Cambridge Assessment International Education

Cambridge International AS & A Level

PHYSICS **9702/21**

Paper 2 AS Level Structured Questions **May/June 2021**

MARK SCHEME

Maximum Mark: 60

Published

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[Turn over

Question	Answer	Mark
1(a)	mass / volume	**B1**
1(b)(i)	absolute uncertainty = $4.0 \times (5 / 100)$ = (±) 0.2 cm	**B1**
1(b)(ii)	percentage uncertainty = 2 + 4 + (5×2)	**C1**
	= (±) 16%	**A1**
1(c)	$p = F / A$ **or** $p = W / A$	**C1**
	$p = (19.5 \times 10^{-3} \times 9.81) / (4.0 \times 10^{-2})^2$	**C1**
	= 120 Pa	**A1**

Question	Answer	Mark
2(a)(i)	$P = Fv$	C1
	$= 18 \times 1.4$ $= 25\,\text{W}$	A1
2(a)(ii)	$a = F / m$	C1
	$a = 18 / 72 = 0.25\ (\text{m s}^{-2})$ $t = 1.4 / 0.25$	C1
	$= 5.6\,\text{s}$	A1
2(b)(i)	$a = (54 - 18) / 72$ **or** $36 / 72\ (= 0.50\ \text{m s}^{-2})$	C1
	$v^2 = 2 \times 0.50 \times 9.5$	C1
	$v = 3.1\ \text{m s}^{-1}$	A1
2(b)(ii)	$W = 54 \times 9.5$ $= 510\,\text{J}$	A1
2(b)(iii)	curved line from the origin	M1
	gradient of line increases	A1
2(c)	(force due to) air resistance increases/changes/not constant **or** air resistance increases with speed	B1

Question	Answer	Mark
3(a)	solid straight line drawn between centre of sphere at X and at Y	**B1**
3(b)	$p = mv$ **or** $0.72 = mv$	**C1**
	$E = ½mv^2$ **or** $0.86 = ½mv^2$	**C1**
	$(m =)\ 0.72^2 / (2 \times 0.86) = 0.30$ (kg) **or** $v = 2E_K / p$ $v = (0.86 \times 2) / 0.72 = 2.4$ (to 2 s.f.) $m = 0.72 / 2.4 = 0.30$ (kg)	**A1**
3(c)	$(\Delta)E = mg(\Delta)h$	**C1**
	$h = 0.86 / (0.30 \times 9.81)$ $= 0.29$ m	**A1**
3(d)	$\cos\theta = (0.93 - 0.29) / 0.93$ so $\theta = 47°$	**A1**
3(e)	moment $= (0.30 \times 9.81) \times 0.93 \times$ (sin 47° **or** cos 43°) **or** moment $= (0.30 \times 9.81) \times [0.93^2 - (0.93 - 0.29)^2]^{0.5}$	**C1**
	$= 2.0$ N m	**A1**

Question	Answer	Mark
3(f)	there is a resultant force (acting on sphere) **or** there is a resultant moment (about P acting on pendulum) (so) not in equilibrium	**B1**

Question	Answer	Marks
4(a)	distance moved by wavefront/energy during one cycle/oscillation/period (of source) **or** minimum distance between two wavefronts **or** distance between two adjacent wavefronts	**B1**
4(b)	$v = \lambda / T$ **or** $v = f\lambda$ **and** $f = 1 / T$	**C1**
	$T = 460 \times 10^{-9} / 3.00 \times 10^{8}$	**C1**
	$= 1.5 \times 10^{-15}$ s	**A1**
4(c)	waves pass through/enter the slit(s)	**B1**
	waves spread (into geometric shadow)	**B1**
4(d)(i)	$n\lambda = d \sin\theta$	**C1**
	$G = \sin\theta / \lambda$ $d = 4 / G$	**A1**
4(d)(ii)	straight line from 400 nm to 700 nm that is always below printed line	**M1**
	straight line has smaller gradient than printed line and is 5 small squares high at wavelength of 700 nm	**A1**

Question	Answer	Mark
5(a)	sum of e.m.f.(s) = sum of p.d.(s) **or** (algebraic) sum of e.m.f.(s) and p.d.(s) is zero	**M1**
	around a loop/around a closed circuit	**A1**
5(b)(i)	$I = 1.8 / 0.90$ $= 2.0$ A	**A1**
5(b)(ii)	$Q = It$	**C1**
	number $= (2.0 \times 45) / 1.60 \times 10^{-19}$ $= 5.6 \times 10^{20}$	**A1**
5(b)(iii)	$4.0 = 1.8 + [2.0 \times (0.35 + R)]$ **or** $4.0 = 2.0 \times (0.90 + 0.35 + R)$	**C1**
	$R = 0.75\ \Omega$	**A1**
5(c)(i)	$1.2 / 1.8 = 0.30 / L$	**C1**
	$L = 0.45$ m	**A1**
5(c)(ii)	p.d. across XY decreases/p.d. across XP decreases	**B1**
	(so) P is moved towards Y/away from X/to the right	**B1**

Question	Answer	Mark
6(a)(i)	(electron) neutrino	**B1**
6(a)(ii)	weak (nuclear force/interaction)	**B1**
6(a)(iii)	β^+ (particle)	**B1**
6(a)(iv)	(quark structure is) up up down **or** uud	**B1**
	$(2/3)e + (2/3)e - (1/3)e = (+)e$	**B1**
6(a)(v)	up up down changes to up down down **or** uud $\rightarrow$ udd **or** up changes to down **or** u $\rightarrow$ d	**B1**
6(b)(i)	$F = Eq$	**C1**
	ratio = 6 / 8 = 0.75	**A1**
6(b)(ii)	ratio = 0.75 $\times$ (16 / 12) = 1.0	**A1**
6(b)(iii)	horizontal straight line at a non-zero value of *a*	**B1**