Topical Past Paper Questions Workbook

Edexcel International GCSE Physics (4PH1) Paper 1P

Exam Series: January 2017 - January 2022

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Introduction

Each topical past paper questions workbook consists of hundreds of questions and their answer schemes, in the form of worksheets. Questions are assigned to each chapter according to their corresponding topic. Topics, in turn, are based on the items of the latest International GCSE or A level syllabus. This book's specifications are as follows:

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Paper: 1P
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Contents

Chapter 1

Forces and motion

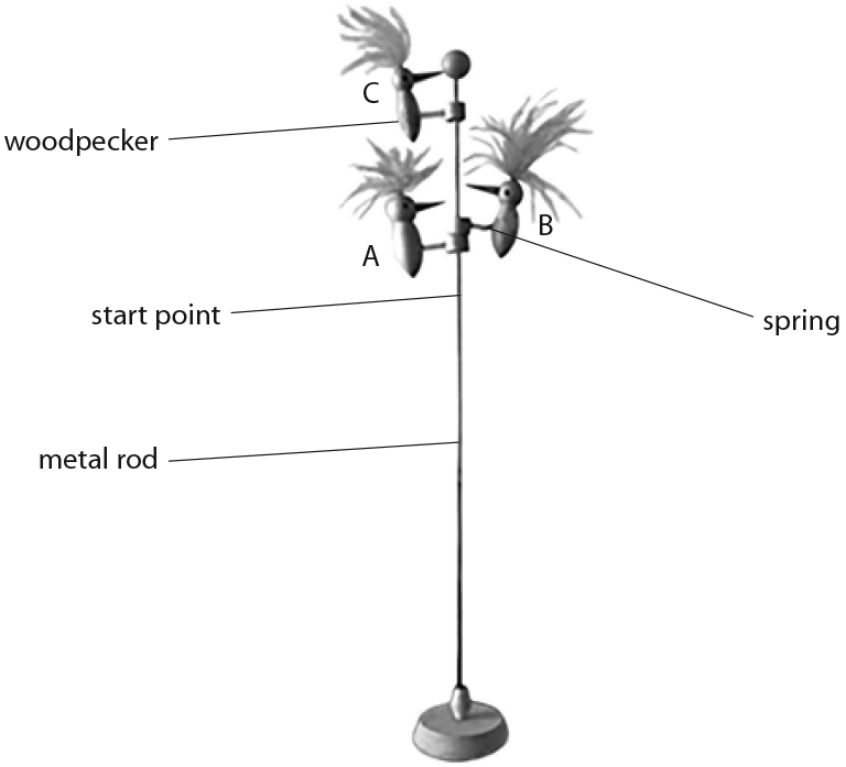
1.1 Movement and position

1. 4PH0_1P_que_20170112 Q: 3

A student investigates a toy.

- the toy has three woodpeckers
- each woodpecker is attached to a wooden ring by a spring
- a metal rod passes through the wooden rings
- the woodpeckers have different masses
- the springs are identical

When a woodpecker is pulled back and released, it vibrates and moves down the rod.



(a) A student uses this method to investigate the toy.

- measure the mass of woodpecker A
- move woodpecker A to the start point and release it
- record the time it takes for woodpecker A to travel 20 cm
- repeat the test two more times

The student uses the same method for woodpeckers B and C.

The table shows the student's results.

Woodpecker	Mass in g	Time in s		
		test 1	test 2	test 3
A	11.2	11.8	11.1	10.8
B	8.3	3.1	5.4	5.5
C	5.9	8.5	9.0	8.7

(i) One of the time measurements in the table is anomalous.

Draw a circle around this anomalous measurement.

(1)

(ii) State the relationship between average speed, distance moved and time taken.

(1)

(iii) Calculate the average (mean) speed for woodpecker B.

(4)

average speed = ... cm/s

(iv) Explain what type of graph the student should use to present his data.

(2)

.....

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.....

(b) Before carrying out his investigation, the student made this prediction.

'The smaller the mass of the woodpecker, the faster it moves down the rod.'

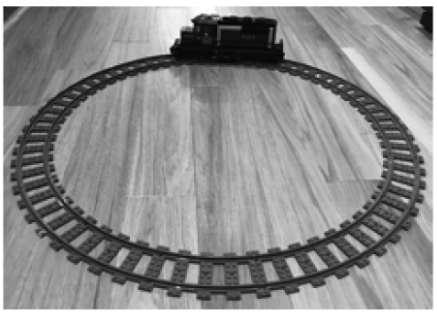
Discuss whether the student's results support his prediction.

(3)

(Total for Question 3 = 11 marks)

2. 4PH0_1P_que_20190111 Q: 7

The photograph shows a toy train as it moves around a circular track.



A student wants to find the average speed of the toy train.

Describe a method that the student could use to find the average speed.

(5)

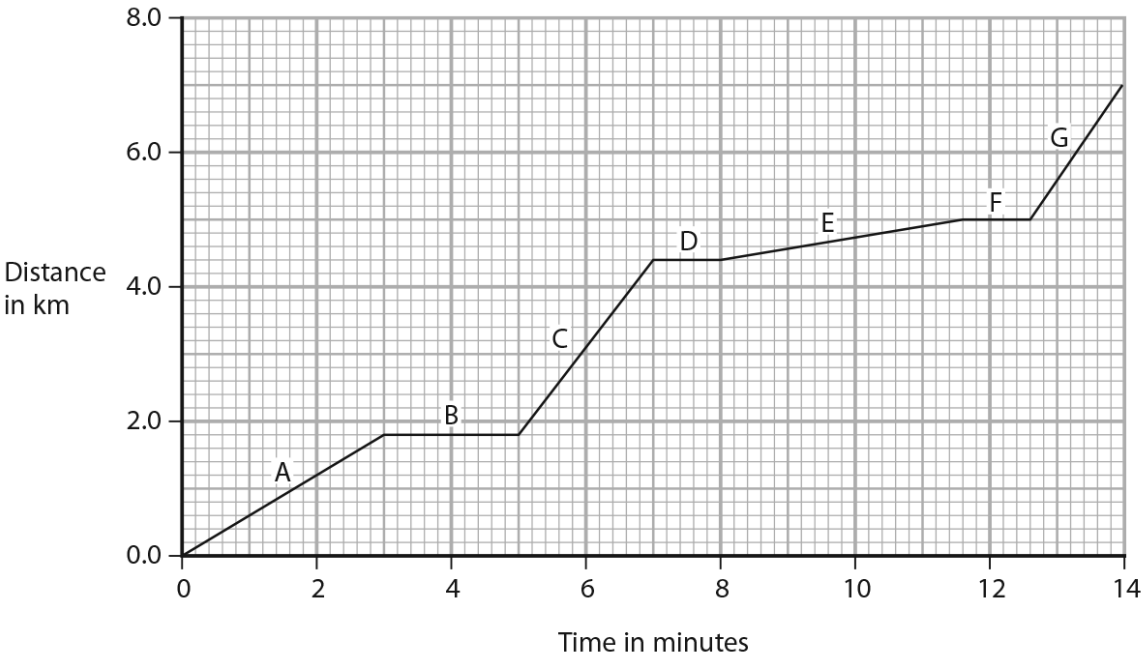
(Total for Question 7 = 5 marks)

3. 4PH1_1P_que_20200305 Q: 5

A bus transports passengers.

(a) The bus stops at certain points in its journey to let passengers get on or off the bus.

The distance-time graph shows part of the bus journey, with sections labelled A to G.



(i) Give the letters of the sections where the bus is stationary.

(1)

(ii) Calculate the speed of the bus during section C of the journey.

