

**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)	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 cm ³	C1 A1	[5]
2	(a) (WD =)Fx or 1680×50 84 000 J	C1 A1	
	(b) friction/drag/resistance of water/air work done against friction/resistance/drag or energy lost due to friction/resistance/drag or energy lost as heat/internal/thermal	B1 B1	[4]
3	(a) (i) (he) loses –ve charge electrons lost (to surface) (positive electrons 0/2)	C1 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 2.4×10^n 2.4×10^{-7} C	C1 C1 A1	[7]
4	(a) (i) one ray from M correctly reflected – checked by eye two rays from M correctly reflected – checked by eye – and traced back to image	C1 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/ R in correct position i.e. gap 11 or 25 { brackets < $\lambda/2$ OR two correct positions but R and C reversed 1/2	B1 B1	
	(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)) $3.16 - 3.37 \times 10^n$ 316 – 337 m/s	C1 C1 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
 correct

B1

B1

(ii) both inputs = 0
 output = 1

B1

B1

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

B1

B1 [6]

[Total: 15]