2008

Sample Answer and Mark Allocation					Notes	Marks
22.	(a)		Stated scale diagram accuracy (1131 N) **OR** $d = \sqrt{800^2 + 800^2}$ $= 1131$ N	(½) (½) (1) (1) (1)		2
	(b)	(i)	W = mg = 180 × 10 = 1800 N	(½) (½) (1)		2
		(ii)	resultant = 2700 - 1800 = 900 N $a = \frac{F}{m}$ $= \frac{900}{180}$ $= 5$ m/s^2	(1) (½) (½) (1)		3
						Total 7

2013

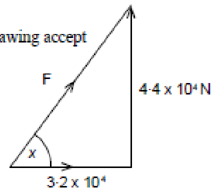
(a)		Calculate the magnitude of the acceleration of the plane assuming there are no other forces acting on the plane at this point. *F = ma* **4500 = 750 × *a*** ***a* = 6 m/s^2**	*(½)* *(½)* *(1)*		**2**	
(b)		The required speed for take-off is 54 m/s. Calculate the time it takes to reach this speed assuming the acceleration is constant. $a = \frac{v - u}{t}$ $6 = \frac{54 - 0}{t}$ *t* = 54 ÷ 6 *t* = 9 s	 *(½)* *(½)* *(1)*	Must be consistent with (a) Don't accept secs	**2**	
(c)		In practice the acceleration is not constant. Give a reason for this. **Other forces will act on the plane (e.g. drag)** **Mass decrease (fuel consumption)**			**1**	**5**

2009

Sample Answer and Mark Allocation	Notes	Marks
23. (a) width/length of card (d) (½) time taken for card to cut beam (t) (½) $v = \frac{d}{t}$ or $\bar{v} = \frac{d}{t}$ (1) or with correct measurements $v = \frac{\text{length of card}}{\text{time taken card to cut beam}}$ (this equation on its own = 2)	} must define 'd' and 't' to get 2nd mark $v = \frac{d}{t}$ on its own = 0 marks	2
(b) (i) $p = mv$ (½) $= (5 \times 10^{-4} + 0{\cdot}3) \times 0{\cdot}35$ (½) $= 0{\cdot}105$ kg m/s	this line on its own = 1 mark must have 2nd line	1
(ii) $v = \frac{p}{m}$ $= \frac{0{\cdot}105}{5 \times 10^{-4}}$ (½) $= 210$ m/s (½)	if they use 0·105175 from mom calculation they get 210·35 = (-½) for sig figs 210·4 = ✓	1

Sample Answer and Mark Allocation	Notes	Marks
(c) (i) $a = \frac{(v-u)}{t}$ (½) $10 = \frac{(v-0)}{0{\cdot}2}$ (½) $v = 2$ m/s (1)	Δ v = 2 m/s ✓ v = 1·96 if using 9·8 or 1·962 if using 9·81	2
(ii) $d = \bar{v}t$ (½) $= 1 \times 0{\cdot}2$ (½) $= 0{\cdot}2$ m (1)	if they use a graph: area under graph/or ½bh = (½) ½ (0·2 × 2) = 0·2 m (½) (1)	2
		Total 8

2011

Sample Answer and Mark Allocation	Notes	Marks
23. (a) $W = mg$ (½) $= 50{,}000 \times 10$* (½) $= 500{,}000$ N (1)	*If g = 9·8 accept 490,000 or 500,000 If g = 9·81 accept 491,000 or 500,000	2
(b) 500,000 N* (1)	*Must be consistent with (a) *Don't penalise repeated sig.fig.error	1
(c) For scale drawing accept (5·4 ± 0·3) (36 ± 3°) (54 ± 3°)  $F^2 = {}^2 + {}^2$ (½) $F = 5{\cdot}4 \times 10^4$ N* (1) $\tan x = \frac{4 \cdot 4 \times 10^4}{3 \cdot 2 \times 10^4}$ (½) $x = 54°$† (½) $F = 5{\cdot}4 \times 10^4$ N at 036(o) (½)	*Accept 5×10^4, $5{\cdot}4 \times 10^4$, $5{\cdot}44 \times 10^4$, $5{\cdot}441 \times 10^4$ If added 'tail-to-tail' max 1½ † Accept 50°, 54°, 54·0°, 53·97° * must be consistent with x	3