Give your answer in m / s.

(4)

speed = ... m / s

(iii) Explain what the graph shows about the speed of the bus in section E compared with the speed of the bus in section A.

(2)

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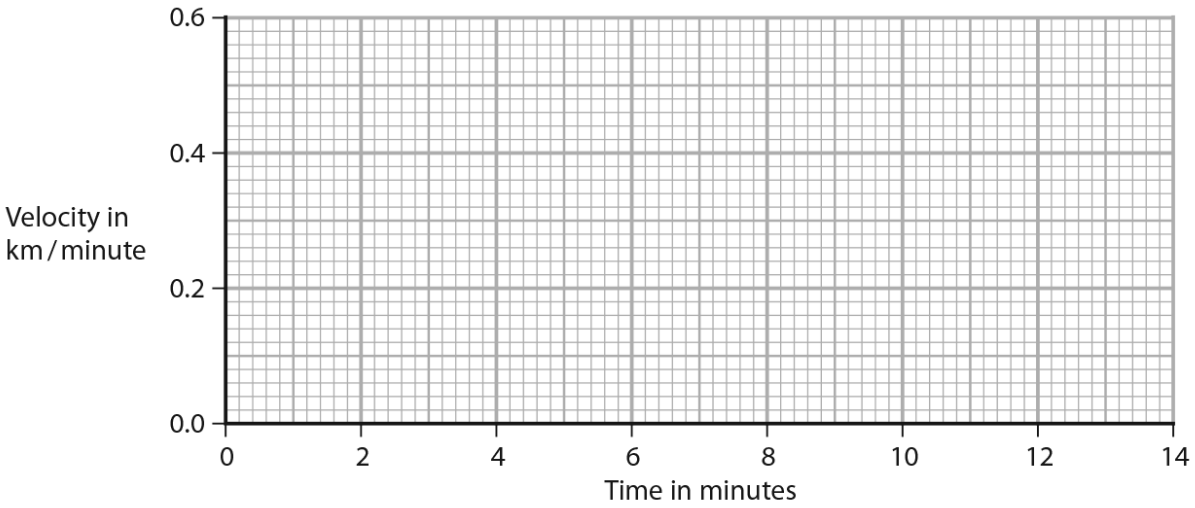
(b) Another bus travels a distance of 7.0 km in a time of 14 minutes.

This bus travels at a constant velocity.

Complete the velocity-time graph to show the motion of this bus.

(2)



(Total for Question 5 = 9 marks)

4. 4PH1_1P_que_20210304 Q: 2

(a) A speed camera is positioned at the side of a road.

The camera measures the speed of a vehicle on the road to determine whether the vehicle is travelling too fast.

The camera takes two photographs of the vehicle 0.25 s apart.

The photographs are used to measure the distance travelled by the vehicle during this time.

(i) State the formula linking average speed, distance moved and time taken.

(1)

(ii) In the time between the two photographs, the car travels a distance of 6.5 m.

Calculate the average speed of the car.

(2)

average speed = ... m/s

(iii) The speed limit of the road is 80 kilometres per hour.

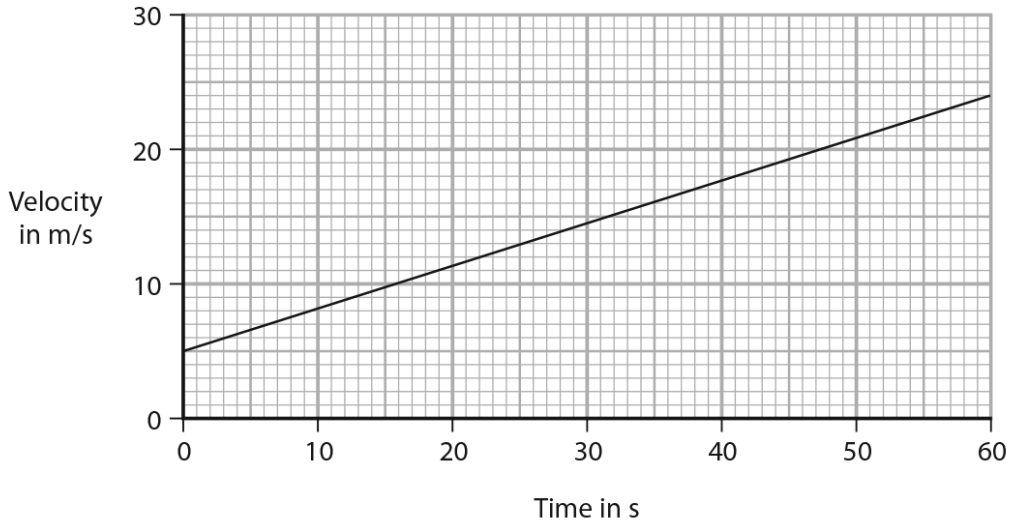
Determine whether the car is exceeding the speed limit.

(2)

.....

.....

(b) The velocity-time graph shows how the velocity of a lorry changes with time.



(i) Explain how the graph shows that the lorry has a constant acceleration.

(2)

.....

.....

.....

.....

(ii) State the formula linking acceleration, change in velocity and time taken.

(1)

(iii) Calculate the acceleration of the lorry.

(3)

acceleration = ... m/s^2

(Total for Question 2 = 11 marks)

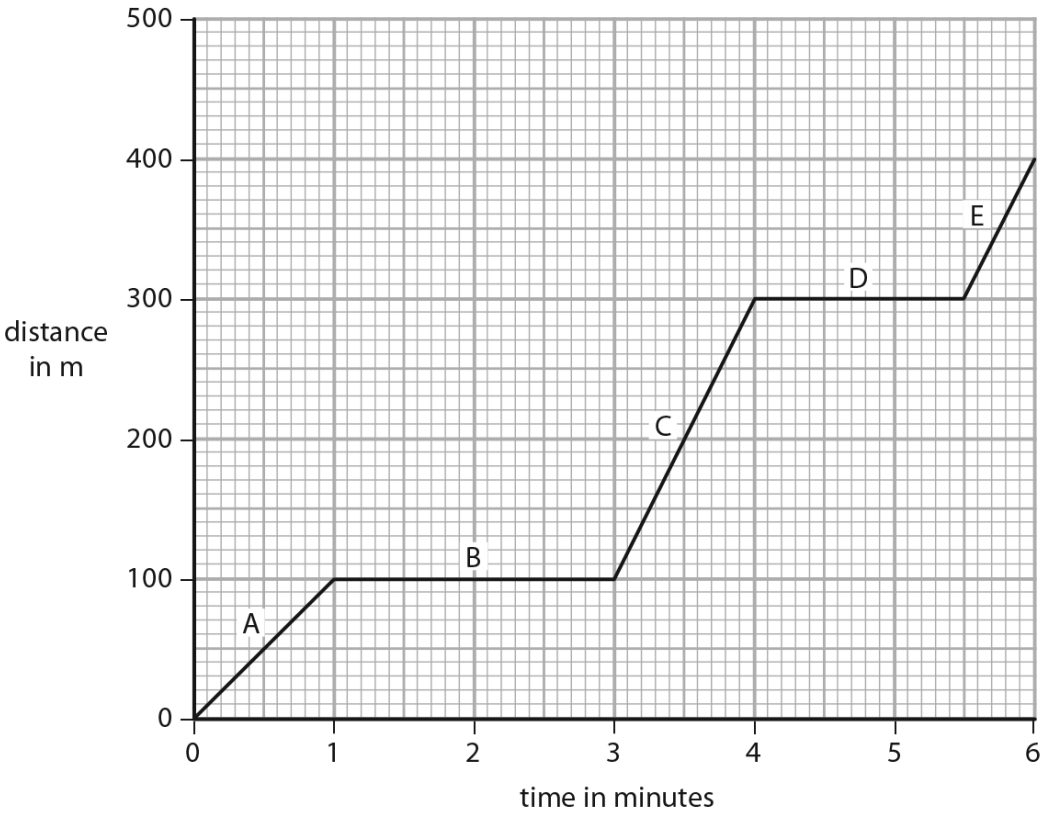
1.2 Forces, movement, shape and momentum

5. 4PH0_1PR_que_20170524 Q: 2

A car travels along a very busy road.

