AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.1.4

Resultant forces

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**25**
Available paper years	**2008–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.5.1.4 Resultant forces

Answer 01 · Mark scheme

June 2008 | PHY2F | Original Q4 | Legacy

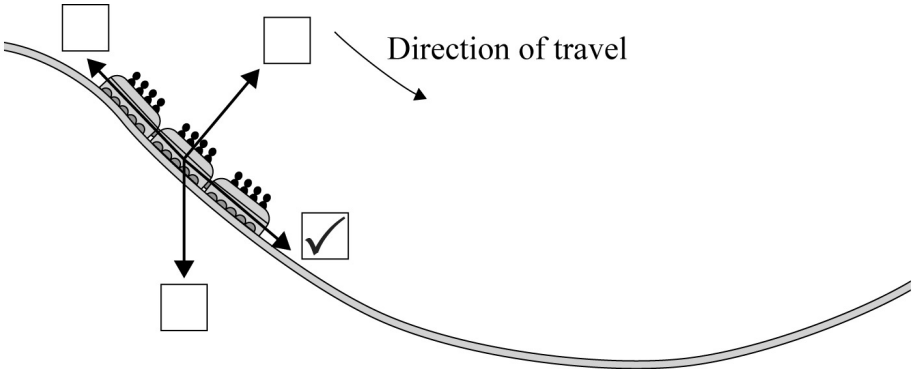
Question 4

	answers	extra information	mark
(a)(i)	0.6 newtons	allow **1** mark for correct substitution accept N do **not** accept n accept Newtons	2 1
(ii)	the same as		1
(b)(i)	changed velocity	accept increased/ decreased for change accept speed for velocity accept change direction accept getting faster/ slower accept start/ stop moving accept correct equation in terms of change in speed or change in velocity	1
(ii)	down(wards)	accept towards the ground accept ↓ do **not** accept south	1
(iii)	increase velocity is increasing **or** it is accelerating	 can only credit second mark if answer is increase accept speed for velocity accept is moving faster accept an answer in terms of resultant force downwards mention of weight/ mass increasing negates second mark	1 1
total			8

4.5.1.4 Resultant forces

Answer 02 · Mark scheme January 2009 | PHY2F | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	correct box ticked 		1
7(b)	each passenger has a different mass	accept weight for mass ignore other irrelevant factors about the person e.g. mass and height do **not** accept a list with incorrect factors e.g. mass and position accept passengers started with different (gravitational) potential energy	1
7(c)(i)	30	ignore added units	1
7(c)(ii)	2400	accept their (c)(i) × 80 correctly calculated for both marks allow **1** mark for correct substitution of their (c)(i) and 80 an answer of 800 gains **1** mark only if answer to (c)(i) is not 10	2
Total			**5**

4.5.1.4 Resultant forces

Answer 02 · Mark scheme

January 2009 | PHY2F | Original Q7 | Legacy

PHY2F

4.5.1.4 Resultant forces

Answer 03 · Mark scheme

June 2009 | PHY3F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	direction	accept any unambiguous indication	1
2(a)(ii)	centripetal	accept any unambiguous indication	1
2(b)	**A**	accept any unambiguous indication	1
2(c)	mass of the passengers is greater	accept any unambiguous indication	1
Total			**4**

4.5.1.4 Resultant forces

Answer 03 · Mark scheme

June 2009 | PHY3F | Original Q2 | Legacy

PHY3F

4.5.1.4 Resultant forces

Answer 04 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)	96	allow **1** mark for correct substitution ie 80 × 1.2	2
	newton or N	allow Newton do **not** allow n	1
6(b)(i)	direction		1
6(b)(ii)	velocity and time are continuous (variables)	answers must refer to both variables accept the variables are continuous / not categoric accept the data / 'it' is continuous accept the data / 'it' is not categoric	1
6(b)(iii)	**C**		1
	velocity is not changing	the **2** marks for reason may be scored even if **A** or **B** are chosen accept speed for velocity accept speed is constant (9 m/s) accept **not** decelerating accept **not** accelerating accept reached terminal velocity	1
	forces must be balanced **or** resultant force is zero	accept forces are equal accept arrows are the same length / size do **not** accept the arrows are equal	1
Total			**8**

4.5.1.4 Resultant forces

Answer 04 · Mark scheme

January 2010 | PHY2F | Original Q6 | Legacy

PHY2F

4.5.1.4 Resultant forces

Answer 05 · Mark scheme

June 2010 | PHY2F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	75 000 newtons / N	accept correct substitution for **1** mark ie 7500 × 10 do **not** accept n full credit for using g = 9.8 **or** 9.81	2 1
6(a)(ii)	60 000 000	accept for both marks their (a)(i) × 800 correctly calculated accept correct substitution for **1** mark ie their (a)(i) × 800	2
6(b)(i)	arrow drawn parallel (to) **and** down (the) slope	accept arrow drawn anywhere on the diagram	1
6(b)(ii)	increases GPE transformed to KE **or** speed increasing	 accept is accelerating however 'speed increasing' only scores if correctly linked to increasing kinetic energy	1 1
6(c)	so more likely to wear one **or** they know wearing a helmet is likely to / will reduce (risk) head injury **or** so can make an (informed) choice (about wearing one)		1
Total			**9**

4.5.1.4 Resultant forces

Answer 05 · Mark scheme June 2010 | PHY2F | Original Q6 | Legacy

PHY2F

4.5.1.4 Resultant forces

Answer 06 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)(i)	120		1
7(a)(ii)	20	accept 140-their (a)(i) provided answer is not negative	1
7(a)(iii)	as speed increases drag force / water resistance / friction / **D** increases (until) **D** = 140 N or (until) **D** = **T**	 forces balance is insufficient	1 1 1
7(b)(i)	(average) speed (of swimmer)		1
7(b)(ii)	any **two** from: • more data • force may vary (a lot) / change • give more <u>reliable average</u>	 accept results for data do **not** accept more accurate data ignore references to anomalies ignore accurate / precise	2

Question 7 continues on the next page . . .