2012

2012 Physics Intermediate 2		
Sample Answer and Mark Allocation		**Marks**
21. (a) (i) $d = vt$ (½) $8{,}300 \times 100 \times 60$ (½) $= 49{,}800{,}000$m (1) (ii) (As orbit is circular) direction changes / or unbalanced force exists (1) so velocity changes . (1)	Mins not converted to s, deduct ½	2 2
(b) $d = vt$ (½) $800 \times 1000 = 300{,}000{,}000\, t$ (½) $t = 0.0027$ s (1)	Anything other than 300 000 000 – stop marking (½ for formula) Wrong conversion of 800 km – deduct ½ 0.003 and 0.00267 OK	2
(c) (i) The weight of 1 kg OR Weight per unit mass OR Earth's pull per kg. (1) (ii) 7.8 N/kg (1) (iii) $W = mg$ (½) $= 84 \times 7.8$ (½) $= 660$N (1)	Weight/mass = 0; force per unit mass = 0; Newtons per kg = 0; Gravity per kg = 0; same as 10m/s^2 = 0 No tolerance – exact value required. Minus ½ for missing/wrong unit. Must use the same value as stated in part (ii) OR correct value. s.f. accept 655.2; 655; 700	1 1 2

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2008

2008 Physics Intermediate 2			
Sample Answer and Mark Allocation		**Notes**	**Marks**
21. (a)	$a = \frac{v-u}{t}$ (½) $a = \frac{9}{2}$ (½) $a = 4·5\ m/s^2$ (1)		2
(b)	$F = m \times a$ (½) $F = 15 \times 4.5$ (½) $F = 67·5\ N$ (1)		2
(c)	d = area under graph (½) $d = (0·5 \times 9 \times 2) + (10 \times 9) + (0·5 \times 9 \times 1)$ (½) $d = 9 + 90 + 4·5$ $d = 103·5\ m$ (1)		2
(d)	$P = \frac{1}{f}$ (½) $P = \frac{1}{0·2}$ (½) $P = 5\ D$ (1)		2
			Total 8

2010 Physics Intermediate 2	
Sample Answer and Mark Allocation	**Notes**
21. (a) $a = \frac{v-u}{t}$ (½) $= \frac{6-0}{60}$ (½) $= 0{\cdot}1\ m/s^2$ (1)	
(b) s = area under graph (½) = $(0{\cdot}5 \times 60 \times 6) + (40 \times 6)$ (½) = 420 m (1)	
(c) $v = \frac{s}{t}$ (½) $= \frac{420}{100}$ (½) $= 4{\cdot}2\ m/s$ (1)	
(d) W = mg (½) = 400×10 (½) = 4000 N (1)	accept 9·8 and 9·81 for 'g' which give 3920 N and
(e) F = ma (½) = $400 \times 0{\cdot}1$ (½) = 40 (N) (½) Upward force = 4000 + 40 (½) = 4040 N (1)	must be consistent with (a) and (d)

Page 4

2012

22.	(a)	Car continues at a <u>constant speed</u> during this time. AB represents driver's reaction time OR the forces are balanced (or equivalent).	(1) (1)	Must describe constant speed to get second
	(b)	$E = \frac{1}{2}mv^2$	(½)	
		$= 0.5 \times 700 \times 30^2$	(½)	If 30 without squaring symbol is used – stop
		$= 315{,}000\,J$	(1)	320 000 J OK
	(c)	$315{,}000\,J$	(1)	Answer must be consistent with (b)
	(d)	$a = \frac{v-u}{t}$	(½)	
		$= (0-30)/2.5$	(½)	$= (30-0)/2.5$ If used = minus (½)
		$(-)12\,(m/s^2)$	OR (½)	
		$F = ma$	(½)	
		$= 700 \times 12$	(½)	
		$= 8400\,N$		If F = 8400 N not stated minus ½
		$d =$ area under graph	(½)	a.u.g. or implied
		$= 0.5 \times 2.5 \times 30$	(½) OR	
		$= 37.5\,(m)$	(½)	
		$E_W = Fd$	(½)	
		$315{,}000 = F \times 37.5$	(½)	If F = 8400 N not stated minus ½
		$F = 8400\,N$		

