CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Pre-U Certificate

MARK SCHEME for the May/June 2015 series

9792 PHYSICS

9792/02 Paper 2 (Part A Written), maximum raw mark 100

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1 (a) (i) A increasing **and** positive [1]
C decreasing **and** positive [1]
E negative **and** constant [1] [3]

(ii) speed / velocity is constant / 20 $m\,s^{-1}$ **or** zero acceleration [1] [1]

(b) correct method used in B [1]
range from 0.43 to 0.45 ($m\,s^{-2}$) [1] [2]

(c) (i)

region	**metres**	**small squares**	
A and C	624 to 640	156 to 160	[1]
B	216 to 232	54 to 58	[1]
D and E	1200 + 600 **or** 1800	300 + 150 **or** 450	[1]

one small square is equivalent to 4 (m) [1]
2630 to 2680 (m) [1] [5]

(ii) straight lines instead of curves **or** difficulty of counting squares [1]
5 to 15 small squares **or** 3 to 10 small squares [1]
20 to 60 (m) **or** 12 to 40 (m) [1] [3]

[14]

2 (a) (i) regains original shape / length <u>when distorting force is removed</u> [1] [1]

(ii) permanent distortion **or** does not regain original shape / length [1] [1]

(iii) considerable plastic deformation / absorbing a lot of energy before it breaks **or** high resistance to breaking [1] [1]

(iv) no / (very) little plastic deformation / absorbs little energy before it breaks [1] [1]

(b) can be beaten into sheets [1]
gold (leaf), silver (decorations); lead (sheet); copper (tray) [1] [2]

(c) long / chain <u>molecules</u> [1]
molecules uncoil [1]
molecules / substance stretches at end **or** totally uncoiled at end [1] [3]

[9]

3 (a) 5493.6 **or** 5488 [1]
$J\,kg^{-1}$ **or** $m^2\,s^{-2}$ [1] [2]

(b) (i) 5493.6×68 **or** 373 551 [1]
$5493.6 \times 68 / (5 \times 60 \times 60)$ **or** $373\,551 / (5 \times 60 \times 60)$ [1]
20.7 **or** 20.8 (W) [1] [3]

(ii) 2.49×10^6 [1]
5.5 **or** 6 (bars) [1] [2]

[7]

4 (a) (i) zero [1] [1]

(ii) (10 Ω in parallel with 30 Ω gives resistance of) 7.5 (Ω) [1]
9.5 (V) [1] [2]

(iii) 5.0 (Ω) [1]
(5 Ω in parallel with 30 Ω gives) 4.29 (Ω) [1]
$(12 \times 4.29 / (7 + 4.29) =)$ 4.56 (V) [1] [3]

(b) V^2 / R **or** in numbers [1]
3.0 (W) [1] [2]

[8]

5 (a) (i) waves of the same frequency **or** same wave reflected back on itself [1]
travelling in opposite directions (in the same space) [1] [2]

(ii) (on one half of the cycle) the molecules either side approach the node [1]
(on the next half cycle the molecules) will be moving away from the node [1]
pressure will be changing (from above to below atm. pressure) [1] [3]

(b) (i) $(69.0 \times 10^9 / 2710)^{\frac{1}{2}}$ [1]
5046 ($m\,s^{-1}$) [1] [2]

(ii) (distance travelled by wave =) 2×0.85 (m) **or** 1.70 (m) [1]
$(1.70 / 5050 =)\ 3.37 \times 10^{-4}$ (s) **or** 0.337 ms [1] [2]

(iii) electronic clock / stopwatch / timer [1]
start and stop clear [1]
experimental detail (e.g. wires connected to rod and plate) [1] [3]

[12]

6 (a) (i) α–particle source directing a stream of α–particles towards a thin gold foil [1]
detector with indication that it can rotate around almost 360° [1] [2]

(ii) few deflected / most go straight through [1]
nucleus (very) small / atom mostly empty space [1]
backscattering observed [1]
nucleus (positively) charged / same charge as α–particle [1] [4]

