OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL AS Physics

(9630)

Unit 1: Mechanics, materials and atoms

Mark Scheme

June 2017

Version: 1.0 Final

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.

<table>
<tr><th>Question</th><th>Marking guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>01</td><td>
<table>
<tr><th>Quantity</th><th>Vector or scalar</th><th>SI unit</th></tr>
<tr><td>Displacement</td><td>Vector</td><td>m</td></tr>
<tr><td>Velocity</td><td>Vector</td><td>m s^{-1}</td></tr>
<tr><td>Weight</td><td>Vector</td><td>Newton</td></tr>
<tr><td>Energy</td><td>Scalar</td><td>Joule</td></tr>
</table>
</td><td>2</td><td>At least 3 correct = 1 mark
All 6 correct = 2 marks
Allow capital letters, misspellings and plural units</td></tr>
</table>

Question	Marking guidance	Mark	Comments
02.1	Force × distance (to point about which moments are taken) ✓ Force × <u>perpendicular</u> distance ….✓	2	
02.2	*F d* seen OR *W* = *F d* OR *F* × 2π*r* × 3 OR 28 × 2π × 0.12 × 3 OR 28π × 0.24 × 3 ✓ 127 (J) ✓	2	Correct answer only

Question	Marking guidance	Mark	Comments
03	Attempts to resolve : Uses 610 sin 70 or 610 sin 20 or 610 cos 20 or 610 cos 70 ✓ OR vertical component + 610 cos 20 = 590 OR vertical component + 610 sin 70 = 590 In any form ✓ 16.8 or 17(N) ✓	3	Correct answer only

Question	Marking guidance	Mark	Comments
04	proton correct (1,1) accept p or p^+ ✓ electron correct (0,–1) accept e or e^- or β or β^- ✓ (electron-)antineutrino correct (0, 0) ✓	3	Must be an antineutrino

Question	Marking guidance	Mark	Comments
05	GW is a unit of power ✓ GW h is a unit of energy ✓	2	Allow 2 marks for GW h is the amount of energy transferred when a power of 1 GW is operated for 1 hour / 3.6×10^{12} J

Question	Marking guidance	Mark	Comments
06.1	$m = V/\rho$ seen as an equation in some form ✓ powers of ten clearly dealt with eg 2.3×10^7 seen **AND** correct answer to at least 3 sf 2.45×10^{11} (kg)✓	2	
06.2	5.8×10^{12} / 5.78×10^{12} (J) ✓	1	Correct answer only Use of 2.5×10^{11} gives 5.89×10^{12} (J)
06.3	Use of $P = E/t$ *eg* $\frac{5.8\ 10^{12}}{6 \times 3600}$ ✓ Use of efficiency = $\frac{\text{useful power o/p}}{\text{Total power i/p}}$ Expect to see $0.42 \times \frac{5.8\ 10^{12}}{6 \times 3600}$ OR $0.42 \times 2.69 \times 10^8$ ✓ $1.1(2) \times 10^8$ (W) ✓ **ecf** from 06.2	3	
06.4	Any **two** from: • Not all of the (kinetic/potential) energy of the water is used • (work done against) friction in the turbines • (heating caused by) turbulent or viscous flow • Electrical heating in generator	2	

Question	Marking guidance	Mark	Comments
07.1	Use of either $v^2 = u^2 + 2as$ OR $\Delta(m)gh = \frac{1}{2}(m)v^2$ ✓ 171 (m) / $58^2/(2 \times 9.81)$ seen ✓ 176 (m) or 180 (m) ✓	3	
07.2	$t = \Delta v/a$ OR $v = u + at$ seen OR $s = \left(\frac{u+v}{2}\right)t$ ✓ 5.91 (s) to at least 2 sf ✓	2	Working must be seen for second mark
07.3	tan 70 = 58/v_h in some form ✓ (v_h) = 21(.1) OR use of $s = vt$ ✓ 125 (m) ✓	3	
07.4	Air resistance slows either component of velocity OR work done against air resistance reduced (kinetic) energy ✓ Reaches its maximum height sooner ✓ **Both** vertical and horizontal distance reduced ✓	3	