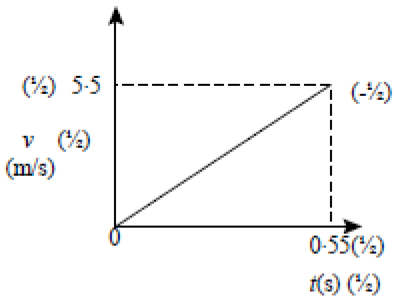
2011

Sample Answer and Mark Allocation					Notes
22.	(a)	(i)	Acceleration is the change of velocity (not speed) in unit time	(1)	Need to be indication of time requirement. No (½).
		(ii)	Direction of satellite is (continually) changing **OR** Velocity of satellite is (continually) changing **OR** There is an unbalanced (not 'resultant') force on the satellite	(1) (1) (1)	
	(b)		$F = 12 - 2 = 10$ N $F = ma$ $\therefore 10 = 50a$ $a = 0{\cdot}2$ m/s^2 Direction is right	(1) (½) (½) (½) (½)	No attempt to calculate F ½/3 for formula

2009

Sample Answer and Mark Allocation				**Notes**
22.	(a)	$a = \frac{(v-u)}{t}$ **OR** $a = \frac{\Delta v}{t}$ $a = \frac{(3-0)}{5}$ $a = 0{\cdot}6\ \text{m/s}^2$	(½) (½) (1)	m/s^{-2}, mp/s^2, m/s/s } (-½)
	(b)	$F = ma$ $F = 40 \times 0{\cdot}6$ $= 24\ \text{N}$	(½) (½) (1)	
	(c)	There is an unbalanced force/friction, this acts against the motion. (must have some mention of opposing the motion) Ignore mention of component of weight	(1) (1)	

2011

21. (a)	$s = vt$ $t = \frac{11}{20}$ $= 0{\cdot}55$ s Accept 0·6 s	(½) (½) (1)	Accept $D = ST$ on its own for ½ mark
(b)	$= \frac{v-u}{t}$ $v = 10 \times 0{\cdot}55$ $= 5{\cdot}5$ m/s Accept 6 m/s	(½) (½) (1)	g = 9·8 → 5, 5·4, 5·39 g = 9·81 → 5, 5·4, 5·40, 5·396
(c)	 (½) for each axis (-½) if no origin (-½) for inappropriate line		Figures on axis must be consistent with parts (a) an s vs t → No marks
(d)	s = area under graph (½) **OR** $s = \bar{v}t$ (½)* $s = \frac{1}{2} \times 0{\cdot}55 \times 5{\cdot}5$ (½) $s = \left(\frac{5{\cdot}5}{2}\right) \times 0{\cdot}55$ (½) $s = 1{\cdot}5$ m (1)* $s = 1{\cdot}5$ m (1)*	(½) (½) (1)	*Accept 2, 1·5, 1·51, 1·513 *Must be $s = \bar{v}t$. No other symbols

2013

	(a)		A contestant has a mass of 60 kg. He runs off the platform with a horizontal velocity of 2 m/s. He takes 0·75 s to reach the water surface in the centre of the ring.		
		(i)	Calculate the horizontal distance X from the poolside to the centre of the ring. $d = vt$ (½) $d = 2 \times 0{\cdot}75$ (½) $d = 1{\cdot}5$ m (1)		2
		(ii)	Calculate the vertical velocity of the contestant as he reaches the water surface. $a = \frac{v - u}{t}$ (½) $10 = \frac{v - 0}{0 \cdot 75}$ (½) $v = 7{\cdot}5$ m/s (1)	If 9.8 used 7.35, 7.4 If 9.81 used 7.358, 7.36, 7.4	2

Question			Sample Answers and Mark Allocation	Notes	Inner Margin	Outer Margin
	(b)		Another contestant has a mass of 80 kg. Will she need to run faster, slower or at the same horizontal speed as the first contestant to land in the ring? You must explain your answer. **Same** (1) **All objects fall with the same (vertical) acceleration.** (1)	Must have explanation to get first mark Will take the same time to reach the water	2	6

Space Exploration.

