted against time for the first 30 s of its journey. This is shown in Fig. 1.1.

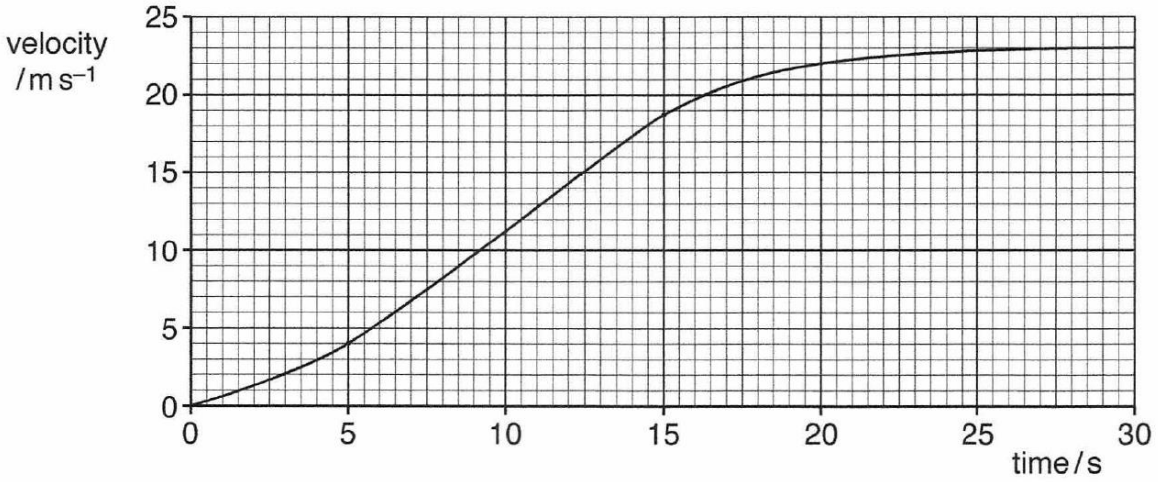


Fig. 1.1

Using data from the graph determine

(a) **(i)** the maximum velocity of the car,

velocity = …… m s^{-1} [1]

(ii) the maximum acceleration of the car.

acceleration = …… m s^{-2} [2]

(b) On Fig. 1.2, sketch the distance-time graph for the first 30 s of the car's journey shown in Fig. 1.1.

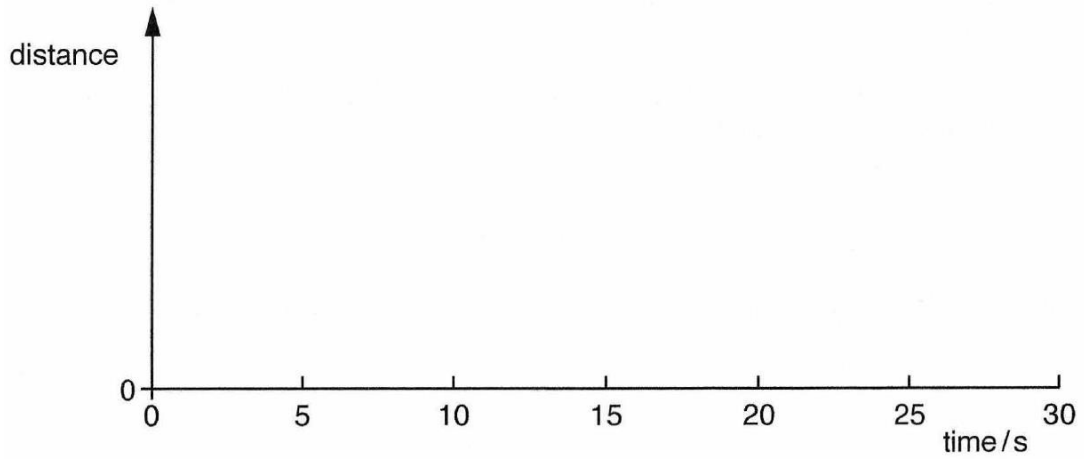


Fig. 1.2

[2]

2 State the two conditions that must be satisfied for the equation of motion to be valid.

……

……..[1]

3 A hot air balloon was rising steadily at a speed of 8.0 m s^{-1} when weather conditions turned windy. A constant breeze of 3.0 m s^{-1} blew horizontally across the sky, which caused the hot air balloon to travel with a resultant velocity of v_R at an angle θ to the horizontal, as shown in Fig. 3.1 below.

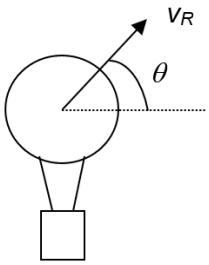


Fig. 3.1

(a) Calculate the magnitude and direction of the resultant velocity v_R.

magnitude = …….. m s^{-1}

θ = …….° [2]

(b) During the flight, one of the passenger accidentally dropped his handphone while trying to take a scenic shot.