© AnRo0002 (Wikipedia)

The graph shows how the distance travelled by the car changes during a six-minute period.



(a) Calculate the total amount of time the car is stationary during this period.

(2)

time = ... minutes

(b) Explain which stage of the graph, A, B, C, D or E, shows the car moving at the slowest speed.

(2)

.....

.....

.....

.....

(c) (i) State the equation linking average speed, distance moved and time taken.

(1)

(ii) Calculate the speed of the car at stage C.

Give a suitable unit for your answer.

(3)

speed = ... unit .....

(d) State two factors that could affect the braking distance of the car.

(2)

1 .....

2 .....

(Total for Question 2 = 10 marks)

6. 4PH1_1PR_que_20190523 Q: 7

A student investigates how the surface material of a ramp affects the average speed of a block sliding down the ramp.

(a) Design a suitable method for the student's investigation.

Your answer should include

- the measuring equipment needed
- details of the independent, dependent and control variables
- how the average speed will be determined

You may include a diagram to help your answer.

(6)

(b) Justify why the student should display their results as a bar chart.

(1)

(Total for Question 7 = 7 marks)

7. 4PH1_1PR_que_20190523 Q: 10

(a) Diagram 1 shows a van accelerating along a horizontal road.

The horizontal forces acting on the van are shown.

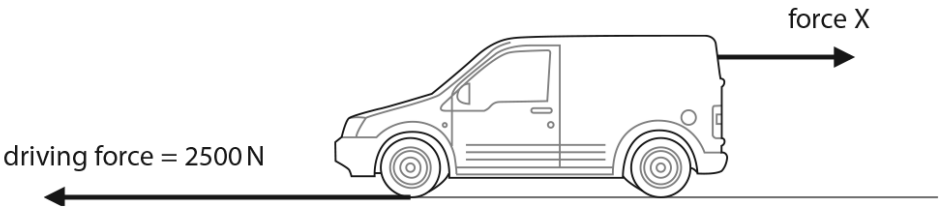


Diagram 1

(i) Force X opposes the motion of the van.

State the name of force X.

(1)

.....

(ii) The resultant force acting on the van is 1500 N.

Calculate the magnitude of force X.

[assume X is the only horizontal force opposing the motion of the van]

(1)

force X = ... N

(b) Diagram 2 shows the resultant force acting on the van when it brakes.

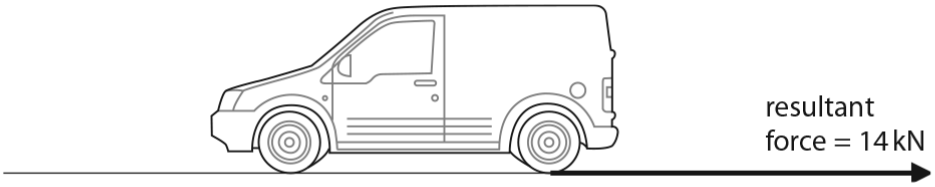


Diagram 2

(i) State the formula linking resultant force, mass and acceleration.

(1)

(ii) The mass of the van is 1900 kg.
Calculate the acceleration of the van when it brakes.
Give the unit.

(3)

acceleration = ... unit .....

(iii) The van was travelling at an initial speed of 18 m/s before braking and coming to rest.
Calculate the distance travelled by the van while it is braking.
[assume that the acceleration remains constant]

(3)

distance travelled = ... m

(iv) Describe two factors that would increase the braking distance.

(2)

1 .....

.....

2 .....

.....

(c) When the van is fully loaded its mass increases to 2500 kg.

Calculate the time taken to bring the fully loaded van to rest when it is travelling at an initial speed of 18 m/s.

[assume that the resultant force during braking remains at 14 kN]

(4)

time = ... s

(Total for Question 10 = 15 marks)

8. 4PH1_1PR_que_20200305 Q: 5

A table tennis ball is a very light plastic ball filled with air.

(a) A student drops a table tennis ball from rest.

The ball falls 13 m to the ground.

Show that the final speed of the ball, just before it reaches the ground, should be about 16 m/s.

Assume that there is no air resistance.

(3)

(b) The student suggests that the ball will reach the ground with a speed that is less than 16 m/s because of air resistance.

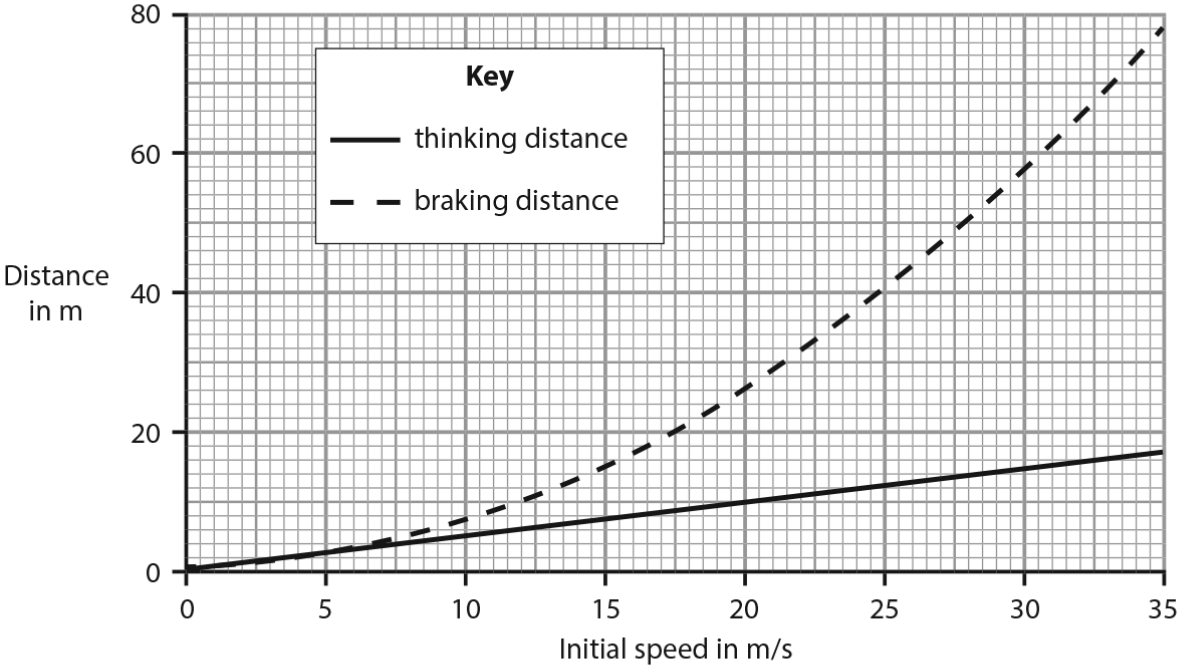
Use ideas about forces to justify the student's suggestion.

(5)

(Total for Question 5 = 8 marks)

9. 4PH1_1PR_que_20201114 Q: 11

The graph shows how the thinking distance and braking distance of a car vary with its initial speed.



(a) A car has an initial speed of 35 m/s.

