GCSE Physics

Momentum

Mark Scheme

Time available: 56 minutes
Marks available: 51 marks

1. (a) (i) 0.15 × 0.08 = 0.012

1

(ii) kg m/s

1

(iii) equal to

1

(b) momentum of the air increases
or
force backwards increases

accept air moves faster

accept momentum backwards increases

accept pushes more air back(wards)

1

so momentum of the toy must increase
or
the force forwards (on the toy) increases

accept momentum forwards must increase

it = toy

1

[5]

2. (a) Zero / 0

Accept none

Nothing is insufficent

1

velocity / speed = 0

accept it is not moving

paintball has not been fired is insufficient

1

(b) 0.27

*allow **1** mark for correct substitution, ie p = 0.003(0) × 90 provided no subsequent step*

2

(c) equal to

1

[5]

3. (a) momentum before (jumping) = momentum after (jumping)

accept momentum (of the skateboard and skateboarder) is conserved

1

before (jumping) momentum of skateboard and skateboarder is zero

accept before (jumping) momentum of skateboard is zero

accept before (jumping) total momentum is zero

1

after (jumping) skateboarder has momentum (forwards) so skateboard must have (equal) momentum (backwards)

answers only in terms of equal and opposite forces are insufficient

1

(b) 7

*accept –7 for **3** marks*

*allow **2** marks for momentum of skateboarder equals 12.6*

or

0 = 42 × 0.3 + (1.8 × –v)

or

*allow **1** mark for stating use of conservation of momentum*

3

[6]

4. (a) (i) momentum before = momentum after

accept no momentum is lost

accept no momentum is gained

or

(total) momentum stays the same

1

(ii) an external force acts (on the colliding objects)

accept colliding objects are not isolated

1

(b) (i) 9600

allow 1 mark for correct calculation of momentum before or after ie 12000 or 2400

or

correct substitution using change in velocity = 8 m/s

ie 1200 × 8

2

kg m/s
or
Ns

this may be given in words rather than symbols
*do **not** accept nS*

1

(ii) 3 or their (b)(i) ÷ 3200 correctly calculated

allow 1 mark for stating momentum before = momentum after

or

clear attempt to use conservation of momentum

2

[7]

5. (a) direction

1

(b) 54 000

*allow **1** mark for calculating and identifying momentum as 10 800*
or
*allow **1** mark for correct substitution into second equation*
ie $\frac{1200 \times 9}{0.2}$

2

(c) increases the time taken (for head) to stop

accept increases impact time
*do **not** accept reference to slowing down time unless qualified*

1

decreases rate of change in momentum

accept reduces acceleration / deceleration
*accept increases the time taken to reduce momentum to zero is worth **2** marks*
reduces momentum is insufficient

1

reduces the force (on the head)

1

[6]

6. (a) (i) lorry

reason only scores if lorry chosen

1

greatest mass

accept weight for mass

accept heaviest

accept correct calculations for all 3 vehicles

the biggest is insufficient

1

(ii) 2450

*allow **1** mark for correct substitution*

ie 175 × 14

2

(b) (i) increases

accept any clear indication of the correct answer

1

(ii) speed increases

accept velocity for speed

accept gets faster

*do **not** accept it accelerates on its own*

moves more is insufficient

1

(iii) straight line going to 6, 20

*allow **1** mark for a curve going to 6,20*

***or** a straight line diagonally upwards but missing 6,20*

2

horizontal line from 6,20 to 8,20

*allow a horizontal line from where their **diagonal** meets 20m/s to 8,20*

1

[9]

7. (a) (i) distance travelled under the braking force

accept distance travelled between applying the brakes and stopping

1

(ii) any **one** from:

- icy / wet roads

  accept weather (conditions)
- (worn) tyres
- road surface

  accept gradient of road
- mass (of car and passengers)

  accept number of passengers
- (efficiency / condition of the) brakes.

  friction / traction is insufficient

1

(iii) greater the speed the greater the braking force (required)

must mention both speed and force

1

(b) 22.5

*allow **1** mark for showing correct use of the graph with misread figures*

or

for showing e.g. 90÷4

*an answer 17 gains **1** mark*

any answer such as 17.4 or 17.5 scores 0

2

(c) (i) momentum before = momentum after

or

(total) momentum stays the same

accept no momentum is lost

accept no momentum is gained

ignore statements referring to energy

1

(ii) 5

*allow **2** marks for correctly obtaining momentum before as 12 000*

or

*allow **2** marks for*

1500 × 8 = 2400 × v

or

*allow **1** mark for a relevant statement re conservation of momentum*

or

*allow **1** mark for momentum before = 1500 × 8*

3

(d) the seat belt stretches **1**

driver takes a longer (*impact*) time to slow down and stop (than a driver hitting a hard surface / windscreen / steering wheel)

1

for the (same) change of momentum

accept so smaller deceleration / negative acceleration

1

a smaller force is exerted (so driver less likely to have serious injury than driver without seat belt)

or

the seat belt stretches ***(1)***

do not accept impact for force

driver travels a greater distance while slowing down and stopping (than a driver hitting a hard surface / windscreen / steering wheel) ***(1)***

for (same) amount of work done ***(1)***

accept for (same) change of KE

a smaller force is exerted (so driver less likely to have serious injury than driver without seat belt) ***(1)***

do not accept impact for force

1

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