UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

9702 PHYSICS

9702/22 Paper 2 (AS Structured Questions)

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UNIVERSITY of CAMBRIDGE
International Examinations

Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE AS/A LEVEL – May/June 2010	9702	22

1 **(a)** micrometer/screw gauge/digital callipers ……. B1 [1]

(b) **(i)** look/check for zero error ……. B1 [1]

(ii) take several readings …….. M1
around the circumference/along the wire ……. A1 [2]

2 **(a)** e.g. initial speed is zero
constant acceleration
straight line motion
(*any two, one mark each*) ……B2 [2]

(b) **(i)** $s = ½at^2$
$0.79 = ½ \times 9.8 \times t^2$ …….. C1
$t = 0.40$ s allow 1 SF or greater ……. A1
2 or 3 SF answer …….. A1 [3]

(ii) distance travelled by end of time interval = 90 cm ……. C1
$0.90 = ½ \times 9.8 \times t^2$
$t = 0.43$ s allow 2 SF or greater ……. C1
time interval = 0.03 s ……... A1 [3]

(c) (air resistance) means ball's speed/acceleration is less …… M1
length of image is shorter …… A1 [2]

3 **(a)** **(i)** force is rate of change of momentum …… B1 [1]

(ii) force on body A is equal in magnitude to force on body B (from A) ……M1
forces are in opposite directions …… A1
forces are of the same kind ……A1 [3]

(b) **(i)** 1 $F_A = -F_B$ ……. B1 [1]
2 $t_A = t_B$ ……. B1 [1]

(ii) $\Delta p = F_A t_A = -F_B t_B$ …….. B1 [1]

(c) graph: momentum change occurs at same times for both spheres ……. B1
final momentum of sphere B is to the right …….. M1
and of magnitude 5 N s …… A1 [3]

4 **(a)** e.g. no energy transfer
amplitude varies along its length/nodes and antinodes
neighbouring points (in inter-nodal loop) vibrate in phase, etc.
(*any two, 1 mark each to max 2* ……..B2 [2]

(b) **(i)** $\lambda = (330 \times 10^2)/550$ …….. M1
$\lambda = 60\,\text{cm}$ …… A0 [1]

(ii) node labelled at piston ……. B1
antinode labelled at open end of tube …… B1
additional node and antinode in correct positions along tube …… B1 [3]

(c) at lowest frequency, length = $\lambda/4$ ……... C1
$\lambda = 1.8$ m
frequency = 330/1.8 ……. C1
= 180 Hz ……..... A1 [3]

5 **(a)** **(i)** Young modulus = stress/strain …… C1
data chosen using point in linear region of graph …… M1
Young modulus = $(2.1 \times 10^8)/(1.9 \times 10^{\ 3})$
$= 1.1 \times 10^{11}$ Pa …….. A1 [3]

(ii) This mark was removed from the assessment, owing to a power-of-ten inconsistency in the printed question paper.

(b) area between lines represents energy/area under curve represents energy .. M1
when rubber is stretched and then released/two areas are different ……..... A1
this energy seen as thermal energy/heating/difference represents energy released as heat …… A1 [3]

6 **(a)** *either* $P \propto V^2$ *or* $P = V^2/R$ …… C1
reduction = $(230^2 - 220^2)/230^2$
= 8.5 % …….. A1 [2]

(b) **(i)** zero …… A1 [1]

(ii) 0.3(0) A …….. A1 [1]

(c) **(i)** correct plots to within ± 1 mm …… B1 [1]

(ii) reasonable line/curve through points giving current as 0.12 A
allow ± 0.005A) …… B1 [1]

(iii) $V = IR$ …… C1
$V = 0.12 \times 5.0$
= 0.6(0) V ……... A1 [2]

(d) circuit acts as a potential divider/current divides/current in AC not the same as current in BC …… B1
resistance between A and C not equal to resistance between C and B ……. B1
or current in wire AC × R is not equal to current in wire BC × R B1 [2]
any 2 statements

7 (a) (i) *either* helium <u>nucleus</u>
or contains 2 protons and 2 neutrons …… B1 [1]

(ii) e.g. range is a few cm in air/sheet of <u>thin</u> paper
speed up to 0.1 *c*
causes dense ionisation in air
positively charged or deflected in magnetic or electric fields
(*any two, 1 each to max 2*) …….. B2 [2]

(b) (i) $^{4}_{2}\alpha$ …… B1
either $^{1}_{1}$p *or* $^{1}_{1}$H…….. B1 [2]

(ii) 1 initially, α-particle must have some kinetic energy …….. B1 [1]

(ii) 2 1.1 MeV = 1.1 × 1.6 × 10^{-13} = 1.76 × 10^{-13} J ……. C1
$E_K = ½mv^2$ …….. C1
1.76 × 10^{-13} = ½ × 4 × 1.66 × 10^{-27} × v^2 …… C1
v = 7.3 × 10^6 m s^{-1} ……..... A1 [4]
use of 1.67 × 10^{-27} kg for mass is a maximum of 3/4