The brakes are applied and the car comes to a complete stop in the braking distance shown by the graph.

Calculate the mean braking acceleration of the car.

(4)

braking acceleration = ... m/s^2

(b) Evaluate how the thinking distance and the braking distance vary for different values of initial speed.

Refer to information from the graph in your answer.

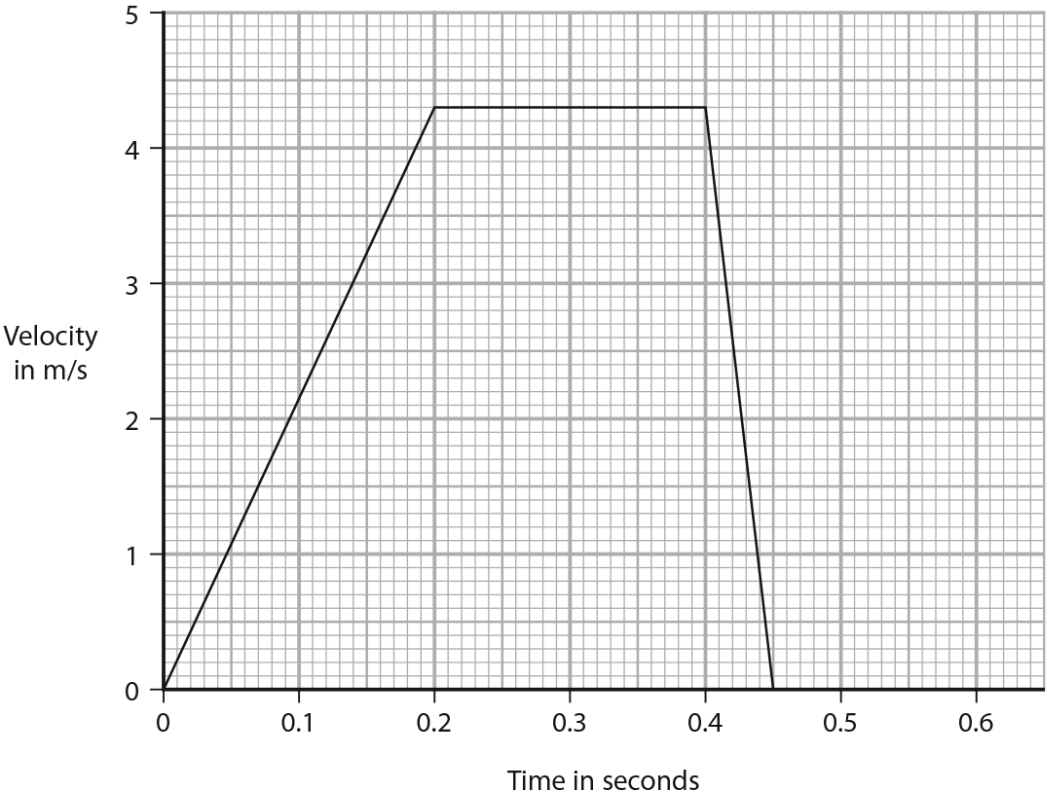
(5)

(Total for Question 11 = 9 marks)

10. 4PH1_1PR_que_20210304 Q: 5

A student does an investigation to show how the velocity of a toy car changes when the car rolls down a ramp onto a table and hits a wooden block.

The graph shows how the velocity of the toy car changes with time.



(a) Calculate the distance travelled by the car during the first 0.4 seconds.

(4)

distance = ... m

(b) (i) Calculate the acceleration of the car between 0.40 s and 0.45 s.

(3)

acceleration = ... m/s^2

(ii) State the formula linking resultant force, mass and acceleration.

(1)

(iii) The car has a mass of 0.13 kg.

Calculate the resultant force on the car as it slows down.

(2)

resultant force = ... N

(c) A piece of soft material is fixed to the front of the toy car.

Explain how this will affect the gradient of the velocity-time graph after the car hits the block.

(3)

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.....

(Total for Question 5 = 13 marks)

11. 4PH1_1PR_que_20220113 Q: 4

This question is about scalar quantities and vector quantities.

(a) Give a similarity and a difference for scalar quantities and vector quantities.

(2)

similarity

.....

.....

difference

.....

.....

(b) The box gives some physical quantities.

Draw a circle around each physical quantity that is a scalar.

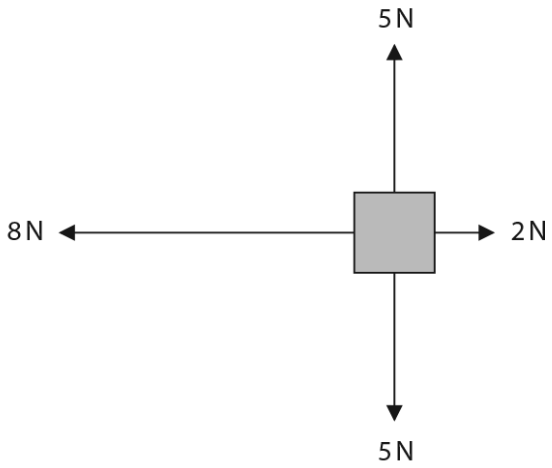
(3)

acceleration	charge	force	power
temperature	velocity	weight	

(c) The diagram shows four forces acting on an object.

Calculate the size and direction of the resultant force.

(2)



resultant force = ... N

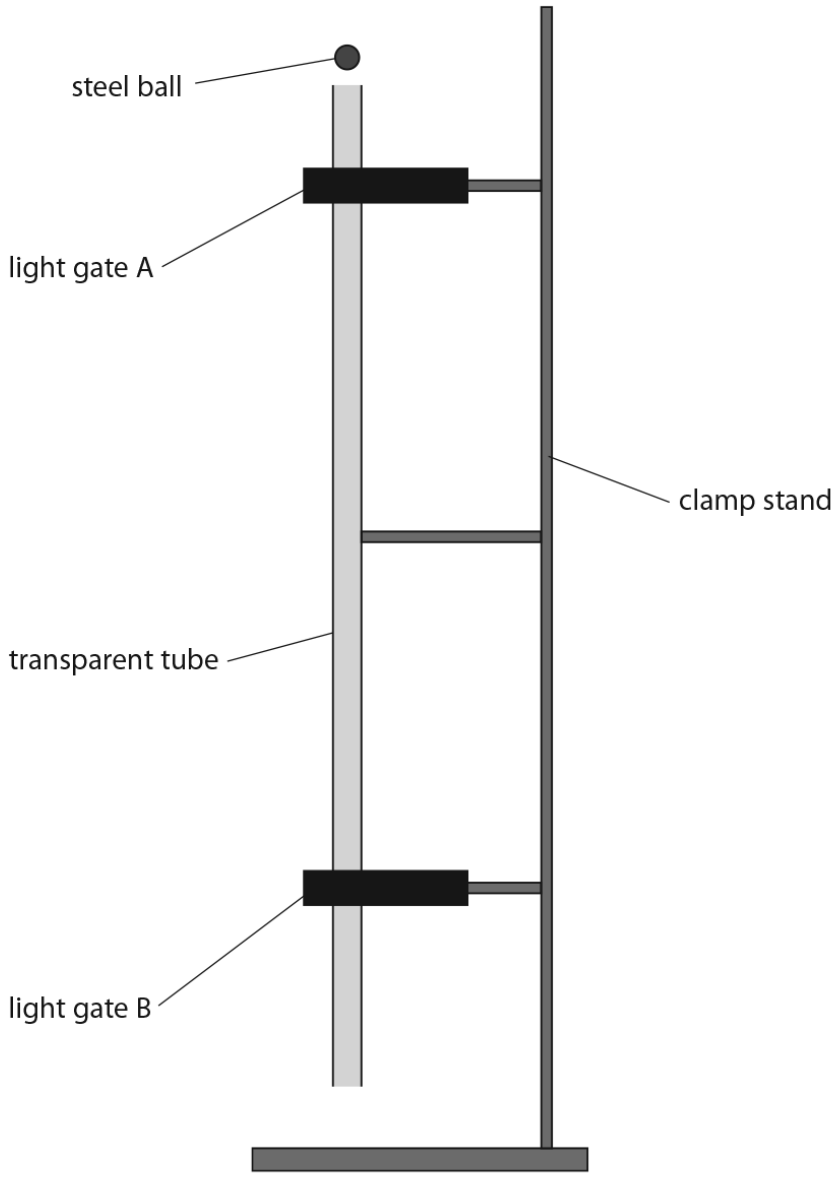
direction = ...