PHY2F

Question 7 continued . . .

question	answers	extra information	mark
7(b)(iii)	examples of acceptable responses: • most / some females produce smaller forces • most / some males produce larger forces • some females swim as fast as males but use a smaller force • most of the faster swimmers are male • most of the slower swimmers are female • range of the (average) speed of males is smaller than the range of the (average) speed of females • range of the (average) force of the males is greater than the range of the (average) force of the females	do **not** accept <u>all</u> females produce smaller forces do **not** accept <u>all</u> males produce larger forces do **not** accept <u>all</u> males swim faster do **not** accept <u>all</u> females swim slower	1
7(b)(iv)	exert maximum (hand) force (throughout the swim / stroke)	accept (any method to) increase (hand) force practise more is insufficient	1
Total			**10**

4.5.1.4 Resultant forces

Answer 06 · Mark scheme January 2011 | PHY2F | Original Q7 | Legacy

PHY2F

4.5.1.4 Resultant forces

Answer 07 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)(i)	centripetal force	accept any unambiguous correct indication	1
2(a)(ii)	**B**		1
2(b)(i)	decrease	accept any unambiguous correct indication	1
2(b)(ii)	increase	accept any unambiguous correct indication	1
2(c)	Bull pit smallest (inside) radius	 accept smallest diameter / circumference	1 1
Total			**6**

4.5.1.4 Resultant forces

Answer 07 · Mark scheme January 2011 | PHY3F | Original Q2 | Legacy

PHY3F

4.5.1.4 Resultant forces

Answer 08 · Mark scheme

January 2013 | PH2FP | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	4 N to the right		1
1(b)(i)	bigger than equal to		1 1
1(b)(ii)	reduces it increases air resistance / drag / force C	 accept parachute has large(r) (surface) area	1 1
Total			**5**

4.5.1.4 Resultant forces

Answer 08 · Mark scheme

January 2013 | PH2FP | Original Q1 | Legacy

PH2FP

4.5.1.4 Resultant forces

Answer 09 · Mark scheme

June 2013 | PH2FP | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	(produces) a force from water on the boat in the forward direction	 accept in the opposite direction this must refer to the direction of the force not simply the boat moves forwards an answer produces an (equal and) opposite force gains **1** mark	1 1
7(b)(i)	1.5 m/s^2	allow **1** mark for correct substitution, ie $\frac{16-4}{8}$ **or** $\frac{12}{8}$ provided no subsequent step shown ignore sign	2 1
7(b)(ii)	102 **or** their (b)(i) × 68 correctly calculated	allow **1** mark for correct substitution, ie 1.5 × 68 **or** their (b)(i) × 68 provided no subsequent step shown	2
7(b)(iii)	greater than need to overcome resistance forces	reason only scores if greater than chosen accept named resistance force accept resistance forces act (on the water skier) do **not** accept gravity	1 1
Total			**9**

4.5.1.4 Resultant forces

Answer 09 · Mark scheme June 2013 | PH2FP | Original Q7 | Legacy

PH2FP

4.5.1.4 Resultant forces

Answer 10 · Mark scheme June 2014 | PH2FP | Original Q2 | Legacy

2(a)(i)	not moving		1	AO2 2.1.2b
2(a)(ii)	straight line from origin to (200,500)	ignore a horizontal line after (200,500)	1	AO2 2.1.2b
2(b)	35 000	allow **1** mark for correct substitution, ie 14 000 × 2.5 provided no subsequent step an answer of 87 500 indicates acceleration (2.5) has been squared and so scores zero	2	AO2 2.1.2a
Total			**4**	

4.5.1.4 Resultant forces

Answer 10 · Mark scheme

June 2014 | PH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO spec ref

Answer 11 · Mark scheme

June 2014 | PH3FP | Original Q8 | Legacy

The full source mark scheme begins on page 47. Follow original question 8 in that document.

4.5.1.4 Resultant forces

Answer 12 · Mark scheme June 2015 | PH3FP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.
8(a)(i)	D		1	AO2 P3.2.4b
8(a)(ii)	friction		1	AO1 P3.2.4b
8(a)(iii)	any **two** from: • the speed / velocity • the radius of the bend • the mass (of the car)	 the radius is insufficient accept curvature of the road size of the bend is insufficient accept distance of car from centre (of bend) accept weight for mass	2	AO1 P3.2.4c
8(b)	the car has a wide base the car has a low centre of mass / gravity	accept any description of a wide base e.g. the wheels are far apart accept wide wheel base do **not** accept long wheel base a large surface area is insufficient wide tyre(s) is insufficient accept any description of low centre of mass e.g. mass is close to the ground a down force is insufficient	1 1	AO2 P3.2
Total			6	

4.5.1.4 Resultant forces

Answer 12 · Mark scheme

June 2015 | PH3FP | Original Q8 | Legacy



4.5.1.4 Resultant forces

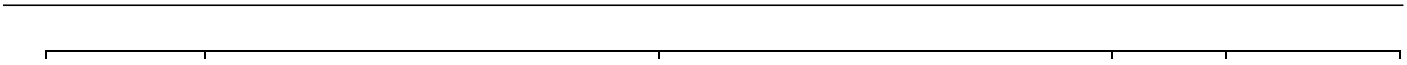
Answer 13 · Mark scheme June 2018 | 8463/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	C		1	AO1 4.5.5.1.2
06.2	weight = 2.5 × 9.8 weight = 24.5 (N)	an answer of 24.5 scores **2** marks an answer of 24.5 rounded to 25 scores **2** marks	1 1	AO2 4.5.1.3
06.3	the upthrust is the same as the weight		1	AO1 4.5.5.1.2
06.4	(resultant) force = mass × acceleration	allow F = m a	1	AO1 4.5.6.2.2
06.5	4.0 = 2.5 × a $a = \frac{4.0}{2.5}$ a = 1.6 (m/s^2)	an answer of 1.6 scores **3** marks	1 1 1	AO2 4.5.6.2.2
Total			**8**	

4.5.1.4 Resultant forces

Answer 13 · Mark scheme

June 2018 | 8463/2F | Original Q6



4.5.1.4 Resultant forces

Answer 14 · Mark scheme

June 2019 | 8463/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6.1	B		1	AO1/1 4.5.6.2.1
6.2	horizontal line drawn from (40, 20) to (300, 20) straight line drawn from the point where line B finishes to 0 m/s finishing on the x-axis at 360 s	 allow a straight line showing time to decelerate as 60s	1 1 1	AO2/2 4.5.6.1.5
6.3	acceleration= $\frac{\text{(change in) velocity}}{\text{time (taken)}}$	allow a = $\frac{(\Delta)v}{t}$	1	AO1/1 4.5.6.1.5 iso
6.4	$1.15 = \frac{\Delta v}{22}$ Δ v = 1.15 × 22 Δ v = 25.3 (m/s)	an answer 25.3 scores **3** marks	1 1 1	AO2/1 4.5.6.1.5
Total			**8**	

