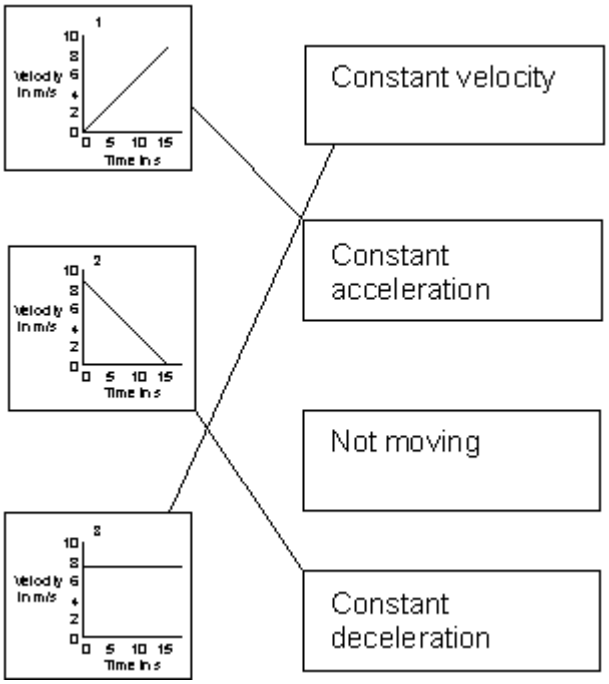
M1. 1 mark for each line



if more than 1 line is drawn from a graph in List A then all those lines are marked incorrect

[3]

M2. (a) A = speeding up

[Accept 'accelerating / acceleration / going faster]

B =moving at a steady speed

[Accept 'constant speed']

C = slowing down

[Accept 'going slower' / decelerating]

each for 1 mark

3

(b) acceleration = $\frac{\text{change in speed/velocity}}{\text{time taken}}$

NB if formula given must be correct

or $\frac{10}{4}$

gains 1 mark

but 2.5

gains 2 marks

unit m/s^2 **or** metres per second squared
or metres per second per second

for 1 mark

or m/s^{-2}
[Credit even if no / an incorrect numerical answer is given]

3

[6]

M3. (a) WX deceleration / speed decreasing / slowing down / negative acceleration

XY constant speed / steady speed *not* constant motion / slow speed

YZ acceleration / speed increasing / speeding up
for 1 mark each

3

(b) distance = v × t **or** distance = 30 × 20
gains 1 mark

but
distance = 600(m)
gains 2 marks

2

(c) acceleration = v / t **or** acceleration = 30 / 12
gains 1 mark
(if –30 / 12, allow negative sign here if not in the answer)

3

but
acceleration = 2.5 (m/s^2)
gains 2 marks

but
acceleration = -2.5 (m/s^2)
gains 3 marks

(d) in a crash / during hard braking car body stops / slows rapidly driver / passengers continue to move forward *not* thrown forward seatbelts provide backward force / keep them in their seats / restrain them to stop them hitting the windscreen / dashboard
(an alternative argument involving momentum is acceptable)
for 1 mark each

4

[12]

M4. (a) (i) acceleration / speeding up
do not accept acceleration increases

1

(ii) constant / steady velocity
accept constant / steady speed

1

(b) 10

3

m/s^2 or ms^{2-}

reject ms^2

if answer not correct then allow 1 mark for

acceleration = $\frac{\text{change in velocity}}{\text{time taken for change}}$

and allow 1 mark for $\frac{40\ (m/s)}{4(s)}$

1

[6]

M5. (a) Each scale optimum
Else both half size
Straight line joining 30,0 to 30,0.67 to 0, 5.67

any 5 for 1 mark each

5

(b) 6
Else a = 30/5

gets 2 marks

Else a = v/t

gets 1 mark

3

(c) 9000
Else F = 6 × 1500

gets 2 marks

Else F = ma

gets 1 mark

3

(d) (i) Driver has forward momentum
Which is conserved
Giving drive relative forward speed to car

for one mark each

3

(ii) If inelastic ke lost
Here ke does work crumpling car

for 1 mark each

2

(iii) Car stops in 75m

gets 1 mark

W = F.d or 9000 × 75

gets 1 mark

W = 675 000 J

OR ke = 1/2 mv^2

gets 1 mark

ke = 1/2.1500.302

ke = 675 000 J

3

[19]

M6. (a) 7.5

correct answer with no working = 3 if incorrect allow 1 mark for (change in velocity from graph =) 15

1 mark for $\frac{\text{change in velocity}}{\text{time taken}}$

2 marks for $\frac{15}{2}$

N.B. correct answer from the incorrectly recalled relationship

= 2 marks $\frac{\text{distance}}{\text{time}}$

3

(b) (4 – 5 seconds) the bungee jumper slows down (decelerates)

1

(the rubber cord) stops the fall

1

(5 – 6 seconds) the bungee jumper starts moving (accelerating) upwards (in the opposite direction)

max 2 marks if no correct indication of time

1

[6]

M7. (a) acceleration = $\frac{\text{change in speed/velocity}}{\text{time taken}}$

or $\frac{10}{4}$

gains 1 mark
do not penalise if <u>both</u> of these present
but 'change in' omitted from formula

but
2.5

gains 2 marks

unit m/s^2 **or** metres per second squared

or metres per second per second

or ms^{-}*
for 1 mark

3

(b) *evidence* of using area under graph or distance <u>average</u> speed × time
or
$10 \times 4 \times \frac{1}{2}$

gains 1 mark

but
20

gains 2 marks

units metres / m^{-2}*
for 1 mark

3

(c) force = mass × acceleration **or** 75 × 25
gains 1 mark

but
1875

gains 2 marks

**NB Correct unit to be credited even if numerical answer wrong or absent.*

2

[8]