UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2009 question paper

for the guidance of teachers

5054 PHYSICS

5054/02   Paper 2 (Theory), maximum raw mark 75

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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1 **(a)** **(i)** weight of water (causes extra pressure)(**not** mass)

(ii) density of liquid/(sea-)water **or** gravitational field strength/acceleration of freefall
(**not** gravity)   B1

(b) **(i)** $3.6/3.60 \times 10^5$ Pa   B1

(ii) $P_1 V_1 = P_2 V_2$ **or** $1.05 \times 10^5 \times 6000 = 3.60 \times 10^5 \times V_2$ C1
1700 **or** 1750 **or** $1800\ cm^3$ A1   [5]

2 **(a)** (WD =)Fx **or** 1680×50 C1
84 000 J   A1

(b) friction/drag/resistance **of water/air**   B1
work done against friction/resistance/drag **or** energy lost due to friction/resistance/
drag **or** energy lost as heat/internal/thermal   B1   [4]

3 **(a)** **(i)** (he) loses –ve charge   C1
electrons lost (to surface)   (positive electrons 0/2)   A1

(ii) (becomes) negative/gains electrons   B1

(b) **(i)** (he) discharges/(re)gains electrons/–ve charge (**not** current flow)   B1

(ii) (Q =)It **or** 1.6×0.15 **or** 0.0016×0.00015 C1
2.4×10^n C1
2.4×10^{-7} C   A1   [7]

4 **(a)** **(i)** one ray from M correctly reflected – checked by eye   C1
two rays from M correctly reflected – checked by eye – **and** traced back to
image   A1

(ii) image point **clearly** marked at intersection/correct place checked by eye   B1

(b) 0.34 m **cao**   B1   [4]

5 **(a)** **(i)** C in correct position i.e. gap 4, 18 **or** 32 { **allow** arrows/   B1
R in correct position i.e. gap 11 **or** 25   { brackets < λ/2   B1
OR two correct positions but R and C reversed 1/2

(ii) $6.2 \rightarrow 6.6$ cm   B1

(iii) (v =)fλ **or** $5.1/5100 \times 6.4/0.064$ (using candidate's **5 (a) (ii)**)   C1
$3.16 – 3.37 \times 10^n$ C1
316 – 337 m/s   A1

(b) (longitudinal wave:) vibration/oscillation direction parallel to/in same direction as wave/energy travel direction   (**not** L & R)   B1
transverse wave: directions perpendicular **or** can be polarized (**not** up & down)   B1

6 **(a)** **(i)** (I =)P/V **or** P = VI **or** 650/230   C1
2.8 **or** 2.83 A   A1

   (ii) 3, 4, 5, 6 **or** 7 A **only**   B1

(b) **(i)** casing becomes live/at high voltage   B1
current through user/user electrocuted/user shocked   B1

   (ii) fuse blows/melts/breaks   B1
fuse in live wire/(microwave) disconnected/circuit broken/no current   B1   [7]

7 **(a)** 1.(0) m   B1

(b) **(i)** (for an object in) equilibrium/balance   B1
$W_1x = W_2y$ (clear) **or** anticlockwise moment/torque/turning force =
clockwise moment/torque/turning force   B1

   (ii) 18 000 × 1. 0 = T × 0.5   C1
36 000 N   A1   [5]

8 **(a)** **(i)** 3 **cao**   B1

   (ii) 208 **cao**   B1

   (iii) 11 **cao**   B1

(b) **(i)** 17 **cao**   B1

   (ii) 20 **cao**   B1   [5]

[Total: 45]

Section B

9 (a) (i) 100 – 22 **or** 78   C1
$(Q =)mc\Delta T$ **or** $35 \times 4200 \times 78$ C1
$1.1/1.1466/1.15 \times 10^7$ J   A1

    (ii) $(t =)E/P$ **or** $P = E/t$ **or** $1.15 \times 10^7/2600$ C1
$4.4/4.41/4.42 \times 10^3$ s   A1