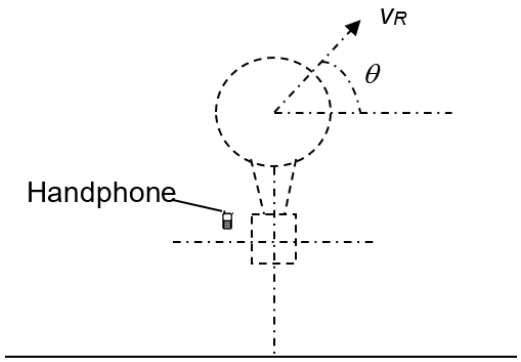


Fig. 3.2

(i) In **Fig. 3.2**, sketch the path of trajectory of the handphone as it drops from the balloon. [1]

(ii) Determine the time taken for the handphone to reach its maximum height before falling downwards.

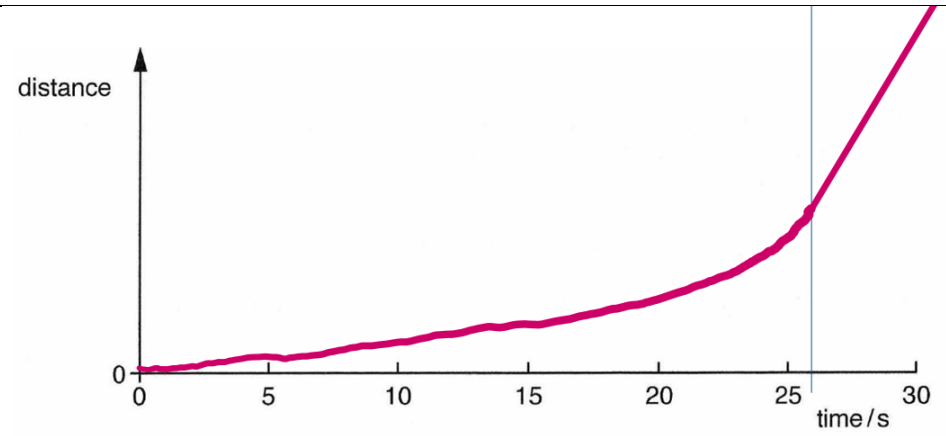
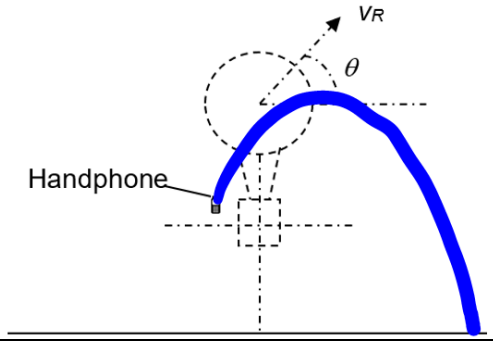
time taken = …… s [2]

(iii) Determine the distance between the balloon the handphone after 3.0 s. You may assume that the handphone has not landed on the ground, the dropping of handphone did not affect the velocity of the hot air balloon and that air resistance on the handphone is negligible.

distance = …… m [3]

END OF PAPER

Class Test Kinematics – Suggested Solutions

1(a)(i)	23 m s^{-1}	**A1**
1(a)(ii)	Gradient = $\frac{15-6}{12.5-6.5}$ **(correct coordinates from graph)** $= \mathbf{1.5\ m\ s^{-2}}$	**M1** **A1**
1(b)	 1 Mark for increasing curve from 0 s to slightly after 25 s 1 Mark for **steepest straight line** slightly after 25 s to 30 s	 **B1** **B1**
2	Linear motion/ motion in a straight line Constant acceleration (Both conditions correct for B1)	**B1**
3(a)	$\sqrt{8^2+3^2} = 8.544$ $= \mathbf{8.54\ m\ s^{-1}}$ $\theta = \tan^{-1}\left(\frac{8}{3}\right)$ $= 69.4°$	**A1** **A1**
3(b)(i)		**A1**
3(b)(ii)	Taking upwards as positive: $v = u + at$ **0 = 8 + (-9.81)*t*** (Marks allocated for correct substitution) t = 0.8154 = **0.815 s**	 **M1** **A1**

3(b)(iii)	Consider the vertical motion: Taking upwards as positive: $s_y = u_y t + \frac{1}{2} a_y t^2$ = **8(3) + ½ (-9.81)(3^2)** = -20.1 m Displacement of balloon = **8 x 3** = 24 m Distance between balloon and handphone: $20.1 + 24 = 44\ m\ (2\ s.f)$	**M1** **M1** **A1**