Cambridge Assessment International Education

Cambridge International AS & A Level

PHYSICS **9702/22**

Paper 2 AS Level Structured Questions **May/June 2020**

MARK SCHEME

Maximum Mark: 60

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

[Turn over

^	Indicates where more is needed for a mark to be awarded (what is written is not wrong, but not enough). May also be used to annotate a response space that has been left completely blank.
SEEN	Indicates that a page has been seen.

Question	Answer	Marks
1(a)	(velocity =) change in displacement / time (taken)	**B1**
1(b)	units of F: kg m s^{-2}	**C1**
	units of k: kg m s^{-2} / [m^2 × (m s^{-1})^2] = kg m^{-3}	**A1**
1(c)	$P = Fv$	**C1**
	$4.8 \times 10^4 = 0.24 \times 5.1 \times v^3$	**C1**
	v = 34 m s^{-1}	**A1**

Question	Answer	Marks
2(a)(i)	area = $ut + \frac{1}{2}(v - u)t$ **or** area = $vt - \frac{1}{2}(v - u)t$ **or** area = $\frac{1}{2}(u + v)t$	**A1**
2(a)(ii)	displacement	**A1**
2(b)(i)	$u = 15 \sin 60°$ (= 13 m s^{-1})	**C1**
	$t = 15 \sin 60° / 9.81$	**C1**
	$= 1.3$ s	**A1**
2(b)(ii)	the force in the horizontal direction is zero	**B1**
2(b)(iii)	(velocity =) $15 \cos 60° = 7.5$ (m s^{-1}) **or** (velocity =) $15 \sin 30° = 7.5$ (m s^{-1})	**A1**
2(c)(i)	$p = mv$ **or** 0.40×7.5 **or** 0.40×4.3	**C1**
	$\Delta p = 0.40\ (7.5 + 4.3)$ $= 4.7$ kg m s^{-1}	**A1**
2(c)(ii)	force = $4.7 / 0.12$ **or** $0.40 \times [(7.5 + 4.3) / 0.12]$ $= 39$ N	**A1**

Question	Answer	Marks
3(a)	(work done =) force × displacement in direction of the force	**B1**
3(b)(i)	**1.** $(\Delta)E = mg(\Delta)h$	**C1**
	$= 0.42 \times 9.81 \times 78$ $= 320$ J	**A1**
	2. $E = \frac{1}{2}mv^2$	**C1**
	$(\Delta)E = \frac{1}{2} \times 0.42 \times 23^2$ $= 110$ J	**A1**
3(b)(ii)	work done = 320 – 110 (= 210 N)	**C1**
	average resistive force = 210 / 78 = 2.7 N	**A1**
3(c)	downward sloping line from (0, g) to a non-zero value on the time axis	**M1**
	line is curved with a gradient that becomes less negative **and** the line meets t-axis at time $t < T$	**A1**

Question	Answer	Marks
4(a)	progressive waves transfer energy **or** stationary waves do not transfer energy	**B1**
4(b)(i)	0.32 m	**A1**
4(b)(ii)	$v = \lambda / T$ **or** $v = f\lambda$ **and** $f = 1 / T$	**C1**
	v = 0.32 / 0.020 **or** 50×0.32 = 16 m s^{-1}	**A1**
4(b)(iii)	450° **or** 90°	**A1**
4(b)(iv)	(P has) maximum downward displacement at 0.005 s	**B1**
	returns to original position/point (at 0.010 s)	**B1**
4(c)(i)	(position where) zero amplitude	**B1**
4(c)(ii)	2	**A1**
4(c)(iii)	180°	**A1**
4(c)(iv)	string drawn between X and Y with one antinode midway along the string	**B1**

Question	Answer	Marks
5(a)	Hooke's (law)	**B1**
5(b)(i)	$\sigma = F / A$	**C1**
	$= 36 / (4.1 \times 10^{-7})$ $= 8.8 \times 10^{7}$ Pa	**A1**
5(b)(ii)	Young modulus = σ / ε **or** $F / A\varepsilon$	**C1**
	$\varepsilon = 8.8 \times 10^{7} / (1.7 \times 10^{11})$ $= 5.2 \times 10^{-4}$	**A1**
5(c)	$R = \rho L / A$	**C1**
	$\Delta R = \rho \Delta x / A$ $= 3.7 \times 10^{-7} \times 0.12 \times 10^{-3} / (4.1 \times 10^{-7})$	**C1**
	$= 1.1 \times 10^{-4}\ \Omega$	**A1**
5(d)	remove the force/F and wire returns to original length	**B1**

Question	Answer	Marks
6(a)(i)	energy is dissipated in the internal resistance/r	**B1**
6(a)(ii)	**1.** $I = Q / t$	**C1**
	$= 750 / 1500$ $= 0.50$ A	**A1**
	2. $V = W / Q$ **or** $V = W / It$	**C1**
	$= 5700 / 750$ **or** $5700 / (0.50 \times 1500)$ $= 7.6$ V	**A1**
	or	
	$V = P / I$ **and** $P = W / t$	**(C1)**
	$V = 3.8 / 0.50$ $= 7.6$ V	**(A1)**
	3. $r = (7.8 – 7.6) / 0.50$	**C1**
	$= 0.40\ \Omega$	**A1**
6(b)(i)	90 Ω and 45 Ω resistors shown connected in parallel	**B1**
6(b)(ii)	the resistors connected in parallel labelled as 90 Ω and 45 Ω with the other resistor labelled as 20 Ω	**M1**
	V_{OUT} or 3.6 V labelled across the 20 Ω resistor	**A1**

Question	Answer	Marks
7(a)(i)	P = 0 **and** Q = 39	**A1**
	R = (+)1 **and** S = 20	**A1**
7(a)(ii)	weak (nuclear force/interaction)	**B1**
7(b)	charge of quark(s) = (+) 2*e* / 3	**B1**
	up/u (quarks)	**B1**