4.5.1.4 Resultant forces

Answer 15 · Mark scheme

June 2019 | 8463/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7.1	crate		1	AO1/1 4.5.4
7.2	centre of mass		1	AO1/1 4.5.1.3
7.3	the pointer is vertical	allow unable to see the pointer allow the bar is horizontal	1	AO3/1a 4.5.4
7.4	P		1	AO2/1 4.5.4
7.5	moment (of a force) = force x distance	allow M = F d	1	AO1/1 4.5.4
7.6	 0.15 = W × 0.06 $W = \frac{0.15}{0.06}$ W = 2.5 (N)	an answer 2.5 (N) scores **3** marks	 1 1 1	AO2/1 4.5.4
7.7	weight = mass × gravitational field strength	allow W = m g	1	AO1/1 4.5.1.3
7.8	 2.5 = m × 9.8 m = 2.5 / 9.8 mass rice = 0.215 (kg)	an answer 0.215 or 0.22 (kg) scores **3** marks allow ecf from 07.6 an answer of 0.255 or 0.26 (kg) scores **2** marks	 1 1 1	AO2/1 4.5.1.3
Total			**12**	

4.5.1.4 Resultant forces

Answer 16 · Mark scheme

November 2020 | 8463/2F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	Move the wooden block to the left.		1	AO3 4.5.6.2.2 RPA7
08.2	use a pulley (on the edge of the bench)	allow any feasible method to stop the string from rubbing	1	AO3 4.5.6.2.2 RPA7
08.3	suitable scale points plotted correctly line of best fit	 allow 5 correctly plotted for **2** marks **OR** 3–4 correctly plotted for **1** mark	1 2 1	AO2 4.5.6.2.2 RPA7
08.4	(directly) proportional	allow a correct description of direct proportionality ignore positive correlation allow weight (added to mass holder) for force allow f = ma for **1** mark	1	AO3 4.5.6.2.2 RPA7
08.5	repeat the measurements/investigation ignore anomalies **and** calculate the mean / average		1 1	AO3 4.5.6.2.2 RPA7
08.6	resultant force = mass × acceleration **or** F = m a		1	AO1 4.5.6.2.2 RPA7

4.5.1.4 Resultant forces

Answer 16 · Mark scheme

November 2020 | 8463/2F | Original Q8

08.7	$0.375 = 0.60 \times a$ $a = \frac{0.375}{0.60}$ $a = 0.625$ (m/s^2) $a = 0.63$ (m/s^2)		1 1 1 1	AO2 4.5.6.2.2 RPA7
Total			**14**	

4.5.1.4 Resultant forces

Answer 17 · Mark scheme

November 2021 | 8463/2F | Original Q8

Question 8

Question	Answers	Mark	AO/ Spec. Ref
08.1	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO1 4.5.6.3.3 4.5.6.3.4 4.1.1.2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content Factors • poor condition of tyres • poor road surface • wet or icy road • poor/worn brakes Explanation • because of decreased friction Factors • increased mass of car/passengers Explanation • increases kinetic energy of car • more work needs to be done to stop car • increases momentum of the car Factor • road slopes downhill Explanation • (a component of) gravity opposes the braking force • resultant (braking) force is reduced allow answers in terms of reducing braking distance throughout A single factor with no related explanation is insufficient to score a mark		

4.5.1.4 Resultant forces

Answer 17 · Mark scheme

08.2	resultant force = mass × acceleration		1	AO1 4.5.6.2.2
08.3	7200 = 1600 × *a* $a = \frac{7200}{1600}$ *a* = 4.5 (m/s^2)	ignore negatives throughout	1 1 1	AO2 4.5.6.2.2
08.4	15 (m) 38 (m) = 53 (m)	two correct values identified allow the correct addition of a misread braking distance and /or a misread thinking distance taken from the graph	1 1	AO3 4.5.6.3.1
08.5	$p = \frac{F}{A}$		1	AO1 4.5.5.1.1
08.6	120 000 = $\frac{60}{A}$ $A = \frac{60}{120\,000}$ *A* = 0.0005 *A* = 5 (.0) × 10^{-4} m^2	 allow an answer given to 2 sig figs from an incorrect calculation using the given data	1 1 1 1 1	AO2 AO2 AO2 AO2 AO1 4.5.5.1.1
Total			**16**	

4.5.1.4 Resultant forces

Answer 18 · Mark scheme

June 2022 | 8463/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	gravitational force		1	AO1 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	air resistance		1	AO1 4.5.6.15

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	the resultant force on the hailstones is zero		1	AO1 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	line extrapolated to 80 mm 46 (m/s)	allow a straight line allow 44 – 48 but not if inconsistent with their extrapolated line	1 1	AO3 4.5.6.1.5

4.5.1.4 Resultant forces

Answer 18 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	it has a greater weight		1	AO3 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	0.48 (N)		1	AO2 4.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	upwards	allow up ignore north	1	AO2 4.5.1.4

Total Question 2		**8**

4.5.1.4 Resultant forces

Answer 19 · Mark scheme

June 2023 | 8463/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	kinetic thermal	this order only	1 1	AO1 4.5.6.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(minimum braking) distance increases with increasing speed	allow positive correlation	1	AO2 4.5.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	increases		1	AO1 4.5.6.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	12.5 – 5.0 = 7.5 (m/s) $t = \frac{7.5}{0.25}$ t = 30 (s)	 this mark may be awarded if the change in velocity is incorrectly calculated allow a correctly calculated answer using a change in velocity incorrectly calculated	1 1 1	AO2 4.5.6.1.5

4.5.1.4 Resultant forces

Answer 19 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	*F* = 1600 × 0.25 *F* = 400 (N)		1 1	AO2 4.5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	initial height of the ruler above the person's hand		1	AO3 4.5.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	there will be more variation in distances	allow reaction times for distances allow the three students tested are not typical	1	AO3 4.5.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	carry out the experiment listening to music then not listening to music (and compare the results)	 allow compare with original results	1 1	AO3 4.5.6.3.2

Total Question 2	13

4.5.1.4 Resultant forces

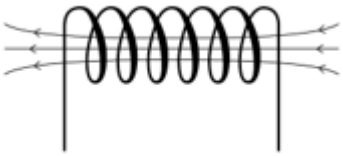
Answer 20 · Mark scheme

June 2023 | 8463/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	direction (of the magnetic field)		1	AO1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	increase the current in the wire		1	AO1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3			1	AO1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	**D A B C**	allow **1** mark for D B A C	2	AO2 4.7.2.1 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	decrease the distance between the electromagnet and the iron arm		1	AO3 4.7.1.2 4.7.2.1

4.5.1.4 Resultant forces

Answer 20 · Mark scheme

June 2023 | 8463/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	period = $\frac{1}{6.25}$ period = 0.16 (s)		1 1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	**B**		1	AO1 4.6.1.1

Total Question 3	9

4.5.1.4 Resultant forces

Answer 21 · Mark scheme

June 2023 | 8463/2F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	7.1 (cm) 497 (m)	allow 7.0 to 7.3 (cm) allow 70 × their measurement of displacement	1 1	AO2 4.5.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	0 (N)		1	AO2 4.5.1.4