Cosmology

2008

Sample Answer and Mark Allocation					Notes	Marks
23.	(a)	(i)	$E_w = F \times d$ $E_w = 300 \times 1{\cdot}5$ $E_w = 450$ J	(½) (½) (1)		2
		(ii)	$E = 450 \times 500 = 225000$ J $P = \frac{E}{t}$ $P = \frac{225000}{5 \times 60}$ $P = 750$ W	(1) (½) (½) (1)		3
	(b)	(i)	$E = c\,m\,\Delta T$ $450 \times 500 = 902 \times 12 \times \Delta T$ $\Delta T = 20.787$ $= 21$°C	(½) (½) (1)		2
		(ii)	energy is lost <u>to the surrounding air</u>	(1)		1
						Total 8

2008

Sample Answer and Mark Allocation					Notes	Marks
24.	(a)	$E_p = mgh$ $E_p = 750 \times 10 \times 7{\cdot}2$ $E_p = 54000$ J		(½) (½) (1)		2
	(b)	(i)	54000 J	(1)		1
		(ii)	$E_K = \frac{1}{2}mv^2$ $54000 = 0.5 \times 750 \times v^2$ $v = 12$ m/s	(½) (½) (1)		2
						Total 5

2012

Sample Answer and Mark Allocation					Notes
23.	(a)	(i)	$E_p = mgh$	(½)	
			$= 0.50 \times 10 \times 19.3$	(½)	Accept g = 9.8 ; 9.81; s.f. accept 2 more or 1 less
			$= 96.5\ \text{J}$	(1)	97 J OK
		(ii)	$E_H = cm\Delta T$	(½)	
			$96.5 = 386 \times 0.50 \times \Delta T$	(½)	E_H must be consistent with (i). If any other value c (½) for formula.
			$\Delta T = 0.5°\ \text{C}$	(1)	
		(iii)	Less than. Some heat is lost to surroundings/ or equivalent.	(1) (1)	If 'less than' is on its own = 0 marks. 'Less than' plus wrong explanation = 1 mark. 'Heat qualified. Qualified sound loss OK eg on hitting the ground
	(b)		$E_h = ml$	(½)	
			$= 0.50 \times (2.05 \times 10^5)$ (½) (1)		If wrong value from same table for latent heat of fu 1. Any other value used = (½) for formula.
			$= 102\,500\ \text{J}$	(1)	100 000 J, 103 000 J OK

2009

21. (a) $E_p = mgh$ (½) $= 2000 \times 10 \times 540$ (½) $= 10800000$ J ($1{\cdot}08 \times 10^7$ J) (1)		If 9·8 used: $E_p = 10584000$ (accept) $= 1{\cdot}06 \times 10^7$ J $E_p = E_{ptop} - E_{pbottom}$ $= 2000 \times 10 \times 540 - 2000 \times 10 \times 0$ $= 10800000 - 20000$ (-½ for arith) $= 10780000$ J [1×10^7, $1{\cdot}1 \times 10^7$ V]
(b) $E_k = \frac{1}{2}mv^2$ (½) $64000 = 0{\cdot}5 \times 2000 \times v^2$ (½) $v^2 = 64$ $v = 8$ m/s (1)		$v = \sqrt{2gh} = 0$ mps is incorrect unit
(c) (i) $P = IV$ (½) $45600 = I \times 380$ (½) $I = 120$ A (1) (Amps) (Amperes) (ii) $E = Pt$ (½) $= 45600 \times 60 \times 60$ (½) $= 1{\cdot}64 \times 10^8$ J (1) (sig fig range $1{\cdot}6 \times 10^8$, $1{\cdot}64 \times 10^8$, $1{\cdot}642 \times 10^8$, $1{\cdot}6416 \times 10^8$)		(-½) for incorrect power conversion (-½) for incorrect time conversion and/or (-½) for incorrec conversion

$E_w = Fd$ (½) $E_w = 250 \times 4{\cdot}5$ (½) $E_w = 1125$ J (1)		2	$E_p = mgh$ $E_p = 144 \times 10 \times 0{\cdot}75$ $E_p = 1080$ J

$\text{percentage efficiency} = \frac{\text{useful } E_o}{E_i} \times 100$ (½) $\text{percentage efficiency} = \frac{1080}{1125} \times 100$ (½) percentage efficiency = 96% (1)	Must be consistent with (a) and (b) (94% if 9·8(1) used)	2	6

