MARK SCHEME

GCSE

PHYSICS

AQA - TRIPLE SCIENCE

P5 - TEST 4

FORCES

Intermediate

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Mark schemes

1.

(a) It will have a constant speed.

1

(b) distance travelled = speed × time

1

(c) $a = \frac{18 - 9}{6}$

1

$a = 1.5$

*allow 1.5 with no working shown for **2** marks*

1

(d) resultant force = mass × acceleration

1

(e) $F = (1120+80) \times 1.5$

1

$F = 1800$ (N)

*allow 1800 with no working shown for **2** marks*

1

*accept their 10.3 × 1200 correctly calculated for **2** marks*

(f) $18^2 - 9^2 = 2 \times 1.5 \times s$

1

$s = 18^2 - 9^2 / 2 \times 1.5$

1

$s = 81$ (m)

1

*allow 81 (m) with no working shown for **3** marks*

*accept answer using their 10.3 (if not 1.5) correctly calculated for **3** marks*

(g) **Level 2 (3–4 marks):**
A detailed and coherent explanation is provided. The response makes logical links between clearly identified, relevant points that include references to the numerical factor.

Level 1 (1–2 marks):
Simple statements are made. The response may fail to make logical links between the points raised.

0 marks:
No relevant content.

Indicative content

- doubling speed increase the kinetic energy
- kinetic energy increases by a factor of 4
- work done (by brakes) to stop the car increases
- work done increases by a factor of 4
- work done is force × distance and braking force is constant
- so if work done increases by 4 then the braking distance must increase by 4

4

[14]

2. (a) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

set up a clamp stand with a clamp

hang the spring from the clamp

use a second clamp and boss to fix a (half) metre ruler alongside the spring

record the metre ruler reading that is level with the bottom of the spring

hang a 2 N weight from the bottom of the spring

record the new position of the bottom of the spring

calculate the extension of the spring

measure the extension of the spring

add further weights to the spring so the force increases 2 N at a time up to 10 N

for each new force record the position of the bottom of the spring and calculate / measure the extension

possible source of inaccuracy

not fixing the ruler in position but simply holding the ruler next to the spring

not clamping the ruler vertical

misjudging the position of the bottom of the spring

parallax error

allow any other sensible suggestion that could reasonably lead to inaccuracy in the data

allow a description that would increase accuracy

repeating the measurements is insufficient

(b) to identify any anomalous results

allow calculate an average for the spring constant

or

to reduce the effect of random error

allow (more) accurate

to obtain an average is insufficient

to be able to draw a graph is insufficient

1

(c) both points plotted correctly

1

correct line of best fit drawn

to pass through (0,0) and (10,20)

1

(d) force = spring constant × extension

allow F = ke

1

(e) extension = 0.2

allow 0.035 / 0.08 / 0.125 / 0.16

1

$10 = k \times 0.2$

force value must match extension
this mark may be awarded if e is in cm

1

$$k = \frac{10}{0.2}$$

allow correct transformation of their chosen values
this mark may be awarded if e is in cm

1

k = 50

*an answer 0.5 scores **3** marks*

1

*an answer of 50 scores **4** marks*

(f) the line is straight

allow the line does not curve

1

and passes through the origin

this mark is dependent on scoring the first mark

*allow a correct description of direct proportionality for **2** marks*

ignore the line shows they are directly proportional

1

[16]

3. (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]

4. (a) double

1

(b) the hypothesis does not say how increasing / decreasing the force increases / decreases the acceleration

1

(c) appropriate equipment to apply and measure force

*eg newtonmeter **or** slotted masses + string + pulley*

1

appropriate equipment to measure change in velocity and time

*eg ticker timer + tape **or** light gates + datalogger*

1

(d) to reduce the effect of friction on the trolley

1

(e)

Level 3: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5-6
Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3-4
Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1-2
No relevant content	0
Indicative content • method by which the trolley is to be accelerated • how the accelerating force is varied to give a suitable range of results • how the accelerating force is measured • the use of suitable apparatus to measure the change in velocity of the trolley over a given distance or time • what data is to be collected in order to calculate acceleration • how the data required is to be measured	

6

(f) so that the mass is constant

fair test is insufficient

1

as changing mass would change the acceleration (produced by a given force)

or

so there is only one independent variable

1

(f) hypothesis A because

***A** must be identified to gain either mark*

1

the results give a straight line that passes through the origin

showing direct proportionality

1

[15]

5. (a) uniform acceleration

allow constant / steady acceleration
allow velocity / speed increasing at a constant rate
ignore reference to direction
*acceleration scores **1** mark*
or
*velocity / speed is increasing scores **1** mark*
*do **not** accept acceleration increases*

2

(b) up(wards)

1

(c) a group of objects that interact

1

(d) velocity just after bounce is less than just before bounce

allow velocity is less / decreases
velocity decreases to zero − on its own scores zero

or

the height at the top of the bounce is less than the height from which it was dropped

1

so the ball has lost energy

1

correct reference to (loss of) ke or (reduced) gpe

1

total energy of ball and Earth / ground is constant

allow 'a system' for ball and Earth
allow energy is conserved

1

[8]

6. (a) (i) turning effect

accept force multiplied by perpendicular distance from the line of action of the force to the pivot

1

(ii) moments are equal (in size) and opposite (in direction)

both parts are required
allow clockwise moment = anticlockwise moment

1

(iii) 0.9 (N)

*allow **2** marks for F = 0.18 ÷ 0.2 provided no subsequent steps*
*allow **1** mark for (anticlockwise moment) = 0.18 (Nm)*
*allow **1** mark for correct substitution i.e. 1.5 × 0.12 = F × 0.20*

3

(b) a longer drumstick lever gives a quieter sound

1

a longer drumstick lever allows a greater range of volumes

1

a greater force gives a louder sound is insufficient

[7]

7. (a) a vector has direction (a scalar does not)

1

(b) accept any vector quantities eg

- velocity
- force
- weight
- acceleration
- displacement

1

(c) mass × velocity

*do **not** accept speed for velocity*

*do **not** accept symbols*

1

(d) kilogram(s) metre per second

allow kg m/s

1

(e) 1.8 ms = 0.0018 s

*an answer of 60 (m/s) scores **4** marks*

1

$$1500 = \frac{0.045 \times v\ (-0.045 \times 0)}{0.0018}$$

1

$$v = \frac{1500 \times 0.0018}{0.045}$$

1

v = 60 (m/s)

*an answer of 60 000 scores **3** marks*

1

(g) longer the time of contact the greater the change of momentum

allow the converse

1

since the mass of the golf ball is constant

1

the velocity of the golf ball must increase

1

increasing the distance the golf ball travels

1

[12]