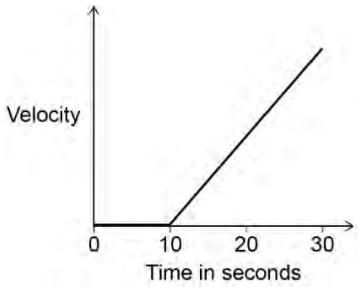
Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	constant velocity	allow constant speed (in a straight line) do **not** accept stationary allow constant acceleration if a **mathematical error** in 02.2 gives a non-zero value for resultant force	1	AO1 4.5.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	any **one** from: • tension • normal contact (force) • upthrust	allow lift, thrust and water resistance allow normal reaction (force) ignore drag	1	AO1 4.5.1.2

4.5.1.4 Resultant forces

Answer 21 · Mark scheme

June 2023 | 8463/2F | Original Q10

Question	Answers		Mark	AO / Spec. Ref.
10.5	horizontal line drawn to 10s along the *x*-axis		1	AO3 4.5.6.1.4
	line with a positive gradient starting from 10 s	allow an upward curving line with increasing gradient starting from 10 s 	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	line of best fit drawn and extrapolated to 10 km	do **not** accept a straight line	1	AO2 4.5.5.2
	28 (kPa)	allow 26 to 32 (kPa) allow a value correctly extrapolated from their line allow 2 marks for a correct mathematically extrapolated value	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.7	the average density of the air above the aeroplane decreases		1	AO3 4.5.5.2

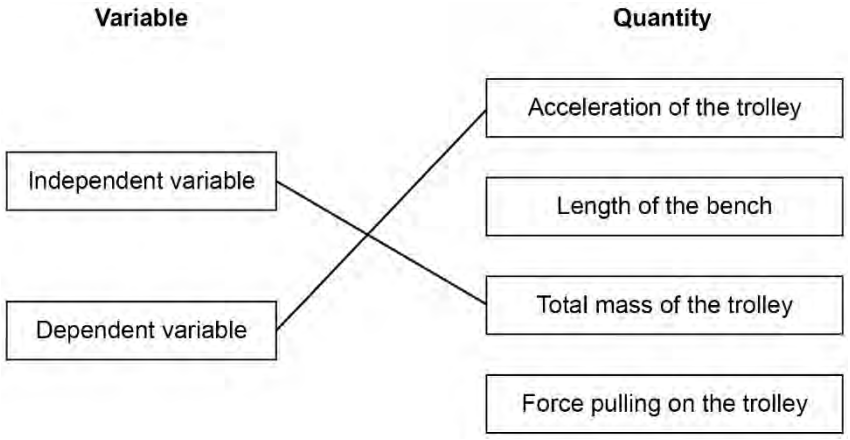
Total Question 10	10

Answer 22 · Mark scheme

June 2024 | 8463/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	friction		1	AO3 4.5.6.2.2 RPA7

Question	Answers	Mark	AO / Spec. Ref.
03.2		1 1	AO1 4.5.6.2.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	$\frac{1.58 + 1.53 + 1.54}{3}$ 1.55 (m/s^2)		1 1	AO2 4.5.6.2.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	the acceleration is inversely proportional to the mass	allow as the mass increases the acceleration decreases allow negative correlation	1	AO3 4.5.6.2.2 RPA 7

4.5.1.4 Resultant forces

Answer 22 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	$F = 1.5 \times 0.62$ $= 0.93$ (N)		1 1	AO2 4.5.6.2.2

Total Question 3	**8**

4.5.1.4 Resultant forces

Answer 23 · Mark scheme

June 2024 | 8463/2F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	0 (N) the child isn't accelerating (vertically) **or** upwards forces are equal to the downwards forces	 MP2 dependent on MP1 allow forces are balanced	1 1	AO2 4.5.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	work done = force × distance **or** $W = F \times s$		1	AO1 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	$35 = F \times 2.8$ $F = \frac{35}{2.8}$ $F = 12.5$ (N)	 allow 13 (N)	1 1 1	AO2 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	the resistive force has decreased so the resultant force increases	allow friction (between the wheels and the floor) has decreased	1 1	AO3 4.5.1.4 4.5.6.2.1 4.5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	moment = force × distance **or** $M = F \times d$		1	AO1 4.5.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	7.5 cm = 0.075 m $M = 2.0 \times 0.075$ $M = 0.15$ (Nm)	 allow a correct substitution of an incorrectly / not converted value of d allow an answer consistent with an incorrectly / not converted value of d	1 1 1	AO2 4.5.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	gear B rotates in the opposite direction (to gear A) **or** gear B rotates clockwise **or** gear B rotates faster than gear A (because) gear A exerts a force on gear B **or** (because) gear A causes a moment about the pivot of gear B		1 1	AO2 4.5.4

Total Question 9	14

4.5.1.4 Resultant forces

Answer 24 · Mark scheme

June 2025 | 8463/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	car **X** has a smaller maximum acceleration		1	AO3 4.5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	$F = 900 \times 2.5$ 2250 (N)	 allow 2300 (N)	1 1	AO2 4.5.6.2.2

Question	Answers	Mark	AO / Spec. Ref.
04.3	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO3
	No relevant content	0	4.5.1.4 4.5.6.1.5 4.5.6.2.1 4.5.6.2.2
	Indicative content • driving force increases • driving force has a maximum value • driving force is greater than air resistance • there is a resultant forward force • air resistance increases (as speed increases) • resultant force decreases • air resistance becomes equal to the driving force (at maximum speed) • resultant force is zero For **Level 2** answers must include how both driving force and air resistance change.		

4.5.1.4 Resultant forces

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	time		1	AO1 4.5.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	force		1	AO1 4.5.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	(thinking distance =) 20 **and** (braking distance =) 60	subsequent marks may be awarded if incorrect reading(s) are taken from the graph	1	AO2 4.5.6.3.1
	stopping distance = 20 + 60		1	
	80 (m)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	the driver becoming tired		1	AO1 4.5.6.3.2
	driving on a wet road		1	4.5.6.3.3

Total Question 4	**14**

4.5.1.4 Resultant forces

Answer 25 · Mark scheme

June 2025 | 8463/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	the turning effect of the force		1	AO1 4.5.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	the resultant moment is clockwise		1	AO3 4.5.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	the tag should be positioned left of the pivot the tag should be on position 7		1 1	AO3 4.5.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	moment (of a force) = force × distance **or** $M = F\ d$		1	AO1 4.5.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	$1.8 = 0.15 \times d$ $d = \frac{1.8}{0.15}$ $d = 12$ (cm)		1 1 1	AO2 4.5.4