Question	Marking Guidance	Mark	Comments
08.1	change in velocity 0.54 (m s^{-1}) seen OR (change in) p = mass × (change in) v seen ✓ 0.648 (kg m s^{-1}) ✓	2	 Correct answer only
08.2	Use of F = rate of change of momentum eg 0.648/65 or 0.638/0.065 seen ✓ 10 (N) / 10.0 (N) / 9.97 (N) / 9.969 (N) ✓ OR Use of $a = \frac{\Delta v}{\Delta t}$ from the graph and *F=ma* ✓ 10 (N) / 10.0 (N) / 9.97 (N) / 9.969 (N) ✓	2	 Allow ecf Also allow calculation for force acting on Q since forces are equal and opposite
08.3	Uses or states law of conservation of momentum ✓ $m_Q = \frac{\Delta p_P}{\Delta v_Q}$ in some form ✓ $\frac{\text{their 08.1}}{0.18}$ ✓ OR Finds acceleration for Q from the graph ✓ $a = \frac{F}{m}$ ✓ $\frac{\text{their 08.2}}{\text{their } a}$ ✓	3	Eg $(\Delta mv)_P = (\Delta mv)_Q$

08.4	Use of $E_K = \frac{1}{2} mv^2$ ✓ E_K = 0.0778 or 0.078 (J) for before OR after collision seen ✓ Correct calculations for before and after PLUS conclusion that the collision is elastic ✓	3	

Question	Marking guidance	Mark	Comments
09.1	same mass as an electron / mass of 9.11×10^{-31} kg ✓ Same magnitude of charge as on electron but charge is positive OR charge of $+1.6 \times 10^{-19}$ C (plus sign clearly seen) ✓	2	Allow charge = +1
09.2	meets an electron or the antiparticle✓ Both particles destroyed / cease to exist ✓ (Accompanied by) emission of **two** gamma rays OR **two** photons✓	3	
09.3	Identifies that five half-lives are needed / makes a clear attempt to calculate the activity though a sequence of half lives ✓ 550 (min) ✓	2	Correct answer only

Question	Marking guidance	Mark	Comments
10.1	Mentions inertia (of the trolley) Or Newton First Law OR trolley initially stationary as the lorry moves ✓ (Spring extends and) exerts force on trolley ✓ (when trolley is stationary w.r.t. case) it is accelerating at same rate as lorry ✓ Force in spring is sufficient to cause trolley to accelerate at the same rate as lorry ✓	3	Any three
10.2	use of $F = kx$ or $F = ma$ ✓ 1.6 or 1.59 (m s^{-2})✓	2	
10.3	Spring with larger spring constant / stiffer Trolley with smaller mass Longer case	1	Any one

Question	Marking guidance	Mark	Comments
11.1	$\frac{1}{2}$ (0.627 - 0.598)/0.613 × 100 % = ± 2.4 % or 2.37 % ✓	1	
11.2	The time of flight depends only on the vertical component of the motion ✓ This is the same for all trajectories since the ball is always projected horizontally and the height of the table is fixed OR vertical distance moved is constant OR g is constant ✓ OR shows that t is independent of h ✓	2	
11.3	Horizontal component (of velocity) is constant ✓ Hence we can use speed =(horizontal)distance/time ✓	2	Must mention horizontal component or horizontal velocity somewhere in order to access the 2nd mark
11.4	0.613/0.28 = 2.2 ✓	1	
11.5	$\delta v\% = \delta T\% + \delta R\%$ ✓ = ± ((0.01/0.28) × 100 + 2.4) = ± 6.0% ✓ ∴ uncertainty = ±(6.0/100) × 2.2 = ± 0.13 ✓	3	

11.6	Ensure that measurement of R starts vertically below the end of the projectile tube by appropriate technique (eg plumbline or vertical rule checked with set square) ✓	1	

Section C

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

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