(Total for Question 4 = 7 marks)

12. 4PH1_1PR_que_20220113 Q: 10

A student does an experiment to determine the acceleration due to gravity, *g*.

The diagram shows the apparatus used.



This is the student's method.

- connect both light gates to a data logger
- drop a steel ball from rest at the top of the transparent tube
- record the speed of the ball at each light gate
- record the time taken for the ball to fall from light gate A to light gate B

(a) The box shows the data recorded by the data logger.

speed at A = 1.45 m/s
speed at B = 4.20 m/s
time from A to B = 0.286 s

(i) Show that the acceleration of the steel ball is approximately 9.6 m/s^2.

(2)

acceleration = ... m/s^2

(ii) Explain why the student's value for the acceleration of the steel ball is lower than the accepted value for the acceleration due to gravity, *g*.

(2)

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.....

(iii) Calculate the distance between the light gates.

(3)

distance = ... m

(b) The student changes the distance between the light gates by varying the position of light gate B.

The student measures the time taken for the steel ball to fall from light gate A to light gate B when the light gates are different distances apart.

The table shows the student's results.

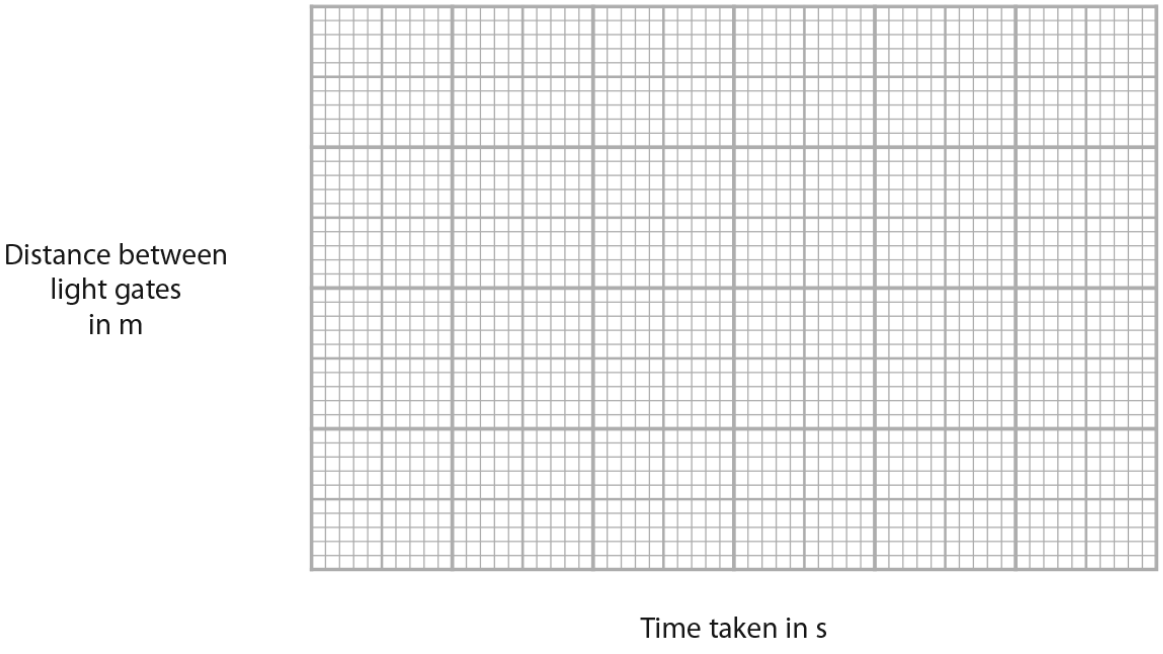
Distance between light gates in m	Time taken in s
0.10	0.058
0.20	0.103
0.30	0.141
0.40	0.175
0.50	0.205
0.60	0.233
0.70	0.260

(i) Plot a graph of the student's results on the grid.

(2)

(ii) Draw the curve of best fit.

(1)



(iii) Explain how the graph shows that the steel ball is accelerating as it falls.

(3)

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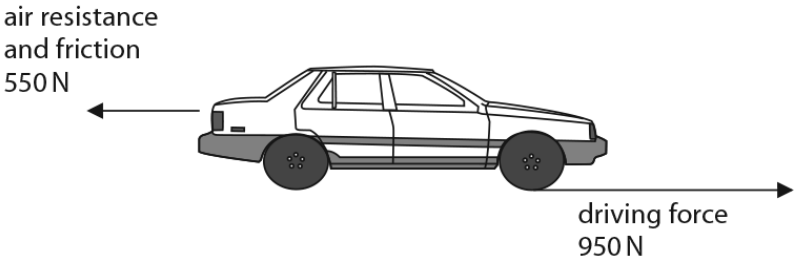
(Total for Question 10 = 13 marks)

13. 4PH0_1P_que_20170112 Q: 4

The diagram shows the horizontal forces on a car travelling to the right along a level road.



(a) How can you tell that the car is accelerating?

(1)

.....

.....

(b) (i) State the relationship between acceleration, change in velocity and time.

(1)

(ii) The car accelerates for 6.0 s.

The velocity of the car increases from 15 m/s to 24 m/s.

Calculate the acceleration of the car.

(2)

acceleration = ... m/s^2

(c) Describe how the horizontal forces on the car change when the driver applies the brakes.

(2)

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.....

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.....

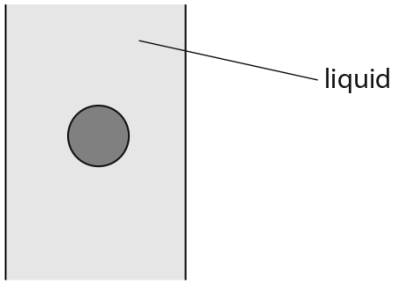
(Total for Question 4 = 6 marks)

14. 4PH0_1P_que_20170524 Q: 7

A student investigates the terminal velocity of steel balls falling through a thick liquid.

(a) (i) On the diagram, draw and label the forces acting on a steel ball as it falls at terminal velocity.

(3)



(ii) Explain, in terms of forces, what is meant by terminal velocity.

(3)

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(b) The student has five steel balls of different diameter and some thick oil.

(i) Name two additional pieces of apparatus the student would need in order to investigate the terminal velocity of the steel balls falling through the oil.

(2)

1 .....

2 .....

(ii) Describe a method the student could use to investigate how the diameter of a steel ball affects the terminal velocity.

In your answer, you should include

- a labelled diagram
- the measurements that the student should take
- how the student could use the measurements to find the terminal velocity.

(5)

(c) Explain which type of graph the student should use to display his results.

(2)

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(Total for Question 7 = 15 marks)

15. 4PH0_1P_que_20180111 Q: 3

The driver of a car sees an obstacle in the road and stops the car as quickly as possible.