Total Question 7	**8**

4.5.1.4 Resultant forces

GCSE
PHYSICS

PH3FP
Mark scheme

4403
June 2014

Version: 1.0 Final

4.5.1.4 Resultant forces

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from aqa.org.uk

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

PMT

Quality of Written Communication and levels marking

In Question 9(a) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

4.5.1.4 Resultant forces

Question	Answers	Extra information	Mark	AO spec ref
1(a)	transmits absorbs	correct order	1 1	AO1 3.1.1b
1(b)	light	allow ultra violet **or** UV **or** infrared **or** IR **or** gamma	1	AO1 3.1.1b
1(c)	20	allow **1** mark for correct working, ie $\frac{60}{3}$ provided no subsequent step	2	AO2 3.1.1b
1(d)	Killing cancer cells		1	AO1 3.1.1b
Total			**6**	

4.5.1.4 Resultant forces

Question	Answers	Extra information	Mark	AO spec ref
2(a)	3000	allow **1** mark for correct substitution, ie 600 × 5 provided no subsequent step	2	AO2 3.2.2b
2(b)	anticlockwise moment	must be both words	1	AO1 3.2.2c
2(c)(i)	3400	allow 3.4 kilo (newtons)	1	AO2 3.2.2c
2(c)(ii)	as the distance (of the girl from point A) increases, force F increases	allow gets bigger for increases force is (directly) proportional to distance will negate any correct response	1	AO3 4.5.3
Total			**5**	

Question	Answers	Extra information	Mark	AO spec ref
3(a)	<table><tr><th></th><th>Digital Camera</th><th>Eye</th></tr><tr><td>Cornea</td><td></td><td>✓</td></tr><tr><td>Lens</td><td>✓</td><td>✓</td></tr><tr><td>Pupil</td><td></td><td>✓</td></tr><tr><td>CCD</td><td>✓</td><td></td></tr></table>	ignore shaded row each correct row = **1** mark	3	AO1 3.1.4a, d
3(b)	long		1	AO1 3.1.4b
3(c)	lens A it is a concave / diverging lens	 this mark is only gained if lens A is stated any reference to lens material or mass of lens negates this mark allow it will focus light onto the retina	1 1	AO1 3.1, 3.1.4b
3(d)	The refractive index of the lens material		1	AO1 3.1.4f
3(e)	4	ignore any signs allow **1** mark for correct substitution, ie $\frac{1}{0.25}$ provided no subsequent step	2	AO2 3.1.4e

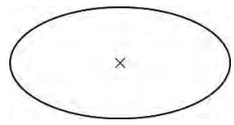
Question 3 continues on the next page . . .

Question 3 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
3(f)	Cauterising open blood vessels		1	AO1 3.1.5f
3(g)	5	allow **1** mark for correct substitution, ie $\frac{70}{14}$ provided no subsequent step	2	AO2 3.1.3i
Total			**12**	

4.5.1.4 Resultant forces

MARK SCHEME – GCSE Physics – PH3FP – June 2014

Question	Answers	Extra information	Mark	AO spec ref
4(a)	concentrated		1	AO1 3.2.1a
4(b)		judge by eye	1	AO2 3.2.1c
4(c)	C A D	3 correct = **2** marks 1 or 2 correct = **1** mark	2	AO1 3.2.1a
4(d)	Lower the athlete's seating position Move the wheels further apart		1 1	AO2 3.2
Total			**6**	

4.5.1.4 Resultant forces

Question	Answers	Extra information	Mark	AO spec ref
5(a)	hydraulic		1	AO1 3.2.3
5(b)	9	allow **1** mark for a correct substitution, ie $\frac{1800}{200}$ provided no subsequent step	2	AO2 3.2.3c
5(c)	an environmental		1	AO3 SALoSE
Total			**4**	

4.5.1.4 Resultant forces

Question	Answers	Extra information	Mark	AO spec ref
6(a)(i)	increase		1	AO3 3.3.1a, 4.5.4
6(a)(ii)	A and B and B and C	both required for the mark either order	1	AO3 3.3.1a, 4.5.4
6(a)(iii)	any **two** from: • size of nail **or** nail material • current • (size of) paper clip • length of wire	 allow (same) nail allow (same) cell allow p.d. same amount of electricity is insufficient accept type/thickness of wire	2	AO3 4.1b
6(b)	4 B picks up the same number as C, so this electromagnet would pick up the same number as A **or** direction of current does not affect the strength of the electromagnet	 allow it has got the same number of turns as A	1 1	AO3 3.3.1a, 4.5.4
6(c)	2	allow 1 or 3	1	AO3 3.3.1a, 4.5.4
Total			**7**	

Question	Answers	Extra information	Mark	AO spec ref
7(a)	(sound waves) which have a frequency higher than the upper limit of hearing for humans **or** a (sound) wave (of frequency) above 20 000 Hz	sound waves that cannot be heard is insufficient a wave of frequency 20 000 Hz is insufficient	1	AO1 3.1.2a
7(b)	640	an answer of 1280 gains **2** marks allow **2** marks for the correct substitution ie 1600 × 0.40 provided no subsequent step allow **2** marks for the substitution $\frac{1600 \times 0.80}{2}$ provided no subsequent step allow **1** mark for the substitution 1600 × 0.80 provided no subsequent step allow **1** mark for the identification that time (boat to bed) is 0.4	3	AO2 3.1.2c
7(c)	any **one** from: • pre-natal scanning / imaging • imaging of a named organ (that is not surrounded by bone), eg stomach, bladder, testicles • Doppler scanning blood flow	accept heart do **not** allow brain **or** lungs (either of these negates a correct answer)	1	AO1 3.1.2d

Question 7 continues on the next page . . .