    (iii) heat escapes/lost (to kitchen) **or** heat to heat the boiler/heater
or not all heat ends up in water **or** heat to cause evaporation
or used as latent heat   (**not** heat wasted)   B1   [6]

  (b) (i) hot/warm **water** expands   (**not** molecules expand)   B1
density (of hot/warm water) decreases   B1
hot/warm water rises   B1
convection current/circulation **or** cold water sinks   B1
mixes water   (max 4)   B1

    (ii) metal/steel is (good) conductor/poor insulator **or** plastic is poor conductor/
insulator   B1
more heat transferred through steel/less through plastic **or** heat transferred more
quickly through steel/less quickly through plastic   B1   [6]

  (c) (i) evaporation   **OR**   condensation   B1

    (ii) any **two** points
only occurs at surface   boiling needs heat/
occurs at any temperature   condensation releases heat   B1
produces cooling   boiling: liquid to gas/
no bubbles   B2   condensation: gas to liquid   B1   [3]

                                     [Total: 15]

10 (a) (i) $(W =)mg$ **or** 0.5×3.7 C1
$1.8/1.85/1.9$ N   A1

    (ii) 3.7 m/s^2 **not** N/kg   B1

    (iii) $(KE =) \frac{1}{2}mv^2$ C1
$\frac{1}{2} \times 0.50 \times 3.2^2$ C1
2.6 **or** 2.56 J   A1   [6]

  (b) (i) A compares/measures (unknown and known) masses/amount of matter   B1
B measures/is dependent on weight/force of gravity (and hence mass obtained)   B1
Mars weights/forces of gravity are less than/different from (Earth)   B1

    (ii) A **or** lever arm balance **or** balance with discs   B1   [4]

(c) **(i)** volume

(ii)
Either:	Or:
record value of water in measuring cylinder (**not** beaker)	water/liquid in displacement/eureka can
insert rock	full to overflowing
record new value	immerse rock
subtract (to obtain volume)	(new) overflow in measuring cylinder
or measure rise)	(**not** beaker is volume)
m/volume **or** *m*/subtraction	*m*/volume **or** *m*/subtraction
(max 4)	(max 4)

B4 [5]

[Total: 15]

11 **(a)** **(i)** (I =)V/R **or** V = IR (in **(i)**/**(ii)**) **or** 9.0/20 (in **(i)**) **or** 0.45 × 16 (in **(ii)**)   C1
0.45 A   A1

(ii) 7.2 V   (max 3 for **(i)** and **(ii)** together)   A1 [3]
C1 may be awarded for **either** A mark

(b) **(i)** R → T **and** line of positive slope throughout   B1
straight line, positive intercept on R-axis **and** slope/0 on **kelvin** scale   B1

(ii) voltmeter reading falls   B1
current (supplied by battery) falls **or** X takes greater proportion of p.d. **or** 16 Ω
takes smaller proportion of p.d.   B1

(iii) 0 **and** to/→/-   B1
8/9/10/whole number not greater than 20 V   (usual unit penalty)   B1 [6]

EITHER:
(c) **(i)** use small, metal conductor as probe/sensor **or** calibrate V reading
(with known T)   B1
the voltmeter reading is used to find T   B1

(ii) any **two** from: high temperatures /remote reading/robust/quick acting/direct input
to computer/low heat capacity   B2

(iii) equal changes in one/T do **not** produce a equal changes in the other/V **or**
graph with axes labelled **not** straight **or not** proportional to   B2 [6]
not a straight line **or** not same change **or** change in V is not uniform 1/2

OR:

(c) (i)

In		Out		
0	0	1	⎫	
0	1	1	⎬ all correct	B1
1	0	1	⎭	
1	1	0	correct	B1

(ii) both inputs = 0   B1
output = 1   B1

(iii) A **and** B inputs = 1   B1
output = 0   B1   [6]

[Total: 15]