OCR

RECOGNISING ACHIEVEMENT

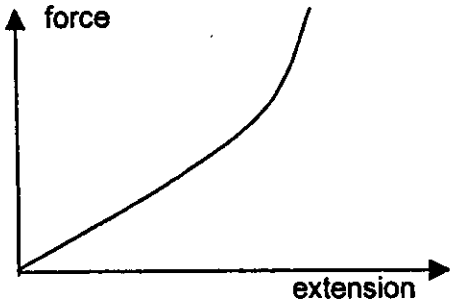
A2 UNIFYING CONCEPTS IN PHYSICS

Mark Scheme 2826/01
June 2004

1.	No reasoning – maximum 1	Ignore any sig. Fig./ discrepancy			
1 (a)	e.g. on a 13 fuse at 230 V		1		
	so could be 10 A × 230 V = 2300 W	allow 500 W – 350 W	1	2	
(b) (i)	e.g. Olympic 100 m in about 10 s		1		
	allow between 11 m s^{-1} and 7 m s^{-1}		1		
(ii)	e.g. 2 – 4 times faster than a good sprinter	allow 20 – 40 m s^{-1}	1		
	OR e.g. 70 mph = 110 kmph	110 000 / 3600 = 30 m s^{-1}			
(iii)	k.e. = ½ m v^2		1		
	e.g. mass = 70 kg ; k.e ½ × 70 × 10^2 = 3500 J	Allow 1000 J – 5000 J	1	5	
(c)	e.g. 60 W 240 V	therefore 0.25 A Max. current 2.5 A	1		
	R = 240 / 0.25 = 960 Ω	allow a wide range if correctly obtained	1	2	
(d)	mass of a molecule in the atmosphere about 30 u		1		
	mass of molecule = 30 × 1.66 × 10^{-27} kg = 5 × 10^{-26} kg		1		
	Number density = 2 × 10^{25}		1	3	12
	OR n = 1000 / 22.4		1		
	1 mole = 6.02 × 10^{23}		1		
	40 moles = 2 × 10^{25}		1		
2 (a)	velocity	NOT SPEED	1	1	
(b)	(electric) current		1	1	
(c)	acceleration		1	1	
(d)	activity	NOT COUNT RATE	1	1	
(e)	power		1	1	5

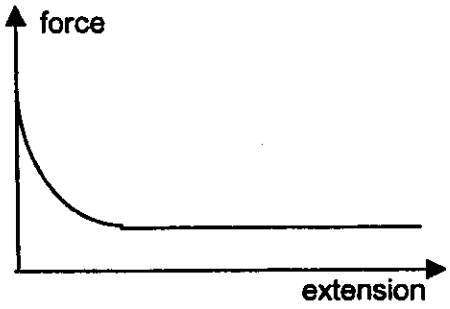
3 (a)	three different types as alpha, beta, and gamma	1		
	penetration through absorbers	1		
	Showing very different penetrations of the three types	1		
	Deflection experiments	1		
	In electric (or magnetic) fields	1		
	Showing alpha positive, beta negative and gamma uncharged	1		
	Other valid point MAXIMUM 5	1		5
(b) (i)	$7.7 \times 10^9 \times 6 \times 7 \times 24 \times 3600$ or similar must be seen ($= 2.79 \times 10^{16}$) ($7.7 \times 10^9 \times 3.63 \times 10^6$)	1		
	(ii) because the rate of decay has been assumed to be constant (for 6 weeks)	1		
	(iii) 1 mole contains 6.02×10^{23} molecules	1		
	$n = 2.8 \times 10^{16} / 6.02 \times 10^{23} = 4.6(5) \times 10^{-8}$	1		
	(iv) from the source itself (-ve charge left on source when alpha particle is ejected)	1		
	(v) conversion of 20 °C to 293 K	1		
	$p = nRT / V = 4.65 \times 10^{-8} \times 8.31 \times 293 / 0.000050$	1		
	$= 2.3$ (Pa)	1	8	
(d)	visible light therefore in range of 400 nm – 700 nm (Allow $10^{-7} \rightarrow 10^{-6}$ m)	1		
	Colour the same as helium	1		
	Position of lines characteristic of element	1	3	16
	OR reference to $E = hf$			

4 (a)



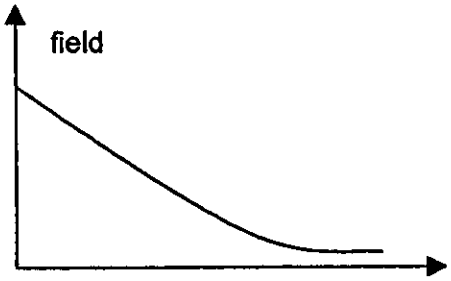
easy extension at start	1		
not much extension at end	1	2	

(b)

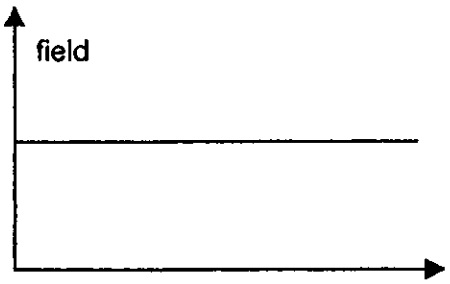


maximum starting force	1		
falling to its weight	1	2	

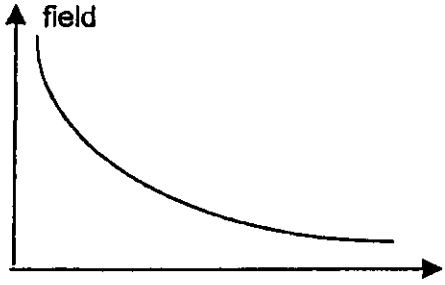
(c)



finite start (9.8 N kg^{-1})	1		
asympototic at the end	1	2	



constant	1		
throughout	1	2	



	1		
asymptotic at start			
asymptotic at end	1	2	10

5 (a) (I) electromagnetic (accept transverse)	1		
(ii) $\lambda = c/f = 3.0 \times 10^8 / 2450 \times 10^6$	1		
$= 0.122$ m	1	3	
(b) resonance	1	1	
(c) heat required = $mc\Delta\theta = 0.20 \times 4200 \times 80$	1		
$= 67\ 200$ J			
Time = 67200 / 600 = 112 s	1	2	
(d) 2 marks allowed for each bullet point with a maximum of 5 overall			
e.g. microwaves supply the energy direct to the molecules of the food			
heating takes place from within the food (as well as to its surface)			
surface heating of conventional cookers relies on slow conduction through the food.			
greater heat losses with conventional cooking			
conventional cooking supplies more heat to the pan itself			
the extra (double) power of the conventional ring has a greater effect because a considerable quantity of energy will be required			
a long time will be needed if only 600 watts are available			
effect of heating the saucepan is of less significance if there is a lot of food.	5	5	
(e) (i) 2 facts given about stationary waves	2		
e.g. a wave in which there are nodes and antinodes			
diagram to illustrate			
energy within the wave but not transmitted			
two waves of the same frequency travelling in opposite directions			
(ii) values of the frequency, the permeability of free space and the permittivity of free space			
inserted correctly into the equation	1		

	giving radius = 0.039 m	1		
(iii)	(80 cm diameter) would be far too large for a conventional microwave oven OR "larger"	1		
(iv)	suggestion using a plate with a (high) negative potential	1	6	11