Question 7 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
7(d)	advantage any **one** from: • (images are) high quality or detailed or high resolution • (scan) produces a slice through the body • image can be viewed from any direction • an image can be made of <u>any</u> part (inside the body) • easier to diagnose **or** see a problem (on the image) disadvantage any **one** from: • (the X-rays used **or** scans) are <u>ionising</u> • mutate cells **or** cause mutations **or** increase chances of mutations • turn cells cancerous **or** produce abnormal growths **or** produce rapidly growing cells • kill cells • shielding is needed	clearer / better image is sufficient allow images are (always) 3D / 360° allow whole body can be scanned allow a description of what ionising is allow for cells: DNA / genes / chromosomes / nucleus / tissue damage cells is insufficient can be dangerous (to human health) unqualified, is insufficient	1 1	AO1 3.1
Total			**7**	

4.5.1.4 Resultant forces

Question	Answers	Extra information	Mark	AO spec ref
8(a)	gravitational attraction (between the satellite and the Earth)	allow gravity allow weight of the satellite	1	AO1 3.2.4b
8(b)	any **two** from: • mass of satellite • speed / velocity (of satellite) • radius of orbit / circle	allow height above the Earth radius / height alone is insufficient	2	AO1 3.2.4c
8(c)(i)	increasing the height (above the Earth's surface) increases the time (for one orbit)	allow a positive correlation allow as one gets bigger, the other gets bigger, or vice versa ignore they are directly proportional	1	AO3 4.5.3
8(c)(ii)	there is no relationship / correlation		1	AO3 4.5.3
8(d)	Isaac Newton was a respected scientist who had made new discoveries before		1	AO3 3.2.4, SALoSE
Total			**6**	

Question	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		Mark	AO spec ref
9(a)			6	
0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**	AO1 3.3.2
No relevant / correct content.	**Either** there is an attempt at a description of the construction of a transformer **or** a correct statement of the effect of one type of transformer on the input p.d.	There is a description of the construction of a transformer **and** a correct statement of the effect of one type of transformer on the input p.d.	There is a clear description of the construction of a transformer **and** there is a correct description of how transformers affect the input p.d.	

details of construction:	extra information
a (laminated) core	
core is made from a magnetic material / iron	
2 coils	
the coils are made from an electrical conductor / copper	
the coils are covered in plastic / insulation	
the coils are (usually) on opposite sides	
step-up transformer has more turns on secondary coil than (its) primary (or vice versa)	
step-down transformer has less turns on secondary coil than (its) primary (or vice versa)	
effect on input p.d. :	
step-up transformer, the output p.d. is greater (than the input p.d.)	accept voltage for p.d.
step-down transformer, the output p.d. is lower (than the input p.d.)	

Question 9 continues on the next page . . .

Question 9 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
9(b)	switch mode (transformer)		1	AO1 3.3.2j
Total			7	

4.5.1.4 Resultant forces

Answer 13 · Examiner comments

June 2018 | 8463/2F | Original Q6

Question 6 (Low and Standard demand)

06.1 This was well known with 95% of the students scoring the mark.

06.2 Most of the students showed a substitution before calculating the final correct answer.

06.3 Answers were split almost equally between the three options.

06.4 44% of the students were able to write down this equation correctly. Most of the students that gave a wrong equation simply wrote the three quantities out in the order they were given – 'acceleration = mass x resultant force' was a common wrong answer.

06.5 43% of the students were able to calculate the correct answer to this question.

Answer 14 · Examiner comments

June 2019 | 8463/2F | Original Q6

Question 6 (Low and standard demand)

06.1 Many of the students did not make the link between zero resultant force and constant velocity and so did not choose answer B.

06.2 This was well done with nearly half of the students scoring all three marks. Common errors were to have section B less than 260 s and / or the time for deceleration in part C to be 50 s.

06.3 67% of students correctly recalled the equation.

06.4 Virtually all of the students that scored a mark in part **06.3** went on to score both marks for the calculation.

4.5.1.4 Resultant forces

Answer 15 · Examiner comments — June 2019 | 8463/2F | Original Q7

Question 7 (Low and standard demand)

07.1 Just over 80% of the students correctly identified the crate as the object not likely to rotate.

07.2 About 48% of the students scored this mark.

07.3 Answers to this question were poorly expressed, with few students writing that the pointer is behind the hanging arm. The most popular answer to gain credit was the idea that each side of the device was level. The word 'horizontal' was rarely seen.

07.4 Only 46% of the students scored this mark.

07.5 Just under a half of the students could recall this equation.

07.6 57% of the students could manipulate the figures and arrive at the correct answer.

07.7 36% of the students could give the equation correctly.

07.8 95% of students either scored zero or did not attempt the question.

Answer 18 · Examiner comments — June 2022 | 8463/2F | Original Q2

Question 2 (Low demand)

02.1 Almost all of the students correctly identified 'gravitational force'.

02.2 About 70% of the students realised that 'air resistance' increased as the hailstones accelerated.

02.3 About 60% of the students gave the correct answer. The incorrect answers were equally split between the two distractors.

02.4 About half of the students made an attempt at extrapolating the line with a subsequent correct value read from the graph. Incorrect answers usually involved students trying to work out a mathematical pattern or simply writing a number down.

02.5 Approximately three quarters of the students realised that it was due to a greater weight.

Answer 18 · Examiner comments — June 2022 | 8463/2F | Original Q2

02.6 Just over half of the students knew how to correctly calculate the resultant force.

02.7 Surprisingly, since the largest force arrow is shown pointing upwards, just under half of the students gave the correct answer of 'up'.

4.5.1.4 Resultant forces

Answer 19 · Examiner comments June 2023 | 8463/2F | Original Q2

02.1

22 % of students scored 1 mark and 61 % of students scored both marks for identifying the energies

02.2

The majority of the students identified the correct relationship between the speed and the braking distance. Those that didn't described the graph rather than mentioning braking distance or speed, or used incorrect phrases eg 'directly proportional'.

02.3

84% of students knew that braking distance increases when a road becomes icy.

02.4

This 3-mark question required students to calculate the change in velocity then use this correctly to determine the time taken. Many students failed to show how they calculated the change in velocity and could not be awarded any marks.

Answer 19 · Examiner comments June 2023 | 8463/2F | Original Q2

02.5

86 % scored 2 marks for calculating the resultant force. Common mistakes involved dividing instead of multiplying, or calculating 1600 x 0.25^2, the squared apparently being inferred from the unit of deceleration (m/s^2).

02.6

77% of students were able to identify the control variable for the investigation.

02.7

Many students correctly stated that there would be a greater number of results, which could lead to a change in the mean. But some simply stated that different people have different reaction times. Credit was also given for those that stated the reaction times of 3 children tested may not be representative of the whole class. However, some only answered by saying 'only 3 children were tested' which was insufficient to get the mark.

02.8

30 % scored 1 mark and only 33 % scored 2 marks. Rather than describing a change to the experiment students would state how they thought music would affect the reaction time, or why music would affect the reaction time.
Many who got 1 mark suggested they did the experiment with music on but did not say to compare with previous results or do it with music off.

4.5.1.4 Resultant forces

Answer 20 · Examiner comments June 2023 | 8463/2F | Original Q3

03.1

Many students confused the arrows with the direction of current.

03.2

Almost 88% of students knew that increasing the current in the wire would increase the strength of the magnetic field.

03.3

62% identified the correct magnetic field pattern for a solenoid.

03.4

Most students identified the correct sequence, or got a mark for identifying the first and last letters correctly.

03.6

Most students calculated the period correctly.

03.7

75% of students recognised an area of compression in a longitudinal wave.

