OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL A-LEVEL PHYSICS

(9630)

PAPER 1
Mark scheme

Specimen 2018

V1.1

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.

Question	Marking guidance	Mark	Comments
01.1	1000 (N) **and** 6000 (N) seen **OR** $F = \sqrt{(1000)^2 + (6000)^2}$ ✓ allow incorrect values seen = 6083 (N) (= 6100) ✓ More than 2 sf seen	2	Independent marks Allow full credit for appropriate scale drawing Ignore rounding errors in 3rd sig fig.
01.2	tanΘ = 1000 / 6000 or correct use of sin or cos ✓ Θ = 9.5 (9.46°) ✓	2	 Allow range 9.4 − 10.4 Use of cos yields 10.4 Allow use of 6100 Some working required for 2 marks Max 1 mark for correct calculation of vertical angle (range 79.6 − 80.6) some working must be seen

Question	Marking guidance	Mark	Comments
02.1	Use of power = *Fv* : 35000 = F1500/28 ✓ 653(650) (N) ✓	2	Condone error in power of 10 in substitution
02.2	Streamline the structure of the car/design a new engine with greater power output ✓	1	

Question	Marking guidance	Mark	Comments
03.1	(electron) antineutrino ✓	1	
03.2	They annihilate ✓ Emitting two gamma photons ✓	2	

Question	Marking guidance	Mark	Comments
04	(proton) down 2/–2 ✓ (nucleon) down 4/–4 ✓	2	

Question	Marking guidance	Mark	Comments
05.1	gamma greater ✓	1	Must express comparison, don't allow simple list
05.2	use of inverse-square law ✓ 1/9 or 0.11 ✓	2	

Question	Marking guidance	Mark	Comments
06.1	$v = \sqrt{(2 \times g \times s)} = \sqrt{(2 \times 9.8 \times 1.27)}$ ✓ $= 4.99\ (m\ s^{-1})$ ✓	2	
06.2	Idea that GPE gained = KE lost ✓ $v = \sqrt{(2 \times g \times h)} = \sqrt{(2 \times 9.8 \times 0.85)} = 4.08\ (m\ s^{-1})$ ✓	2	
06.3	$\Delta p = p_1 - p_2 = 16 \times 10^{-3}(4.99 - (-4.08))$ ✓ $= 0.145\ (kg\ m\ s^{-1})$ ✓	2	Any mass × any velocity
06.4	$F = \Delta p/\Delta t = 0.145/40 \times 10^{-3}$ ✓ $= 3.63\ (N)$ ✓	1	
06.5	The solid block may deform ✓ This would affect the rate of change of momentum of the ball (and force) ✓	2	

Question	Marking Guidance	Mark	Comments
07.1	Y = stress/strain = F / (A × strain) ✓ F = Y × A × strain = $2.0 \times 10^{11} \times 7.5 \times 10^{-3} \times 3.0 \times 10^{-4}$ ✓ = 4.5×10^{5} (N) ✓	3	
07.2	Elastic strain energy = $\frac{1}{2} \times F \times \Delta l = \frac{1}{2} \times F \times (l \times \text{strain})$ ✓ = $\frac{1}{2} \times 4500 \times 45 \times 3 \times 10^{-4} = 3040$ (J) ✓	2	
07.3	$\Delta\Theta$ = pre-strain/ change in strain per degree change in temp = $3 \times 10^{-4} / 2.5 \times 10^{-5} = 12$ K ✓ $\Theta = 8 + 12 = 20$ (°C) ✓	2	
07.4	So that the rail is not always under tensile stress ✓ as the rail spends little time at the highest temperature ✓ **or** To reduce the average stress the rail is under ✓ as zero stress will occur closer to average temperature/ the rail will be under compressive / tensile stress at different times ✓	2	

Question	Marking guidance	Mark	Comments
08.1	840 × 2.3✓ 1900 (J)/1930 (J) ✓	2	
08.2	uses gradient data extraction correct –350 N, 0.3 m 1170 ✓ $N\ m^{-1}$ ✓	2	
08.3	uses area, counts squares = 25 ✓ Each square is equivalent to 5 J ✓ 125 (J) ✓	3	

Question	Marking guidance	Mark	Comments
09.1	isotopes (are varieties of the same element that) have the same number of protons/atomic number/proton number ✓ but different numbers of neutrons/nucleons/atomic mass ✓	2	
09.2	$C\ kg^{-1}$ in column heading ✓	1	
09.3	92 ✓	1	
09.4	Charge of nucleus = $92 \times 1.6 \times 10^{-19}$ ✓ Mass of nucleus =$(92 \times 1.67 \times 10^{-27} + 143 \times 1.67 \times 10^{-27})$ ✓ 3.8×10^{7} ✓	3	
09.5	$3.7 \times 10^{7} = 92 \times 1.6 \times 10^{-19}/(A \times 1.67 \times 10^{-27})$ ✓ $A \times 1.67 \times 10^{-27} = 92 \times 1.6 \times 10^{-19}/3.7 \times 10^{7}$ giving A = 238 ✓ number of neutrons = 238 – 92 = 146 ✓	3	

Question	Marking guidance	Mark	Comments
10.1	all plots correct to $\frac{1}{2}$ small square ✓ line appropriate ✓	2	
10.2	one correct determination from correct numbers 154 ± 10 s ✓ two correct determinations and average ✓	2	

Question	Marking guidance	Mark	Comments
11.1	Straight line ✓ passing through all error bars, best fit by eye ✓	2	
11.2	Identifies h_o as y-intercept ✓ = 165 (mm) ± 3 mm ✓	2	
11.3	h_0k = gradient ✓ = (165-80)/(100-0) ✓ = 0.83 to 0.88 mm K^{-1} ✓	3	
11.4	k = gradient/h_0 = 0.83/163 = 4.94 to 5.43 × 10^{-3} ✓ K^{-1} ✓	2	
11.5	When h = 8 m (8000 mm) d^{-1} = h/grad = 8000/14.5 = 551.7 mm^{-1} ✓ d = 1.81 × 10^{-3} mm ✓	2	
11.6	The range of data in the graph is h = 290 mm h and d^{-1} may not be proportional up to 8000 mm ✓	1	OR no indication of uncertainties in graph data

Section C

In this section, each correct answer is awarded 1 mark.

Question	Key
12	B
13	A
14	C
15	D
16	C
17	D
18	D
19	B
20	B
21	A
22	D
23	C
24	A
25	C