The car stops without hitting the obstacle.

State three factors that could have affected the stopping distance of the car.

(3)

1 .....

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2 .....

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3 .....

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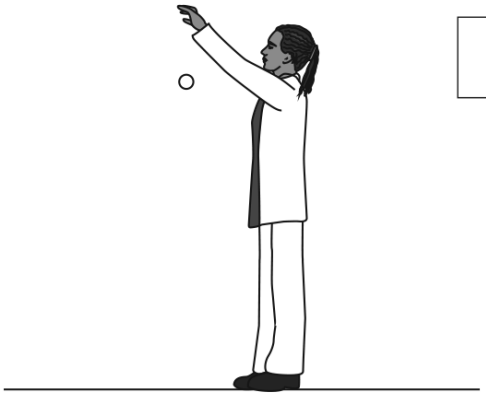
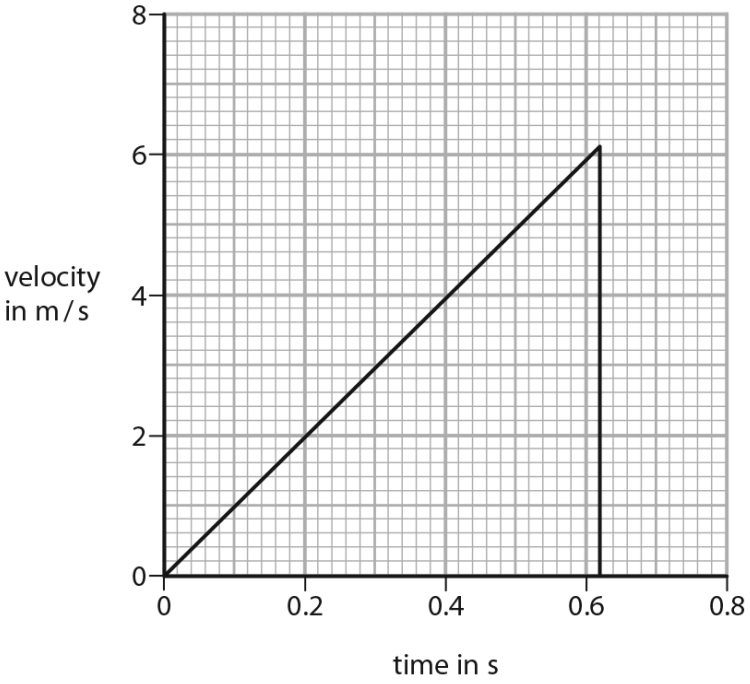
(Total for Question 3 = 3 marks)

16. 4PH0_1P_que_20180524 Q: 7

(a) The diagram shows a coin being dropped from a height.



The graph shows how the velocity of the coin changes until it hits the ground.



(i) State the equation linking acceleration, change in velocity and time.

(1)

(ii) The coin hits the ground in a time of 0.62 s with a velocity of 6.1 m/s.

Calculate the acceleration of the coin as it falls.

Give the unit.

(3)

acceleration = ... unit .....

(iii) State the feature of the graph that shows this acceleration.

(1)

.....

(iv) Calculate the height from which the coin was dropped.

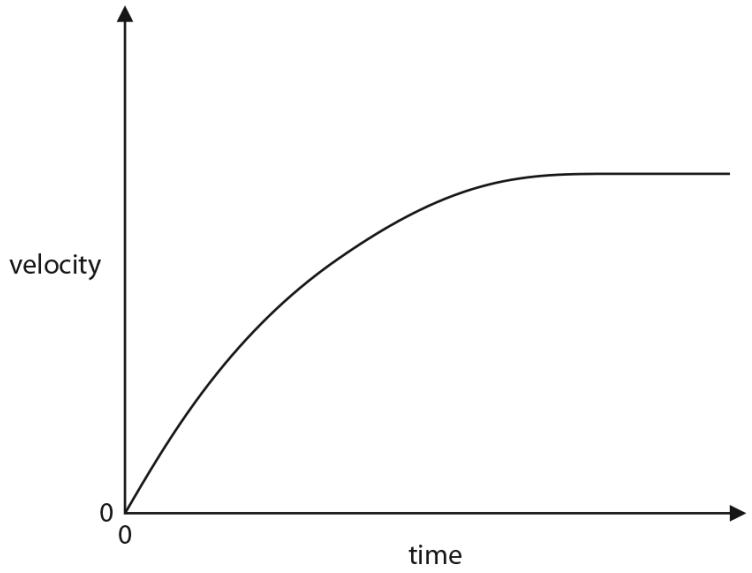
Use the graph to help with your calculation.

(3)

height = ... m

(b) A ball is dropped from a very large height.

The graph shows how the velocity of the ball changes until just before it hits the ground.



Explain why the velocity of the ball changes in this way.

Refer to ideas about forces in your answer.

(5)

(Total for Question 7 = 13 marks)

Appendix A

Answers

1. 4PH0_1P_rms_20170112 Q: 3

Question number		Answer	Notes	Marks
(a)	i	3.1 ONLY circled in the table;		1
	ii	(average) speed = distance (moved)/time (taken);	accept words or standard symbols	1
	iii	discards anomalous result; calculates mean time for B; substitution; evaluation; e.g. average time = 4.7 gets 1 marks average time = 5.5 gets 2 marks speed = 20/ 5.5 gets 3 marks =3.7 gets 4 marks	 allow 4.67 Allow 5.45 allow 20/5.45 Allow 3.67 answers which round to 4.3 get 3 marks	4
	iv	explanation including the following ideas EITHER bar chart; because woodpeckers are discrete / eq; OR mass is a continuous variable; therefore scatter-gram / eq;	 condone histogram DOP DOP allow line graph	2
b		discussion to include any 3 ideas from: MP1. there is no (discernible) pattern; MP2. supporting data quoted; MP3. discussion of why prediction is wrong/ C should be fastest; MP4. three data sets is insufficient to decide; MP5. need for further data to extend range of results;	no mark for unqualified 'yes' or 'no' results don't go in order/eq allow calculated speeds (cm/s) A= 1.8 B= 3.7 (4.3) C = 2.3 A heaviest,slowest; B middle, fastest; C lightest, middle ignore discussion of anomalies	3

2. 4PH0_1P_rms_20190111 Q: 7

Question number	Answer	Notes	Marks
	any five from: MP1. determine / measure distance; MP2. determine / measure time; MP3. appropriate measuring instrument for distance OR time; MP4. use a suitable distance / count laps (of known length); MP5. repeat experiment and calculate average; MP6. use of speed = distance ÷ time; MP7. suitable experimental precaution e.g. reaction time considered, time from and to predetermined points;	 allow idea of measuring diameter/radius and calculating distance ignore 'human error' allow mark a start/finish point	5

3. 4PH1_1P_rms_20200305 Q: 5

Question number	Answer	Notes	Marks
(a) (i)	B, D, F;	all required for the mark reject if additional sections listed	1
(ii)	use of speed = distance / time;	seen anywhere allow symbols allow attempt to find gradient of line	4
	correctly read time or distance from graph; conversion from minutes to seconds or km to m; correct evaluation;		
	e.g. v = s / t distance = 2.6 km or time = 2 minutes distance = 2600 m or time = 120 s (v =) 22 (m/s)	allow s = d / t allow 21.7, 21.6… (m/s) 0.0216…, 1300 = 3 marks 1.3 = 2 marks	
(iii)	idea that speed of bus is greater in section A; (because) line is steeper / gradient is larger / eq;		2
(b)	single horizontal line drawn; horizontal line drawn at 0.5 km/minute for some period of time in journey;	judge by eye line must extend the entire length of the time axis	2