Answer 21 · Examiner comments June 2023 | 8463/2F | Original Q10

10.1

Only 9% of students calculated the displacement correctly. Those who did not gain the mark simply measured the route taken by the aircraft and scaled that distance up. A small minority didn't attempt the question.

10.2

27% of students gained the mark for the resultant force. Some missed out a force, others did not know how to combine the forces.

10.3

6% of students, who calculated the resultant force correctly, also scored this mark. Very few correctly described the motion using simplistic descriptions like moving forwards or moving slowly, rather than describing the motion in terms of velocity speed and acceleration. It was common to see the aircraft was "stationary", even though the question says it is moving.

10.4

Some students confused energy and force. It was common to see non-contact forces given. 20% of students could name an additional contact force.

4.5.1.4 Resultant forces

Answer 21 · Examiner comments

June 2023 | 8463/2F | Original Q10

10.5

6% of students scored 1 mark, usually for drawing an upward line/curve from 10s. Only 23 % of students scored 2 marks.

10.6

A minority of students attempted to draw a smooth curve and extrapolate this to the 10km line. Those who did generally obtained full marks by using the graph correctly, with 12% of students scoring both marks. A number of students miscalculated the scale on the graph and quoted incorrect values from their line. It was more common to see a straight line, which often allowed the award of 1 mark for a correct reading of the value.

10.7

50% of students knew that as the height of the aeroplane above the ground increased, the average density of the air decreased.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.5.1.4 Resultant forces

Answer 22 · Examiner comments June 2024 | 8463/2F | Original Q3

03.1
27% of students answered this question about force correctly.

03.2
Those scoring marks tended to get the dependent variable correct, as opposed to getting the independent variable. Only 23% gained both marks. A significant minority could not identify either correctly or drew more than one line from each box to different answers.

03.3
86% scored both marks for calculating the mean acceleration. The clarity of writing numbers was an issue with some responses, where a '1' could be confused for a '2', or a '5' for a '6' or '3'. Taking more care in writing answers would benefit some students.

03.4
Most of the students identified the correct relationship between the two factors. Those that did not score this mark said the factors were 'directly proportional', or that as one decreased the other decreased.

03.5
90% scored full marks for this calculation of resultant force. A common error was to multiply 1.5 by 0.62^2, the squared value incorrectly being moved from the unit to the number.

Answer 23 · Examiner comments June 2024 | 8463/2F | Original Q9

09.1
42% of students correctly gave the resultant vertical force on the child as 0N, but then failed to score the second mark point, as they stated that the child is not moving or there is no force acting. Only 3% understood the concept that a stationary object has forces acting on it, but those forces are balanced.

09.2
93% of students managed to write down the correct equation for the moment of a force.

09.3
A well answered calculation of force, with 74% of students gaining all 3 marks. Some students tried to convert the units.

09.4
Only 0.5% of students scored 2 marks for explaining why the speed of the baby walker increased as the baby moved onto the hard floor, and 52% scored 1 mark. Most students understood that the friction was less on the hard floor but did not go on to describe what happens to the resultant force.

09.5
93% of students chose the correct equation for the moment of a force.

09.6

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4.5.1.4 Resultant forces

Answer 23 · Examiner comments June 2024 | 8463/2F | Original Q9

This calculation of the moment of the force was well answered with 14% of students scoring all 3 marks. About 72% forgot to convert the cm to m, or made a mistake converting, and scored 2 marks.

09.7
This question related to interaction of two gears. Of those that scored marks, most got the first mark point for stating the gears moved in opposite directions, with the minority discussing the different speeds. Very few achieved the second mark point. For those who did, it was for stating gear A exerts a force on gear B. A few attempted to explain it as gear A causing a moment about the pivot of gear B but some mentioned momentum instead of moment, thereby causing confusion in the response.

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4.5.1.4 Resultant forces

Mark Ranges and Award of Grades

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4.5.1.4 Resultant forces

Questions matter

GCSE
Physics
8463/2F

Report on the examination

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4.5.1.4 Resultant forces

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Report on the examination – GCSE - Physics – 8463/2H – June 2025

General comments

Students should pay attention to the number of options that need to be ticked when doing multiple choice questions. They should make sure they cross out wrong options when they change their minds, as marks cannot be awarded where there are multiple ticks instead of one.

Many students demonstrated good maths skills, although there are always issues with rearrangements. Formula triangles are not always helpful. Students who had correctly written down an equation in a previous question and then tried to use a formula triangle often scored no marks, because they don't understand how to use them. If they had substituted into the equation from the equations sheet they would have scored the 1st mark.

Students had access to the equations sheet for this examination series. A minority of the students however did not use them to find the appropriate equation.

Levels of demand

Questions are set at two levels of demand on this paper:

- Low demand questions are targeted at students working at grades 1–3.
- Standard demand questions are targeted at students working at grades 4–5.

A student's final grade, however, is based on their attainment across the qualification, not just on questions that may have been targeted at the level at which they are working.

01.1

Over 90 % of the students knew that a protractor is used to measure angles. The phonetic spelling of protractor was allowed.

01.2

Almost 70% of the students scored all four marks for completing the graph. Despite a clear instruction a significant number did not label the y-axis. A number of the students did not use a ruler to draw the line of best fit.

01.3

Most of the students correctly identified the relationship between the angle of incidence and the angle of reflection.

01.4

Half of the students knew which measurement was the amplitude of a wave. Most of the others thought the vertical distance between a peak and a trough was the amplitude.

01.5

About 80 % of the students knew which line showed the wavelength of the wave. The most common incorrect answer was the distance showing half the wavelength.

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01.6

Over 90 % of the students correctly calculated the wavelength. Those who did not achieve full marks mainly did so by not choosing the correct unit for wavelength, with Pa being a popular incorrect choice.

01.7

This was well answered, with most of the students scoring both marks. A few inverted the equation and thus calculated the period incorrectly.

02.1

Most of the students correctly calculated the weight of coal.

02.2

Just over 90% of the students were able to use the work done equation correctly. Those that did not get full marks tended to put an additional step into the calculation by dividing the answer 68 000 000 by 4; the number of engines in total.
Occasionally a student would attempt to convert the number calculated into standard form. Whilst not being penalised, this was not required.

02.3

Well answered by most students. As with part 02.2, occasionally a student would attempt to convert the number calculated into standard form.

02.4

Nearly 90% of the students could identify that friction was a contact force.

02.5

Most of the students identified the correct distance-time graph for constant speed.

02.6

This was the 1st calculation that was more challenging for many students. A common error was to use only one of the quoted velocities to calculate the acceleration rather than using the difference between the velocities. However just over 80 % did score full marks, with 10 % scoring zero or not attempting the question.