2013

(a)		State what is meant by the term voltage. **(The voltage of a supply is a measure of) the energy given to the charges in a circuit.** *(1)*	Don't accept energy per electron Do accept: energy given to electrons energy per coulomb energy per charge

(b)	**(i)**	Calculate the input current. $I = P/V$ *(½)* $= 1196/230$ *(½)* $= 5{\cdot}2$ **A** *(1)*	Accept Amps

	(ii)	The microwave is used to heat a cup of milk for 1 minute 30 seconds. Calculate how much electrical charge passes through the flex in this time. $Q = It$ *(½)* $= 5{\cdot}2 \times (60 + 30)$ *(½)* $= 468$ **C** *(1)*	Must be consistent with (b) (i)

2008

Sample Answer and Mark Allocation					Notes	Marks
25.	(a)	$P = I^2 R$		(½)		
		$2 = I^2 \times 50$		(½)		
		$I^2 = 0{\cdot}04$				
		$I = 0{\cdot}2\ A$		(1)		2
	(b)	(i)	$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2}$	(½)		
			$\frac{1}{R_t} = \frac{1}{60} + \frac{1}{30}$	(½)		
			$R_t = 20\ \Omega$	(1)		2
		(ii)	$P = \frac{V^2}{R}$	(½)	½ for equation <u>once</u> only.	
			$P = \frac{9^2}{60}$	(½)	½ for both substitutions.	
			$= 1{\cdot}35\ W$	(1)		
			$P = \frac{V^2}{R}$	(½)		
			$P = \frac{9^2}{30}$	(½)		
			$= 2{\cdot}7\ W$	(1)		3
		(iii)	30 ohm resistor will overheat	(1)		1
	(c)	none		(1)		1
						Total 9

2013

Lamp A	*(1)*		
It has the lowest resistance/highest current/greatest power	*(1)*	one of three	2

$P = V^2/R$	*(½)*	V = I R and P = I V (½)	
$= 24^2/2{\cdot}5$	*(½)*	(I = 9.6 A)	
= 230 W	*(1)*	230·4 W	2

		1

(i)	State the voltage across the motor.		
	12 V	1 or 0 unit required	1

$1/R_p = 1/R_1 + 1/R_2$	*(½)*		
$= 1/8 + 1/24$	*(½)*	-½ if rounding within calculation	
$= 4/24$			
$R_p = 24/4$			
$= 6\ \Omega$	*(1)*		2

The motor speed will reduce ***(1)*** **The (combined) resistance (of the circuit) is now higher/current is lower.** **Voltage across motor is less** **Motor has less power** ***(1)***	any one of four	**2**	**10**

2013

(a)	(i)	Name component X. **X = (NPN) transistor**	0 marks for MOSFET or PNP transistor	1
	(ii)	What is the purpose of component X in the circuit? **To act as a switch**	To turn on the buzzer 0 marks To operate the buzzer 0 marks	1
(b)		The darkroom door is opened and the light level increases. Explain how the circuit operates to sound the buzzer. **Resistance of LDR reduces** *(½)* **so voltage across LDR reduces** *(½)* **Voltage across variable resistor/R increases** *(1)* **When voltage across variable resistor/R reaches (0·7 V) transistor switches buzzer on.** *(1)*	Accept 'when voltage is high enough'	3
		80 units: resistance of LDR = 2500 (Ω) *(½)* **Total resistance = 2500 + 570** **= 3070 (Ω)** *(½)* ------------------------------------ $I = V/R$ *(½)* **= 5/3070** *(½)* **= 1·63 × 10^{-3} A or 1·63 mA** *(1)*	1·6 mA 1·63 mA 1·629 mA	3

