

# MARK SCHEME

# GCSE

## PHYSICS

## AQA - COMBINED SCIENCE

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P5 - TEST 6

FORCES

Advanced

## Mark schemes

1.

(a) momentum = mass × velocity

*allow  $p = mv$*

1

(b)  $200 = m \times 3.2$

1

$$m = \frac{200}{3.2}$$

1

$m = 63$  (kg)

*allow 62.5 (kg)*

1

*an answer of 63 (kg) scores 3 marks*

(c) (total) momentum before (collision) = (total) momentum after (collision)

1

**either**

momentum of skater A decreases and momentum of skater B increases

*allow (total) momentum is shared between skater A and skater B*

1

velocity of skater A decreases and velocity of Skater B increases

1

**or**

momentum of skater A decreases and so velocity of skater A decreases (1)

momentum of skater B increases and so velocity of skater B increases (1)

[7]

2.

(a) constant velocity

*allow constant speed*

*ignore references to stationary*

1

(b) the man will accelerate

1

so force B increases

1

until force B equals force A

*allow until resultant force is 0 (N)*

1

the man moves at a higher constant velocity

1

*allow drag for force B*

- (c) horizontal arrow pointing left (3000 N) and vertical arrow pointing down (1000 N) drawn to the same scale



1

resultant force with a value in the range 3100 N–3200 N

*allow and answer of 3000 N if a scale diagram has been drawn using the cm squares*

1

direction in the range 251°–253° (clockwise from north)

*allow 17°–19° (to the horizontal)*

1

- (d) the magnitude will increase

*allow size*

1

direction will change towards the south

*allow answers consistent with their response to part (c)*

1

[10]

3.

- (a) weight = mass × gravitational field strength

1

- (b) mass = weight ÷ g

1

$$= 1.4 \div 9.8$$

1

$$= 0.143 \text{ (kg)}$$

*allow 0.143 with no working shown for 3 marks*

1

- (c) momentum = mass × velocity

momentum before = momentum after

1

$$143 \times 7.9 = 150 \times v$$

1

$$v = \frac{143 \times 7.9}{150}$$

1

$$= 7.5 \text{ (m / s)}$$

*allow 7.5 (m / s) with no working shown for 4 marks*

1

*incorrect number of sig. figs max. 3 marks*

1

(d) ball is falling / moving down

1

at terminal velocity

1

air resistance and weight have the same magnitude / size

1

so no acceleration / constant speed

1

[12]

4.

(a) either:

7.5 (m) **and** 12.3 (m) from the graph

**or**

15 (m/s)  $\times$  0.32 (s) using speed

*allow 7.5 (m) and between 12.2 (m) and 12.4 (m)*

1

extra distance = 4.8 (m)

1

*an answer between 4.7 (m) and 4.9 (m) scores 2 marks*

(b) there is a decrease in kinetic energy of the car

*allow work is done by friction (on the brakes)*

1

so this (causes) the internal / thermal energy store of the brakes to increase

1

(c)  $19^2 - u^2 = 2 \times 2 \times 84$

1

$u^2 = 19^2 - (2 \times 2 \times 84)$

1

$u = 5$  (m/s)

$$u = \sqrt{19^2 - (2 \times 2 \times 84)}$$

1

*an answer of 5 (m/s) scores 3 marks*

(d) **Level 3:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

5–6

**Level 2:** Scientifically relevant facts, events or processes are identified and their relevance is clear. The account is not fully accurate.

3–4

**Level 1:** Facts, events or processes are identified and simply stated but their relevance is not clear.

1–2

**No relevant content**

0

**Indicative content**

- use of drugs, alcohol, tiredness and distractions would increase the thinking distance
- thinking distance increases with speed
- thinking distance is directly proportional to speed
- use of drugs, alcohol, tiredness and distractions would increase the gradient of thinking distance
  
- poor brakes, poor tyres, wet / icy roads and mass would increase the braking distance
- braking distance increases with speed
- braking distance increases at an increasing (accept greater) rate (with speed)
- poor brakes, poor tyres, wet / icy roads and mass would increase the gradient of braking distance
- braking distance is directly proportional to speed squared
  
- stopping distance = thinking distance + braking distance
- factors that increase thinking and / or braking distance would increase the gradient of stopping distance
- stopping distance increases at an increasing (accept greater) rate (with speed)

[13]

5.

(a) between **A** and **B** (the elastic store decreases and) the kinetic and gravitational stores increase

1

between **B** and **C** the kinetic store decreases and the gravitational store increases

1

the internal energy store of the surroundings increases

*allow either*

*some energy is dissipated to the surroundings*

*or*

*some energy is dissipated as heat / sound*

1

(b) the weight and air resistance are equal and opposite

1

so the resultant force is zero

1

(c)  $25\,000 = \frac{1}{2} \times 125 \times e^2$

1

$$e^2 = \frac{2 \times 25000}{125}$$

1

$$e = \sqrt{\frac{2 \times 25000}{125}}$$

1

$$e = 20 \text{ (m)}$$

*an answer of 20 (m) scores 4 marks*

1

(d) acceleration =  $(-9.8 \text{ m/s}^2)$

1

$$0^2 - 26^2 = 2 \times (-9.8) \times s$$

1

$$s = \frac{-26^2}{2 \times (-9.8)}$$

1

$$s = 34 \text{ (m)}$$

*allow any correct rounding of 34.489...*

*an answer of 34 (m) scores 4 marks*

1

[13]

6.

(a) vector

1

direction

*must be in this order*

1

(b) 42 km **and** 210 minutes

1

(c) draw a tangent

1

at 20 minutes

1

measure the gradient of the tangent

1

(d) 1.5 m/s

1

180 (s)

1

$$\frac{1.5}{180}$$

1

0.00833 (m/s<sup>2</sup>)

*an answer of 0.00833 (m/s<sup>2</sup>) scores 4 marks*

*an answer of 0.0083333 (m/s<sup>2</sup>) scores 3 marks*

*an answer of 0.500 (m/s<sup>2</sup>) scores 3 marks*

*an answer of 0.5 (m/s<sup>2</sup>) scores 2 marks*

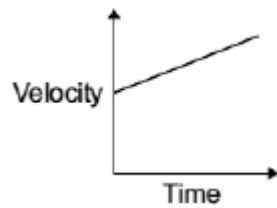
1

(e) axes labelled and velocity intercept on y-axis

1

straight line with increasing gradient

*an answer of:*



*scores 2 marks*

1

(f)  $-855 = 950 \cdot a$   
*ignore sign*

1

$$a = \frac{-855}{950}$$

1

$$a = -0.9 \text{ (m/s}^2\text{)}$$

1

$$0^2 - 5.2^2 = 2 \cdot (-0.9) \cdot s$$

$$(v^2 - u^2 = 2as)$$

*for this mark, sign of a must be opposite to sign of u, ie allow:*

$$0^2 - (-5.2)^2 = 2 \cdot 0.9 \cdot s$$

1

$$s = \frac{-27.04}{-1.8}$$

*ignore signs*

1

$$s = 15.0 \text{ (m)}$$

*an answer of 15.0 (m) scores 6 marks*

*allow credit for use of a correct alternative method*

1

**[18]**