

**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

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- 1 (a) (i) weight of water (causes extra pressure)(**not** mass) B1
- (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** $1.05 \times 10^5 \times 6000 = 3.60 \times 10^5 \times V_2$
1700 **or** 1750 **or** 1800 cm³ C1
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 < $\lambda/2$ B1
OR two correct positions but R and C reversed 1/2
- (ii) $6.2 \rightarrow 6.6$ cm B1
- (iii) (v =)f λ **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

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	(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	[8]
6	(a) (i) $(I =)P/V$ or $P = VI$ or 650/230 2.8 or 2.83 A	C1 A1	
	(ii) 3, 4, 5, 6 or 7 A only	B1	
	(b) (i) casing becomes live/at high voltage current through user/user electrocuted/user shocked	B1 B1	
	(ii) fuse blows/melts/breaks fuse in live wire/(microwave) disconnected/circuit broken/no current	B1 B1	[7]
7	(a) 1.(0) m	B1	
	(b) (i) (for an object in) equilibrium/balance $W_1x = W_2y$ (clear) or anticlockwise moment/torque/turning force = clockwise moment/torque/turning force	B1 B1	
	(ii) $18\ 000 \times 1.0 = T \times 0.5$ 36 000 N	C1 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]

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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]

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(c) (i) volume B1

(ii) **Either:**
 record value of water in measuring cylinder (**not** beaker)
 insert rock
 record new value
 subtract (to obtain volume) **or** measure rise)
m/volume **or** *m*/subtraction
 (max 4)

Or:
 water/liquid in displacement/eureka can
 full to overflowing
 immerse rock
 (new) overflow in measuring cylinder
 (**not** beaker is volume)
m/volume **or** *m*/subtraction
 (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))
 0.45 A C1
 A1

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

(b) (i) $R \rightarrow T$ **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/ \rightarrow / \leftarrow 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
1	0	1
1	1	0

} all correct

B1

correct

B1

(ii) both inputs = 0
output = 1

B1

B1

(iii) A and B inputs = 1
output = 0

B1

B1 [6]

[Total: 15]