2009

25. (a) (i) I = 0·075 A (1)	
$V = IR$ (½) $4{\cdot}2 = 0{\cdot}075 \times R$ (½) $R = 56\ \Omega$ (1)	
(ii) stays the same (1) $\frac{1{\cdot}3}{0{\cdot}023} = 56{\cdot}5 \quad \frac{3{\cdot}6}{0{\cdot}064} = 56{\cdot}25$ (1) or as the voltage increases the current increases by the same ratio or because it's a straight line <u>through the origin</u>	incorrect conclusion = 0 marks must have an attempt at justification 1 correct calculation enough for 1 mark (Not enough to say voltage increases at the current increase
(b) (i) $R_t = R_1 + R_2$ (½) $= 270 + 390$ (½) $= 660\ \Omega$ (1) (ii) $\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2}$ (½) $= \frac{1}{33} + \frac{1}{56}$ (½) $= 0{\cdot}048$ $R_t = 20{\cdot}76\ \Omega$ (1) (sig fig range 20 Ω, 21 Ω, 20·8 Ω, 20·76 Ω)	must have calculation for both (i) and (ii) no calculations = 0 (-½) for 0·048 = 20·76 Ω

2010

24.	(a)	$R_T = R_1 + R_2 = 8 + 24 = 32\ \Omega$	(1)
		$V = IR$	(½)
		$I = \frac{6}{32}$	(½)
		$I = 0{\cdot}19\ A$	(1)
	(b)	$V_2 = \left(\frac{R_2}{R_1 + R_2}\right) V_S$	(½)
		$V_2 = \left(\frac{8}{8+24}\right) 6$	(½)
		$V_2 = 1{\cdot}5\ V$	(1)
		OR	
		$V = IR$	(½)
		$= 0{\cdot}19 \times 8$	(½)
		$= 1{\cdot}5\ V$	(1)
	(c)	Voltage across 8 Ω resistor would decrease	(1)
		The 8 Ω resistor now has a smaller proportion of the total resistance or less current in the circuit	(1)

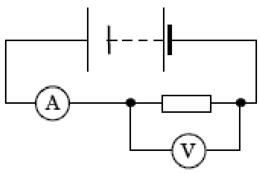
2011

25.	(a)	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$	(½)
		$= \frac{1}{4} + \frac{1}{2}$	(½)
		$\therefore R_T = 1{\cdot}3\ \Omega$	(1)
		Accept 1 Ω, 1·33 Ω, 1·333 Ω	
	(b)	$R_T = R_1 + R_2$	(½)
		$= 1{\cdot}3 + 6$	(½)
		$= 7{\cdot}3\ \Omega$ Consistent with (a)	(1)
		Accept 7·3 Ω, 7·33 Ω, 7·333 Ω	
	(c)	(Voltage across 2 Ω resistor = Voltage across 4 Ω resistor)	
		$V = IR$	(½)
		$= 0{\cdot}1 \times 4$ (or $0{\cdot}2 \times 2$)	(½)
		$= 0{\cdot}4\ V$	(1)
		(½) max, if divide final answer by 2	

2011

27.	(a)	To reduce <u>current</u> in LED **OR** To reduce <u>voltage</u> across LED **OR** To reduce <u>power</u> to LED	(1)
	(b)	$V = 6 - 2 = 4\text{ V}$	(1)
		$V = IR$	(½)
		$\therefore R = \frac{4}{0{\cdot}1}$	(½)
		$= 40\ \Omega$	(1)
	(c)	$P = I^2R$ $P = V^2/R$	(½)
		$= (0{\cdot}1)^2 \times 40$* $= 16/40$*	(½)
		$= 0{\cdot}4\text{ W}$ $= 0{\cdot}4\text{ W}$	(1)
		*Must be consistent with (b) $P = IV$	
		$= 0{\cdot}1 \times 4 = 0{\cdot}4\text{ W}$	

2012

24.	(a)			(½) mark each symbol (½) for position of each meter (voltmeter across battery = OK) One cell drawn - unacceptable 6V label not needed	(2) (1)
	(b)	$V = IR$	(½)		
		$5.7 = 0.60 \times R$	(½)		
		$R = 9.5\ \Omega$	(1)	10 Ω OK	
	(c)	$P = VI$	(½)	$P = \frac{V^2}{R}$ or $P = I^2R$ OK	
		$P = 5.7 \times 0.60$	(½)	Values must be consistent with (b).	
		$P = 3.42\text{ W}$	(1)		
		This is greater than the 3W or labelled power rating (so it overheats).	(1)		