4. 4PH1_1P_rms_20210304 Q: 2

Question number	Answer	Notes	Marks
(a) (i)	(average) speed = distance (moved) / time (taken);	allow standard symbols and rearrangements e.g. v = s / t allow s for speed, d for distance	1
(ii)	substitution; evaluation; e.g. (speed =) 6.5 / 0.25 (speed =) 26 (m/s)		2
(iii)	correct conversion of EITHER m to km OR s to h; full conversion from m/s to km/h AND consistent conclusion;;	allow ECF from (ii) allow ECF from (ii) allow conversion of km/h to m/s e.g. 80km/h = 22.2m/s	2
	e.g. 26 (m/s) = 0.026 (km/s) OR 26 (m/s) = 93600 (m/h) 94 (km/h) => too fast	 allow 93.6 (km/h)	
(b) (i)	acceleration is the gradient (of the graph); graph has a constant gradient;	 allow line on graph is straight	2
(ii)	acceleration = change in velocity / time;	allow standard symbols and rearrangements e.g. a = (v-u) / t, a = Δv / t	1
(iii)	correct reading of either two velocity values or time interval taken from graph; correct substitution into formula; evaluation; e.g. u = 5 (m/s), v = 24 (m/s) OR t = 60 (s) (a =) 24-5 / 60 (a =) 0.32 (m/s^2)	allow attempt at gradient calculation allow (v – u =) 19 seen allow range of 0.30-0.32	3

5. 4PH0_1PR_rms_20170524 Q: 2

Question number	Answer	Notes	Marks
(a)	clear recognition that stationary is the horizontal sections; 3.5 (minutes);	seen on graph or in working e.g. use of 1.5 or 2 allow 3½	2
(b)	A; idea of line having smallest gradient;	 allow 'line is shallowest' / 'least steep' etc. allow calculated speeds	2
(c) (i)	(average) speed = distance (moved) / time (taken);	allow in standard symbols or in words e.g. s = d/t OR v = s/t	1
(ii)	substitution; evaluation; matching unit; e.g. (speed =) 200 / 60 (speed =) 3.3 m/s	 must match units used in calculation allow 3, 3.33, 3.333 etc. condone 3.34 200 **metres per minute** receives 3 marks 12 **km/h** (condone kph) receives 3 marks 200 m/s receives 2 marks allow any suitable unit of speed for 1 mark if no other mark scored	3
(d)	any 2 of: speed of car; mass / weight of car; road / weather conditions; road slope / angle; condition / type / age of tyres; condition / age of brakes; wind speed / direction;	ignore references to reaction time, thinking distance, stopping distance etc. road surface, rain, ice, snow etc. ignore fog, mist etc.	2

6. 4PH1_1PR_rms_20190523 Q: 7

Question number	Answer	Notes	Marks
(a)	**measuring equipment:** MP1. ruler / tape measure; MP2. stopclock / stopwatch; **variables:** MP3. surface material is the independent variable; MP4. (average) speed is the dependent variable; MP5. any one control variable from; • size / mass / material / area /weight of block • height/angle/gradient of ramp • initial force given to block • distance travelled down the ramp **determining average speed:** MP6. use of (average) speed = distance travelled / time	allow if clearly included in diagram condone 'timer' accept use of light gates if connected to timing device e.g. computer/datalogger accept 'camera' if subsequent method describes 'freeze-frame'/timestamp technique allow time as the dependent variable allow 'keep constant' for 'control variable' allow 'push' given to block allow **initial** speed or velocity allow same starting point and finishing point accept use of light gate if description includes length of card/block and time of transit	6
(b)	(bar chart because) surface material is a {categoric / discontinuous / non-continuous} variable;	condone surface material being a discrete variable	1

7. 4PH1_1PR_rms_20190523 Q: 10

Question number	Answer	Notes	Marks
(a) (i)	friction / air resistance / drag;		1
(ii)	1000 (N);		1
(b) (i)	(resultant) force = mass × acceleration;	allow rearrangements and standard symbols e.g. a = F/m	1
(ii)	substitution AND rearrangement; evaluation; unit; e.g. (a =) (-)14000 / 1900 (a =) (-)7.4 m/s^2	-1 for POT error mark independently Condone 7.4, 7.36842..., etc. accept $m\,s^{-2}$ ignore N/kg	3
(iii)	substitution into $v^2 = u^2 + 2as$; rearrangement; evaluation; e.g. $0 = 18^2 + (2 \times -7.4 \times s)$ (s =) 324 / (2 x 7.4) (s =) 22 (m)	allow ecf from (b)(ii) no mark for equation alone as given -1 if negative sign given with answer allow answer in range 21.8-22.0 from rounding differences allow time to stop of 2.4... (s) for 1 mark	3
(iv)	any two **described** factors from: MP1. increased mass (of van); MP2. increased speed (of van); MP3. idea of less friction on the road e.g. road being wet / icy etc; MP4. idea of worn vehicle parts e.g. tyres / brakes etc.; MP5. van travelling downhill;	ignore condition of driver allow weight for mass allow KE for speed	2

Question number	Answer	Notes	Marks
(c)	calculation of new acceleration (5.6); substitution into a = (v - u) / t; rearrangement; evaluation; e.g. new acceleration = 5.6 (m/s^2) 5.6 = 18 / t (t =) 18/5.6 (t =) 3.2 (s)	-1 if POT error allow ecf from acceleration value allow use of previously calculated acceleration award full marks for momentum method i.e. recall of F = (mv-mu)/t; substitution; rearrangement; evaluation; allow 3.214... ignore negative reject 25000/14000 x 18 (i.e. mass x 10 x speed/force) which gives 32.	4

8. 4PH1_1PR_rms_20200305 Q: 5

Question number	Answer	Notes	Marks
(a)	substitution into given equation $v^2 = u^2 + (2 \times a \times s)$; evaluation of v^2; evaluation of v to 3sf or more i.e. 16.1 (m/s); e.g. $v^2 = u^2 + (2 \times a \times s)$ $v^2 = 0^2 + (2 \times 10 \times 13)$ $v^2 = 260$ $v = \sqrt{260} = 16.1$ (m/s)	accept $mgh = 1/2mv^2$ accept use of $g = 9.8(1)$ m/s^2 giving v = 16.0, 15.97 etc.	3
(b)	any FIVE from: MP1 ball has weight; MP2 ball accelerates; MP3 drag increases (while accelerating); MP4 resultant force decreases; MP5 (so) acceleration decreases; MP6 drag = weight / resultant = 0 / forces balanced; MP7 terminal velocity/constant speed /acceleration=0;	 allow 'has gravitational force' REJECT 'has gravity' REJECT 'balls slows down' allow 'air resistance' for 'drag'	5

9. 4PH1_1PR_rms_20201114 Q: 11

Question number	Answer	Notes	Marks
11 (a)	value of braking distance correctly read from graph; substitution into $v^2 = u^2 + 2as$; rearrangement; evaluation; e.g. braking distance = 78 m $0 = 35^2 + (2 \times a \times 78)$ $(a =) (-) 35^2 / (2 \times 78)$ $(a =) (-) 7.9$ (m/s^2)	allow 77-79 m allow ecf incorrect distance allow 7.75… - 7.95…(m/s^2)	4
(b)	any five from: MP1. thinking distance OR braking distance increases as (initial) speed increases; MP2. braking distance increases by a greater amount than thinking distance for the same increase in (initial) speed; MP3. thinking distance is (directly) proportional to (initial) speed; MP4. braking distance has a non-linear relationship with (initial) speed; MP5. idea that braking distance is proportional to (initial) speed squared; MP6. suitable use of data to justify thinking distance relationship; MP7. suitable use of data to justify braking distance relationship;	 e.g. gradient of braking distance graph larger than gradient for thinking distance e.g. when initial speed doubles, the braking distance is four times greater / eq. e.g. reading off thinking distance for two values of initial speed and showing they increase by the same factor e.g. reading off braking distance for two values of initial speed and showing they do not increase by the same factor	5

