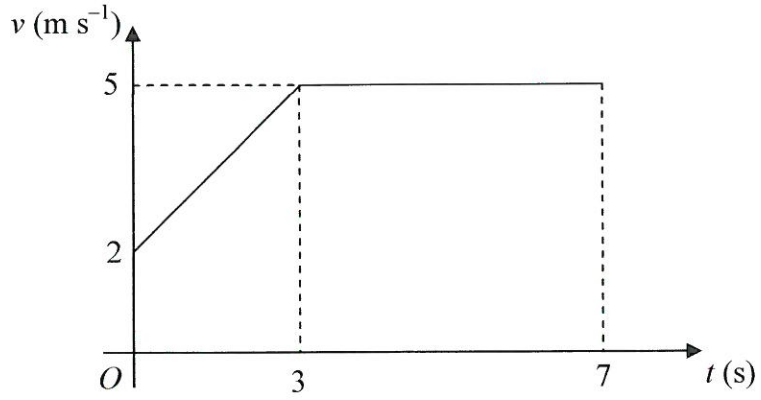
M1 – HAPPY HALF TERM HOMEWORK !

**1.** **Figure 1**




June 2006

Figure 1 shows the speed-time graph of a cyclist moving on a straight road over a 7 s period. The sections of the graph from $t = 0$ to $t = 3$, and from $t = 3$ to $t = 7$, are straight lines. The section from $t = 3$ to $t = 7$ is parallel to the $t$-axis.

State what can be deduced about the motion of the cyclist from the fact that

($a$) the graph from $t = 0$ to $t = 3$ is a straight line,

**(1)**

($b$) the graph from $t = 3$ to $t = 7$ is parallel to the $t$-axis.

**(1)**

($c$) Find the distance travelled by the cyclist during this 7 s period.

**(4)**

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**3.** A train moves along a straight track with constant acceleration. Three telegraph poles are set at equal intervals beside the track at points $A$, $B$ and $C$, where $AB = 50$ m and $BC = 50$ m. The front of the train passes $A$ with speed 22.5 m s$^{-1}$, and 2 s later it passes $B$. Find

June 2006

($a$) the acceleration of the train,

**(3)**

($b$) the speed of the front of the train when it passes $C$,

**(3)**

($c$) the time that elapses from the instant the front of the train passes $B$ to the instant it passes $C$.

**(4)**

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June 2007

**4.** A car is moving along a straight horizontal road. At time $t = 0$, the car passes a point $A$ with speed 25 m s$^{-1}$. The car moves with constant speed 25 m s$^{-1}$ until $t = 10$ s. The car then decelerates uniformly for 8 s. At time $t = 18$ s, the speed of the car is $V$ m s$^{-1}$ and this speed is maintained until the car reaches the point $B$ at time $t = 30$ s.

(a) Sketch, in the space below, a speed–time graph to show the motion of the car from $A$ to $B$.

**(3)**

Given that $AB = 526$ m, find

(b) the value of $V$,

**(5)**

(c) the deceleration of the car between $t = 10$ s and $t = 18$ s.

**(3)**

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Jan 2003

**7.** A ball is projected vertically upwards with a speed $u$ m s$^{-1}$ from a point $A$ which is 1.5 m above the ground. The ball moves freely under gravity until it reaches the ground. The greatest height attained by the ball is 25.6 m above $A$.

(*a*) Show that $u = 22.4$.

**(3)**

The ball reaches the ground $T$ seconds after it has been projected from $A$.

(*b*) Find, to 2 decimal places, the value of $T$.

**(4)**

The ground is soft and the ball sinks 2.5 cm into the ground before coming to rest. The mass of the ball is 0.6 kg. The ground is assumed to exert a constant resistive force of magnitude $F$ newtons.

(*c*) Find, to 3 significant figures, the value of $F$.

**(6)**

(*d*) State one physical factor which could be taken into account to make the model used in this question more realistic.

**(1)**

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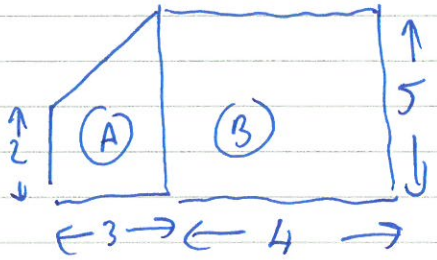
M1 June 06

M/41.

Q1 (a) Constant acceleration B1

(b) speed is constant (zero accel) B1

(c) dist = Area under graph




Area of A $= \frac{1}{2}(2+5) \times 3 = 10.5$ M1 A1

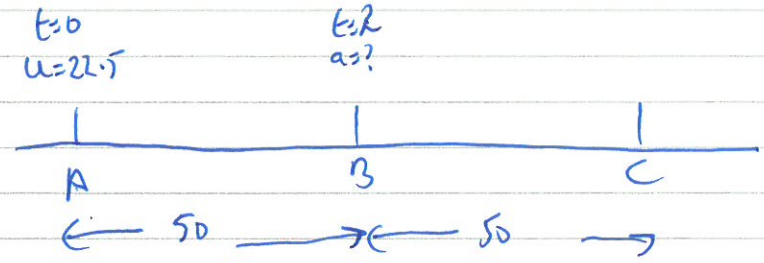
Area of B $= 4 \times 5 = 20$

$\therefore$ dist travelled = 30.5 metres. B1 A1

M/6.