2011

28 (a) (i) $P = IV$ (½) $= 0{\cdot}4 \times 10^{-3} \times 0{\cdot}5$ (½) $= 2 \times 10^{-4}$ W (1) (ii) $\frac{4\times10^{-3}}{2\times10^{-4}}$ (1) $=$ 20 (cells) * (1) *Must be consistent with (a) (i)		*Must be whole number rounded up -½ if not
(b) Light → electric (al) Not 'electricity' (1) -or "to", but something needed (not just two words)		No (½) marks

2009

24. (a) $E_h = cm\Delta T$ $= 4180 \times 0{\cdot}1 \times 15$ $= 6270$ J	(½) (½) (1)	If 4180 not used then (½) max for formula ignore negative energy
(b) $E_h = ml$ $= 0{\cdot}1 \times 3{\cdot}34 \times 10^5$ $= 3{\cdot}34 \times 10^4$ J	(½) (½) (1)	If $3{\cdot}34 \times 10^5$ not used then (½) max for formula
(c) (i) 33400 + 6270 = 39670 J	(1)	must be consistent with (a) and (b)
$E = Pt$ $39670 = 125 \times t$ $t = 317{\cdot}(36)$ s	(½) (½) (1)	must have added (a) and (b). If not max (½) for formula (no secs)
(ii) Heat energy will be gained from surroundings/other food etc More energy must be removed	(1) (1)	

2010

23. (a) $E_h = cm\Delta T$ $c = \dfrac{2{\cdot}59 \times 10^7}{60 \times [\,(307 - (-173))\,]}$ $= 899$ J/kg°C	(½) (½) (1)
(b) $P = \dfrac{E}{t}$ $t = \dfrac{2{\cdot}59 \times 10^7}{1440}$ $= 18000$ s	(½) (½) (1)
(c) $\dfrac{288000}{1440}$ = 200 (rocks)	(1) (1)
(d) It would be easier Gravitational field strength at the surface of Mercury is less than that at the surface of Earth OR Weight of rocks on Mercury is smaller than their weight on Earth OR Gravity is less on Mercury	(1) (1)

2011

24.	(a)	(i)	$(33-21) = 12\ °C$	(1)	*Must be consistent with parts (i) + (ii)
		(ii)	$(120{,}000-12{,}000) = 108{,}000\ J$	(1)	
		(iii)	$E_h = cm\Delta T$	(½)	
			$108{,}000 = c \times 2{\cdot}0 \times 12$	(½)	
			$c = 4{,}500$ J/kg °C* (not J/kg/°C)	(1)	
	(b)	(i)	Measured value of E_h too large OR ΔT too small	(1)	
			Heat lost to surroundings (or similar) * OR water not evenly heated (or similar) †	(1)	*to air, from water, from equipment etc † or immersion heater not fully immersed Explanation must be offered
		(ii)	Insulate beaker OR Put lid on beaker OR Stir water OR Fully immerse heater	(1)	
	(c)		$E = Pt$	(½)	*If no conversions answer is 21,600. Also accept 22,000
			$108{,}000† = P \times 5 \times 60$	(½)	† must be consistent with (a) (ii) or wrong physics
			$P = 360$ W*	(1)	

2013

(a)		State what is meant by the term voltage. **(The voltage of a supply is a measure of) the energy given to the charges in a circuit.** *(1)*	Don't accept energy per electron Do accept: energy given to electrons energy per coulomb energy per charge	**1**
(b)	(i)	Calculate the input current. **$I = P/V$** *(½)* **$= 1196/230$** *(½)* **$= 5{\cdot}2$ A** *(1)*	Accept Amps	
	(ii)	The microwave is used to heat a cup of milk for 1 minute 30 seconds. Calculate how much electrical charge passes through the flex in this time. **$Q = It$** *(½)* **$= 5{\cdot}2 \times (60 + 30)$** *(½)* **$= 468$ C** *(1)*	Must be consistent with (b) (i)	
	(iii)	The milk of mass 0·25 kg absorbs 48 kJ of energy during the heating process. The specific heat capacity of milk is 3900 J/kg °C. Calculate the temperature rise in the milk. **$E = mc\Delta T$** *(½)* **$48000 = 0{\cdot}25 \times 3900 \times \Delta T$** *(½)* **$\Delta T = 49{\cdot}2^{\circ}$ C** *(1)*	49, 50, 49.23	