AQA Style

GCSE

COMBINED SCIENCE: TRILOGY

H

Higher Tier Physics Paper 2

Mark Scheme

Question	Answers	Extra Information	Mark
01.1	the force/mass (applied to the spring)	Accept weight.	1
01.2	Any **one** from: • use the same spring throughout the investigation • measure the same part of the spring each time i.e. including or excluding loop • unload the spring and check it has not reached its elastic limit each time • make sure the spring is stationary for each measurement • read the measurement at the same angle each time • make sure the masses each weigh the same/equal amounts/100g		1
01.3	10.1 (cm)	An answer of 10.13... scores **1** mark. Accept answer written in the table instead of on the answer line.	2
01.4	the student measured the total length of the spring instead of the extension	Accept student did not calculate/ work out extension.	1
01.5	directly proportional		1
01.6	force = spring constant × extension	Allow any correct rearrangement. Allow F = k e	1
01.7	2 = spring constant × 0.04 (spring constant =) $\frac{2}{0.04}$ 50 (N/m)	Values correctly substituted into equation. Correct transformation. An answer of 50 (N/m) with no working shown scores **3** marks. Award **2** marks for $\frac{2}{0.04}$ without the first step.	1 1 1
Total			10

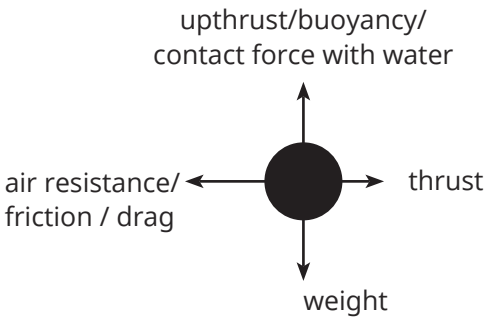
Question	Answers	Extra Information	Mark
02.1	**Level 2:** There is a description of the motion of the car in at least two sections of the graph. For four marks, there must be data from the graph included in the answer.		3-4
	Level 1: There are simple statements that describe the motion of the car. Two marks can be given for two valid statements.		1-2
	No relevant content.		0
	Indicative content **Between A and B:** • the car moves at a constant speed • for 30s/280m/at 9.3m/s (280/30) • away from its starting position **Between B and C:** • the car is stationary • (so) the car's speed is 0 m/s/for 30s **Between C and D:** • the car is moving at a constant speed • for 30s/260m/at 8.7m/s (260/30) • away from its starting position **Between D and E:** • the car moves at a constant speed • for 60s/540m/at 9m/s (540/60) • towards its starting position		
02.2	the distance the car travels during the time the braking force acts/braking distance		1

Question	Answers	Extra Information	Mark
02.3	Any **two** from: • tiredness • drugs • alcohol • named distractions i.e. use of mobile phone • speed of the car		2
02.4	acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$		1
02.5	(deceleration =) $\frac{17}{3.4}$ = 5 (m/s^2)	An answer of 5 (m/s^2) with no working shown scores **2** marks.	1 1
02.6	the temperature increases	Accept they get warm/hot.	1
Total			11

Question	Answers	Extra Information	Mark
03.1	**Level 3:** There is a clear description of how the electromagnet is made **and** the number of coils is varied **and** the paperclips are counted. Steps are logically ordered and could be followed to obtain valid results. For six marks at least one additional detail is included, e.g. control variables or processing data.		5-6
	Level 2: There is a clear description of how the electromagnet is made **and** the number of coils is varied **or** the paperclips are counted. For four marks at least one additional detail is included, e.g. control variables or processing data.		3-4
	Level 1: There are simple statements that describe how to make or use the electromagnet. Two marks can be given for two valid statements.		1-2
	No relevant content.		0
	Indicative content **Making the electromagnet:** • The wire is wrapped around the iron core/nail. • The wire is connected to the power supply/battery. • The power supply is switched on/current flows through the wire. **Using the electromagnet:** • The electromagnet is used to pick up paperclips. • The number of paperclips that the electromagnet holds is counted **or** the distance between the electromagnet and the paperclip when it is attracted is measured using a ruler. • The number of turns/coils/times the wire is wrapped around the nail is changed. • At least three different values for the number of turns on the coil are given, e.g. 5 coils, 10 coils, 15 coils. **Additional details:** • Measurements are repeated for each number of coils. • Control variables are mentioned, e.g. same size current, potential difference, same nail, identical paper clips, same length/resistance of wire. • The data is processed. A mean could be calculated or a graph of number of coils against number of paperclips drawn.		

