Rewarding Learning

General Certificate of Secondary Education
2010–2011

Science: Double Award (Modular)

Forces and Energy
End of Module Test

Higher Tier

[GDC02]

FRIDAY 20 MAY 2011, AFTERNOON

MARK SCHEME

			AVAILABLE MARKS
1	**(a)** Air is trapped [1] which is a (good) insulator [1] } Mark independently	[2]	
	(b) **(i)** Metal	[1]	
	(ii) Best conductor of heat [1] } dependent marking on **b(i)**	[1]	4
2	**(i)** C	[1]	
	(ii) All bodies fall at the same rate (under gravity) [1] **or** they are in free fall } dependent marking for **(ii)**	[1]	
	(iii) Feather	[1]	3
3	**(a)** Efficiency $= \frac{\text{useful output energy}}{\text{input energy}}$ [1]		
	$= \frac{1200}{3000}$ [1]		
	$= 0.4$ or 40% [1]	[3]	
	(b) $\frac{3}{5}$ or 60% or 0.6 [1] allow e.c.f. from **(a)** or equivalent	[1]	4
4	**(a)** 20 (m)	[1]	
	(b) Speed = Gradient or $\frac{\text{distance}}{\text{time}}$ [1]		
	$= \frac{60}{8}$ [1] or equivalent fraction		
	$= 7.5$ [1] (m/s)	[3]	4
5	**(a)** **(i)** 6 (mm)	[1]	
	(ii) Extension	[1]	
	(b) Extended length = 16 [1] (mm) or from graph		
	Load = 4 [1] (N)	[2]	4

		AVAILABLE MARKS
6	**(a)** Work done = Force × distance or equivalent [1]	
	= 25 000 × 1.5 [1]	
	= 37 500 [1] (J) [3]	
	(b) Power = $\frac{\text{work done}}{\text{Time taken}}$ [1]	
	= $\frac{42\,000}{30}$ [1]	
	= 1400 [1] (W) [3]	6

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Energy source	Highest decommissioning costs	Lowest operating costs	Fossil fuel which responds most quickly to demand	Contributes most to the greenhouse effect
Gas			✓	
Hydroelectric		✓		
Coal				✓
Nuclear	✓			

[1] per row [4] 4

8	**(a)** (A gains heat) by convection [1] and radiation [1] **or** B gains heat by radiation [1] only [1] [2]	
	(b) **(i)** Equal (readings) [1] or same [1]	
	(ii) Heat transfer by convection needs a fluid [1] **or** no convection [1] **or** only radiation occurs **or** radiation only [1]	4
9	**(a)** **(i)** t = **450** to t = **550** [1]	
	(ii) t = **150** to t = **450** [1]	
	(b) Acceleration = Gradient [1] **or** $a = \frac{v-u}{t}$ or equivalent	
	= $\frac{30}{150}$ [1] or equivalent	
	= 0.2 [1] (m/s^2) [3]	5

			AVAILABLE MARKS
10	**(a)** 25 (N)	[1]	
	(b) ACM $=$ CM [1] or $F_1d_1 = F_2d_2$ $20 \times x = 5 \times 98$ [1] $\therefore \quad x = 24.5$ [1] (cm)	[3]	4
11	RF $=$ m $\times$ a [1] or F $=$ ma or equivalent 9000 [1] $=$ 3000 $\times$ a [1] Must have "=" for any subs. marks a $=$ 3 (m/s^2) [1]	[4]	4
12	**(i)** KE $=$ 1/2 m v^2 [1] or equivalent, e.g. $v = \sqrt{2KE/m}$ 50 $=$ 1/2 $\times$ 0.15 $\times$ v^2 or $v^2 = 666.6$ [1] v $=$ 25.8 [1] (m/s) or 26	[3]	
	(ii) 50 (J)	[1]	4
		Total	**50**