OCR

RECOGNISING ACHIEVEMENT

UNIFYING CONCEPTS IN PHYSICS

Mark Scheme 2826/01
January 2005

Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit () = words which are not essential to gain credit ____ = (underlining) key words which **must** be used to gain credit *ecf* = *error carried forward* AW = alternative wording ora = or reverse argument

1	(a)	Impossible graph is A	1	
		The object is in two different places at the same time	1	2
		OR object requires infinite speed (during the vertical part of the graph only)		
	(b)	B.		
		The direction in which the object is travelling is suddenly reversed	1	
		This occurs when something hits a vertical wall	1	
		very large acceleration is required	1	
		example e.g. ball bouncing against a wall	1	
		OR tennis ball hit by tennis racket		3
		MAXIMUM 3		
		C.		
		acceleration going from zero to a high value	1	
		example e.g. letting go of a ball, dropping an egg	1	
		acceleration changes suddenly as the force holding the object in place is removed	1	3
		D.		
		e.g. constant force being applied drops to zero suddenly	1	
		example e.g. taking foot off car accelerator	1	
		OR ceasing to pedal bicycle		
		so zero subsequent acceleration	1	3
		[Overall		
		1 for explaining what is happening		
		1 for sensible example		
		1 for relating example to sketch graph]		

2	(a)	Kirchhoff's (first) law OR conservation of charge	1	
		for electric current into house must equal current out of house	1	
		need for difference in potential for a current	1	
		gas supply is used in the house (chemically)	1	
		waste gas (combustion products) go up the chimney	1	3
		MAXIMUM 3		
	(b) (i)	unit of Q/t is J s^{-1}		
		unit of A is m^2		
		unit of $(\theta_2 - \theta_2) / d$ is K m^{-1} (allow °C m^{-1})	1	
		reorganise to unit of k is J s^{-1} / m^2 K m^{-1}	1	
		unit of k = J s^{-1} m^{-1} K^{-1} OR W m^{-1} K^{-1} OR kg m s^{-3} K^1	1	3
	(ii)	Q/t = 0.35 x 12 x (22 – 8)/ 0.10	1	
		= 588 J s^{-1} or 588 (W)	1	2
	(c) (i)	$Q/t = I = V/R$ $R = \rho l/A$	1	
		$Q/t = AV/\rho l$	1	2
	(ii)	1. $(\theta_2 - \theta_2)$ OR temperature difference	1	
		2. $1/k$	1	2
	(d) (i)	$V/t = Ap/cl$ OR $m/t = Ap/cl$	1	
		where V/t is volume of gas per unit time		
		m/t is mass of gas per unit time		
		c is a constant and	1	
		p is the pressure (difference)	1	3
	(ii)	$V_1 /160 = 22^2/15^2$	1	
		V_1 = 160 x 484 /225 = 344 (cm^3 s^{-1})	1	2

3(a)	Force per unit (positive) charge (allow potential gradient)		1	1
(b)	A tangent to the curve at A away from the frame (NOT directly away from the rod)		1	1
(c)	negative			
	(induced) charge due to presence of + charge on rod (even though at zero potential)		1	1
(d)	ring approximately half way between 200 V and 300 V		1	1
(e) (i)	$E = \Delta V/d$		1	
	values e.g. 100 V across 0.7 cm	300 V across 2 cm	1	
	E = 100 / 0.007 = 14 000	300/0.02 = 15 000	1	
	V m^{-1} OR N C^{-1}		1	4
(ii)	Force = EQ		1	
	= 15 000 x 1.6 x 10^{-19} = 2.4 x 10^{-15}		1	
	to the left		1	3
(f)	e.g.			
		3 ceramic magnets	1	
		south poles inwards	1	
		top of a magnet between them	1	
		north pole upwards	1	3
		MAXIMUM 3		
(g)	e.g. <u>All matter has gravitational field towards it</u>		1	
	an object emitting gravitational field is impossible		1	
	long rectangular bodies are not found in space		1	
	gravitational field in the laboratory is mostly just that due to the Earth		1	
	this is just a parallel field		1	3
	2 reasons required up to two for each reason, properly explained			
		MAXIMUM 3		

4 (a)(i)	shortest: gamma	1	
	allow any wavelength between 10^{-12} and 10^{-16} (m)	1	
	longest: radio	1	
	allow any wavelength between 10^{2} and 10^{5} (m)	1	4
(ii)	candidates ratio e.g. $10^{4} / 10^{-14} = 10^{18}$	1	1
(iii)	e.g. $10^{18} = 2^{x}$	1	
	$x = 18/\lg 2 = 60$	1	2
(iv)	knowing equation and what each term means	1	
	e.g. $E = hc/\lambda = 6.63 \times 10^{-34} \times 3.0 \times 10^{8} / 10^{-14}$		
	$E = 2 \times 10^{-11}$	1	2
(b)	e.g. all are transverse waves	1	
	so all can be polarised (under suitable conditions)	1	
	all can travel in a vacuum	1	
	at the same speed	1	
	MAXIMUM 2 for first part		
	Discussion of other wave phenomena and how they change as wavelength changes		
	e.g. diffraction		
	refraction		
	or such things as		
	the sensitivity of the eye to certain wavelengths		
	photographic film for certain wavelengths		
	heating effect, particularly of infra-red		
	radio and its effect on electrons		
	quantum effects – minimal for radio, predominant for gamma		
	4 marks can be given as 2,2 or 2,1,1	4	6
	i.e. 2 topics dealt with fully or 1 topic dealt with fully and 2 topics outlined		