10. 4PH1_1PR_rms_20210304 Q: 5

Question number	Answer	Notes	Marks
(a)	any attempt at finding the area/ "area = distance" stated; area of triangle = ½ x 4.3 x 0.2 (= 0.43 m); area of rectangle = 4.3 x 0.2 (= 0.86 m); distance = 1.29 (m) ;	 accept area of trapezium = ½ x 4.3 x (0.2 + 0.4) for MP2 and MP3. count squares; area of 1 square = 0.001 (m); distance = 1.29 (m)	4

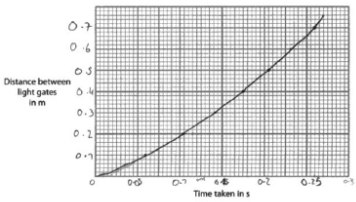
(b) (i)	idea that acceleration = gradient;
	gradient = (-)4.3 / 0.05;
	acceleration = (-) 86 (m/s^2);
		
		-1 for POT error
			3

(ii)	(resultant) force = mass x acceleration / F = ma		1
(iii)	substitution; evaluation; eg F = 0.13 x 86 F = 11 (N)	 allow ECF from (i) ignore sign 11.18, 11.2	2
(c)	increases time of collision; any reference to shallower gradient on graph; so acceleration will be smaller (in magnitude);		3

11. 4PH1_1PR_rms_20220113 Q: 4

Question number	Answer	Notes	Marks
(a)	both have magnitude; (only) vectors have a direction;		2
(b)	charge; power; temperature;	if 4 circled, 2 marks max. if 5-6 circled, 1 mark max. no marks if all circled	3
(c)	(resultant force =) 6 (N); (direction =) left;	ignore sign allow indication of same direction as 8 (N) force condone West	2

12. 4PH1_1PR_rms_20220113 Q: 10

Question number	Answer	Notes	Marks
(a) (i)	substitution into a = Δv / t; evaluation to 3 or more s.f.; e.g. acceleration = (4.20 - 1.45) / 0.286 (acceleration =) 9.62 (m/s^2)		2
(ii)	idea that air resistance / friction also acts on ball; which opposes the ball's weight;	allow drag allow idea that frictional force is upwards whilst weight is downwards allow idea that resultant force is less that weight ignore idea of reaction time / other human errors	2
(iii)	substitution into $v^2 = u^2 + 2 \times a \times s$; rearrangement; evaluation; e.g. $4.20^2 = 1.45^2 + (2 \times 9.6 \times s)$ $s = (v^2 - u^2) / 2a$ (s =) 0.809 (m)	allow use of a=9.6, 9.8, 9.81 or 10 reject 'change in speed × time' giving 0.78(65) as incorrect physics allow answers using correct average velocity. allow range 0.78-0.81 (m)	3
(b) (i)	suitable scale on both axes; all points plotted correctly to nearest half square;  		2
(ii)	smooth curve drawn with an even distribution of data points either side;	ECF candidate plotting	1
(iii)	gradient of graph is equal to the speed / velocity of the ball; gradient is increasing (as time increases); speed / velocity is increasing (as time increases);	 allow "curve gets steeper" allow idea of greater distance in a unit of time DOP award 1 mark for idea that graph is a curve if no other marks awarded	3

13. 4PH0_1P_rms_20170112 Q: 4

Question number			Answer	Notes	Marks
	(a)		(however expressed) driving force> resistive force;	there is a resultant force forces are not balanced	1
	(b)	i	a= **change** in velocity; time	in words or accepted symbols	1
	b	ii	substitution; evaluation;		2
			e.g. a= 24-15 6 a= 9/6 = 1.5 (m/s^2)		
	(c)		any two from: MP1. braking force increases; MP2. the driving / forward force becomes zero/decreases; MP3. air resistance decreases (as speed decreases); MP4. resultant force is now in opposite direction;	the overall resistive force /backwards force increases allow resultant force increases for 1 mark	2

14. 4PH0_1P_rms_20170524 Q: 7

Question number	Answer	Notes	Marks
a i	drag/friction labelled on up arrow; weight labelled on down arrow; both arrows same size;	ignore upthrust, resultant, unqualified resistance, air resistance reject unqualified gravity judge by eye	3
ii	force up = force down; (therefore) no acceleration; (hence TV =) constant velocity/speed;	accept • weight = drag (or resistance or friction) • balanced forces • resultant force is zero ignore maximum velocity	3
b i	any two from:- long thin container e.g. measuring cylinder; metre rule; (electric) balance; micrometer; light gates; stop clock/ EQ; magnet (to remove the balls);	ignore oil, steel balls, condone beaker allow ruler, (metal) tape measure scales callipers	2
ii	any 5 from:- MP1. labelled diagram; MP2. fixed and measured distance; MP3. time over the distance; MP4. measures diameter or mass; MP5. repeat and average (for same ball); MP6. use of speed = distance/ time; MP7. prelim experiment to determine range / criterion for choice of range; MP8. start some distance from the top/allow for forces to equalise; MP9. determine velocity at different points and plot graph;	the medium can be air, water or oil must be more than repeat of previous diagram mark start and end position allow repeat for reliability criterion for diameter of ball	5

Question number	Answer	Notes	Marks
c	discussion of **either** idea of discrete data (however expressed); bar chart DOP; **or** data is continuous (however expressed); scatter gram DOP;	 Allow line graph	2

15. 4PH0_1P_rms_20180111 Q: 3

Question number	Answer	Notes	Marks
	any three from: MP1. reaction time of driver (including comment on drink / drugs / driver paying attention / driver distracted / driver tired); MP2. condition of car's brakes / force applied to brakes; MP3. condition of car's tyres; MP4. condition of road surface (including ice / water / mud / friction ideas); MP5. visibility factor (e.g. fog / dirty windscreen); MP6. speed of car; MP7. mass of car; MP8. kinetic energy of car; MP9. momentum of car;	 allow 'thinking distance' allow 'braking distance' in the absence of MP2, MP3 and MP4	3

16. 4PH0_1P_rms_20180524 Q: 7

Question number	Answer	Notes	Marks
a (i)	acceleration = <u>change</u> in velocity / time (taken);	allow standard symbols and rearrangements e.g. a = (v-u)/t	1
(ii)	substitution; evaluation; unit; e.g. (acceleration =) 6.1 (-0) / 0.62 (acceleration =) 9.8 m/s^2	 allow 10, 9.8387…	3
(iii)	gradient;	allow slope	1
(iv)	height = area under the line; use of ½ x base x height; evaluation; e.g. height = area under the line; (height =) 0.5 x 6.1 x 0.62 (height =) 1.9 (m)	seen explicitly or implied by working allow alternative methods leading to correct answer for 3 marks allow range of 1.88-1.92	3
b	any five from: MP1. weight / downward force (acts on the ball); MP2. so it accelerates; MP3. there is drag (acting upwards); MP4. drag increases with velocity/speed; MP5. idea that eventually drag = weight; MP6. (hence) resultant force is zero; MP7. ball falls at a constant velocity/speed OR ball has zero acceleration;	 allow 'gravity pulls it down' the velocity/speed increases air resistance / air friction allow 'forces are equal/balanced' allow 'reaches terminal velocity'	5