M1 JUNE06

Q3




(a) Using $S = ut + \frac{1}{2}at^2$

$50 = 22.5(2) + \frac{1}{2}(a)(2)^2$ M1 A1

$50 = 45 + 2a$

$a = \frac{5}{2} = 2.5 \text{ ms}^{-2}$ A1

(b) from A→C $u = 22.5$ $V = ?$ $a = 2.5$ $S = 100$

Using $V^2 = u^2 + 2as$

$V^2 = (22.5)^2 + 2 \times 2.5 \times 100$ M1 A1

$V^2 = 506.25 + 500$

$V = 31.7 \text{ ms}^{-1}$ A1

(c) time to C $V = u + at$ M1

$31.7 = 22.5 + 2.5t$

$t = 3.7 \text{ sec}$ from A to C M1 A1

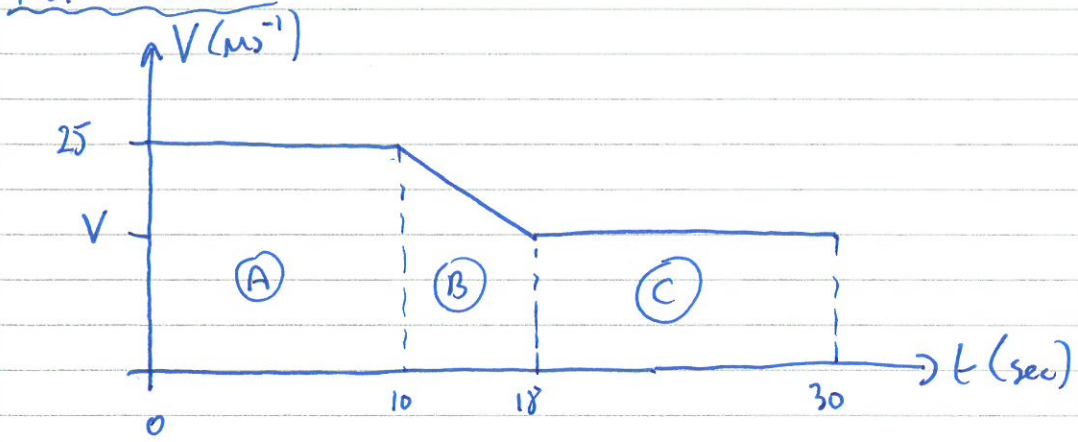
$\therefore$ from B to C $3.7 - 2 = 1.7 \text{ sec}$ A1

M1/10

M1 – June 07

Q4

(a)




B1 B1 B1

(b) Total Area = 526

$(25 \times 10) + \frac{1}{2}(25+V) \times 8 + 12V = 526$ M1 A1 A1

$250 + 100 + 4V + 12V = 526$ M1

$16V = 176$

$V = 11 \text{ ms}^{-1}$ A1

(c) $u = 25 \quad v = 11 \quad t = 8 \quad a = ?$

Using $v = u + at$ M1 A1

$11 = 25 + 8a$

$a = \frac{-14}{8} = -1.75 \text{ ms}^{-2}$ A1

M 11

# M1 – Jan 2003

Q7 (a) $u\uparrow$ @ Max ht $V=0$ $S=25.6\uparrow$ $a=9.8\downarrow = -9.8\uparrow$

Using $V^2 = u^2 + 2as$

$0 = u^2 + 2\times -9.8 \times 25.6$ M1 A1

$u^2 = 501.76$

$u = 22.4\uparrow$ A1

(b) $u = 22.4\uparrow = -22.4\downarrow$ $a = 9.8\downarrow$ $S = 1.5\downarrow$ $t = T$

Using $S = ut + \frac{1}{2}at^2$

$1.5 = -22.4T + \frac{1}{2}\times 9.8T^2$ M1 A1

$4.9T^2 - 22.4T - 1.5 = 0$ M1

$T = 4.64$ sec A1

(c) ~~KE lark = 0.6~~

Speed of impact $V = u + at$

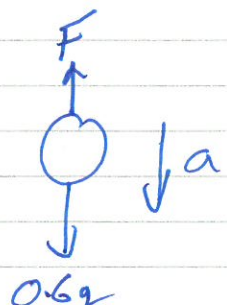
$V = -22.4 + (9.8 \times 4.64) = 23.1\ ms^{-1}$ M1 A1

Now whilst in ground $u = 23.1$ $V = 0$ $S = 0.025$ $a = ?$

$V^2 = u^2 + 2as$ M1

$0 = 23.1^2 + 2\times 0.025a$ A1

$a = -10672.2\ ms^{-2}$




Now NII ~~$R = ma$ $R = 0.6 \times -10672.2 =$~~

$0.6g - F = 0.6(-10672.2)$ M1 A1

$F = 6400$ N (d) B1

(M 14)