03.1

Approximately 60% of the students scored both marks. Often students did not know the correct word for a natural satellite. However, many correctly identified ‘star’ for the second word.

03.2

Most of the students knew that we are part of the Milky Way galaxy.

03.3

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Only about 40 % of the students knew that the Sun will eventually become a black dwarf. The most popular wrong answer was that it would become a black hole.

03.4

Just fewer than 40 % of the students knew that a very distant galaxy moves faster than a nearer galaxy.

03.5

About 70 % of the students knew that an increase in the wavelength of light from a distant galaxy is called red-shift.

03.6

About 60 % of the students selected the correct word to describe the beginning of the universe.

03.7

Almost 80 % of the students knew that the universe is expanding.

04.1

Just over 70 % of the students were able to make the connection between the mass of a vehicle and how it would affect the maximum acceleration.

04.2

Over 90 % of the students scored full marks for calculating the resultant force using F = ma. However, some of the students thought that the value of acceleration needed to be squared and then multiplied by mass.

04.3

This level of response question proved too challenging for many. Only just over 1 % of the students scored full marks. Most identified that the driving force would increase, but fewer recognised that as this happened the air resistance would also increase, with many stating that the air resistance would decrease as the cars speed increased.

04.4

Most of the students knew that the thinking distance is affected by the driver's reaction time.

04.5

Just fewer than 70 % of the students were aware that the braking distance is the distance travelled under the braking force.

04.6

Only just over 20 % of the students scored full marks for using the graph of distance against speed to find the stopping distance. The correct distances were often identified from the graph. However, these were then either subtracted from each other, divided or multiplied rather than added.

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04.7

Nearly 80 % of the students identified factors that would increase the stopping distance of a car. Despite two being emboldened twice in the question, some students only ticked one box.

05.1

The principal focus was correctly identified by just over 60 % of the students.

05.2

About 80 % of the students knew that the change in direction of light as it enters a lens is called refraction.

05.3

Nearly 70 % the students recognised the shape of a convex lens.

05.4

Under a half of the students managed to correctly measure the object height and image height. This may have been due to a lack of skill or a lack of equipment.

05.5

This was much more successfully answered than part 05.4 with nearly 90 % of the students scoring both marks. These students used their values from part 05.4 to calculate magnification.

05.6

Just fewer than 50 % of the students knew that magnification is a ratio, but almost the same number thought it is a power.

05.7

This was a challenging question. Most of the students that did score a mark were awarded only the first mark point. This was for explaining that white light is transmitted through colourless glass. A lot of the students think of white light as an entity in itself rather than the result of the colours of the visible light combined. Few used the word transmitted but rather described it as passing through or goes through.
For the 2nd and 3rd mark points many of the students decided that white light was reflected or refracted, reinforcing the misconception that white light is a single entity rather than being made up of a combination of wavelengths. The idea that filters would absorb different wavelengths of light seemed to be difficult for the students to express, with very few achieving the third mark.

06.1

Only just over 30 % of the students could identify two magnetic materials from the list, with about 60 % being able to identify one. Again, a number of students ticked just one box or more than two boxes.

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06.2
Just over 70 % of the students correctly named the iron nails as induced magnets.

06.3
Just fewer than 40 % of the students knew the direction of the magnetic field.

06.4
Nearly 80 % of the students recognised the shape of the magnetic field around a current carrying wire.

06.5
Very few of the students could give two changes that would increase the magnetic field strength. 'Increasing the current' was a common correct response. Many of the students answered 'increasing the number of coils' as such they were implying the wire was already coiled and not answering the question asked, which was about the straight wire shown in Figure 10.

07.1
Nearly 60 % of the students understood what is meant by the moment of a force. The most common incorrect option was 'The direction of the force.'

07.2
The correct resultant moment was selected by just over 80 % of the students.

07.3
Students generally answered this well, identifying position 7 and on which side of the balance the tag should be placed. Some indicated this on the diagram which was an accepted alternative response, provided what was written did not contradict it.

07.4
Some students wrote the equation for the moment of a force in words and then in symbols. This risks not gaining the mark if either is incorrect. Also, correct use of symbols should be stressed, especially when they are given in the question. It was surprising that some of the students scored zero or did not attempt to write down an equation despite having the equations sheet.

07.5
Almost three quarters of the students were able to rearrange the equation and then calculate the distance between the pivot and the tag on the balance.

08.1
Most of the students found this level of response question difficult to answer. Only just over 1 % gave a level 2 answer. Many of the students scored 2, 1 or 0 marks. Of those that scored a mark the most common response was light travels faster than sound. Many also tried to describe light and sound as transverse and longitudinal waves, with the majority getting this

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confused. Very few identified acceptable similarities. Common answers that did not gain credit included light travels at the speed of light, sound travels at the speed of sound, light can be seen and sound cannot be seen.

08.2

Just fewer than 80 % of the students choose the correct equation for calculating speed.

08.3

This question required students to rearrange the equation. About three quarters of the students scored all three marks.

09.1

About 65 % of the students correctly stated the independent variable in this investigation.

09.2

Just over 40 % of the students scored both marks for identifying a risk of harm and a suitable safety precaution to reduce the risk. Too few students connected a hazard, such as a falling weight, becoming a risk of harm when it hit or hurt the student.

09.3

Students were expected to clearly describe two improvements to the arrangement shown that would improve the accuracy of the results. Many had difficulty describing their ideas clearly and answers were often too vague to gain credit.

09.4

Almost 40 % of the students scored this mark usually by explaining that the spring length was not 0 cm rather than describing the relationship between spring length and force.

09.5

This was not successfully answered, with only about 2 % of the students scoring both marks and a further 13 % scoring one mark. The 1st mark point was for stating or giving a clear description of inelastic deformation. Of those who were awarded marks most of them described how the spring had reached or passed its limit of proportionality.

09.6

Over 90 % of the students selected the correct equation.

09.7

Nearly 80 % of the students scored all three marks. Those that did not often rearranged the equation incorrectly.

10.1

Only about 5% of the students correctly calculated the uncertainty correctly from either the range or the mean.

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10.2

Just over 40 % of the students identified that a random error had caused the variation in this investigation. A greater proportion of the students thought there was a systematic error but this would not have accounted for the variation in the results.

10.3

This mark was awarded for a clear description of variation in the way the ball was dropped. For example, through different heights, at different speeds, or a different delay each time. Common answers giving reaction time or human error were too vague, to be awarded marks unless qualified.

10.4

Just fewer than 30 % of the students scored all three marks. Many of the students took only one value from the graph rather than a corresponding pair of values and so scored 0. Those that used a pair of correct values often then used them the wrong way round when calculating the gradient.

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