Question	Answers	Extra Information	Mark
03.2	motor effect		1
03.3	up/upwards	Accept clockwise.	1
03.4	reverse the current reverse the magnets		1 1
03.5	Any **two** from: • increase the current • use stronger magnets • move the magnets closer together • increase the number of coils • use an iron core	Do **not** accept bigger magnets.	2
Total			12

Question	Answers	Extra Information	Mark
04.1	measure the time taken from seeing the rock hit the water to hearing the sound		1
	speed= $\frac{\text{distance travelled}}{\text{time}}$	Allow a description of the calculation in words. Allow 5m for distance travelled.	1
04.2	the oscillations/vibrations of longitudinal waves are parallel to the direction of energy transfer	Allow direction of travel for energy transfer.	1
	the oscillations/vibrations of transverse waves are perpendicular to the direction of energy transfer	Allow direction of travel. If no other mark is awarded, allow **1** mark for oscillations/ vibrations of longitudinal waves are parallel **and** oscillations/ vibrations of transverse waves are perpendicular.	1
04.3	yes/correct conclusion		1
	(because) the lily pad was not carried away from the direction of impact		1
	(so) the water was not moving away from the impact site		1
04.4	light travels at a <u>lower</u> speed/velocity in water	The speed/velocity changes is insufficient for the mark.	1
	so the edge of the wave (front) slows down as it enters the water	Allow wavelength decreases.	1
	but the part of the wave (front) in the air continues at the same/higher speed/ velocity/does not slow down		1
Total			10

Question	Answers	Extra Information	Mark
05.1	air resistance/drag/friction/resistive forces act in the opposite direction to thrust		1
	the resistive forces are 15000N/equal thrust		1
	upthrust acts in the opposite direction to weight	Allow buoyancy or contact force with the water.	1
	upthrust is 24000N/equal to weight		1
05.2	weight and upthrust arrows are drawn equal in size and opposite in direction		1
	the resistive forces arrow is larger than the thrust arrow	Allow absence of thrust arrow.	1
	arrows are correctly labelled  		1
05.3	correct parallelogram drawn		1
	value of resultant force in the range 192 000N to 196 000N		1
Total			9

Question	Answers	Extra Information	Mark
06.1	ultraviolet	Allow UV.	1
06.2	microwaves		1
06.3	radio waves gamma rays	Answers in this order only.	1 1
06.4	x-rays are absorbed by bones or teeth but pass through soft tissues or gaps in bones low-energy x-rays will not destroy/ damage cells		1 1 1
06.5	$\frac{300\,000\,000}{20}$ = 15 000 000 Hz	15 000 000Hz with no working shown scores **3** marks. 15 000 000 without correct units scores **2** marks. Accept conversion to 15 000kHz or 15MHz if correct units are given.	1 1 1
06.6	Any **two** from: • electrons (in the aerial) vibrate • inducing an alternating current (in the aerial) • which causes oscillations in the receiver • with the same frequency as the radio wave		2
Total			12

Question	Answers	Extra Information	Mark
07.1	total momentum before (firing the cannon) is equal to total momentum after (firing the cannon)	Accept the momentum of the cannon and the cannonball is conserved.	1
	before the cannon is fired, the momentum of the cannon and the cannonball is zero	Accept total momentum before = 0.	1
	when the cannon is fired, the cannonball has forward momentum so the cannon must have (equal) momentum backwards/in the opposite direction		1
07.2	$10 \times 67.5 = 1500 \times v$	An answer of (-)0.45 with no working shown scores **3** marks.	1
	$v = \frac{675}{1500}$ or $\frac{67.5 \times 10}{1500}$		1
	0.45 (m/s)		1
Total			6