(iii) the size of the nucleus is (very) much smaller than the one drawn [1] [1]

(b) (i) $^{238}_{92}U \rightarrow {}^{4}_{2}\alpha + {}^{234}_{90}Th$
$^{4}_{2}\alpha$ **or** $^{4}_{2}He$ [1]
$^{238}_{92}U$ **and** thorium nuclide according to candidate's α–particle [1] [2]

(ii) any **three** from
a different isotope of uranium is used / uranium–235
neutrons can be used to bombard the uranium nuclei
fission can make the uranium nuclei break into parts
this can release many more neutrons
that can cause a chain reaction
releases energy
heat water / steam turns (turbine and) generator [3] [3]

[12]

7 (a) any **five** from
use of a suitable named metal
lamp must be UV unless sodium or similar is used
detector of emitted electrons
electron detector suitable for very low currents
description of use
electrons emitted [5] [5]

(b) (i) same shape graph coming down to zero / at the same point [1]
parallel on the right but lower [1] [2]

(ii) maximum kinetic energy is **not** dependent on intensity **or** number of electrons emitted is directly proportional to intensity [1] [1]

(c) (i) 3.68×10^{-19} (J) [1] [1]

(ii) hc/λ [1]
$6.63 \times 10^{-34} \times 3.00 \times 10^{8} / 1.124 \times 10^{-7}$ **or** 1.77×10^{-18} (J) [1]
(electron energy =) photon energy – work function **or** $1.77 \times 10^{-18} - 3.68 \times 10^{-19}$ [1]
1.40×10^{-18} (J) [1] [4]

[13]

8 **(a)** pressure greater outside than inside **or** water pressing on concrete [1] [1]

(b) **(i)** (m =) $\pi \times (4.27^2 - 3.65^2) \times 32.5 \times 2420$ [1]
$1.21(329238) \times 10^6$ (kg) [1] [2]

(ii) (F_u =) $\pi \times 4.27^2 \times 32.5 \times 1020 \times 9.81$ [1]
$1.\ 86(276540) \times 10^7$ (N) [1] [2]

(c) **(i)** any **two** from
weight of (trapped) air is small (compared with the weight of the concrete)
upthrust due to the air outside equal to / (slightly) larger than weight of air
density of concrete was determined in air [2] [2]

(ii) 1.86×10^7 **and** $1.21 \times 10^6 \times 9.81$ **and** 1.72×10^4 [1]
$1.86 \times 10^7 - 1.21 \times 10^6 \times 9.81 - 1.72 \times 10^4$ ($\approx 6.71 \times 10^6$ (N)) [1] [2]

(d) **(i)** scale stated **and** $\geqslant$ 1 cm : 10^6 N [1]
correct triangle **or** correct parallelogram **and** correct diagonal [1]
(T_P =)$1.25 - 1.33 \times 10^6$ (N) **or** $3.85 - 3.90 \times 10^6$ (N) [1]
(T_P =)$1.28 - 1.30 \times 10^6$ (N) [1] [4]

(ii) **1.** 2.08×10^8 (N m^{-2}) [1] [1]

2. $2.08 \times 10^8 \times 250 / 1.93 \times 10^{11}$ [1]
0.269 (m) [1] [2]

(e) the cable has weight [1]
stress at Q is less [1] [2]

(f) any **seven** from

social:
makes the journey easier/quicker/improves transport
opens up new land for suburbs etc
makes social contact easier
terrorist target
opens new areas to industrial expansion
obstructs shipping
public perception (poor)
can be built in deep channels
not visible
less disruption during construction

safety:
confined space
not as exposed as bridge
might leak / salt water damage / maintenance difficult / expensive
might be hit (submarine, whale)
resonance **or** tunnel might flex (in strong current, earthquake)
large number of people present in tunnel together

economic:
expensive to build
cheaper / shorter / less material / quicker to build / fewer man-hours than bored tunnel
encourages industry
encourages tourism / tourist attraction itself
substantial payback time
no income until complete
money to build must be borrowed
jobs created (during construction) [7]

[25]