Mark Scheme 2826/01
June 2006

1.	**(a)**	use tape measure to find thickness of book	{1}		
		divide by number of sheets in book	{1}	[2]	
	(b)	count a (large) number of paperclips and divide total mass by the number	{1}	[1]	
	(c)(i)	(wrap tape measure around column to) find circumference	{1}		
		divide by π to get diameter	{1}	[2]	
	(ii)	(parallax) problem in lining up tape markings with ends of diameter	{1}	[1]	
	(d)(i)	measure size of one (or a few) paving slabs or kerb stones	{1}		
		count number of slabs and multiply number of slabs by size of each	{1}	[2]	
		OR by repeated measurements {1} for statement and {1} for indication of use of assistant or careful marking. Maximum 1 for pacing			
	(ii)	time car over measured distance and divide distance by time	{1}		
		accuracy of obtaining position of car against distance measured	{1}	[2]	10
2	**(a)**	coulomb	{1}	[1]	
	(b)	farad	{1}	[1]	
	(c)	hertz	{1}	[1]	
	(d)	pascal OR newton per square metre	{1}	[1]	
	(e)	newton per kilogram	{1}	[1]	
	(f)	weber	{1}	[1]	
	(g)	becquerel	{1}	[1]	7
3	**(a)(i)**	use of area beneath graphs	{1}		
		acceleration section 125 m and deceleration section 50 m	{1}		
		constant velocity sections and total 50 m + 200 m + 125 m + 50 m = 425 m	{1}	[3]	
	(ii)	2 straight line sections correct	{1}		
		2 acceleration / deceleration sections correct	{1}		
		smooth transition between sections OR zero speed at end	{1}	[3]	
	(b)(i)	at least three points correctly calculated and drawn	{1}		
		straight line towards origin	{1}	[2]	
	(ii)	240 (V)	{1}	[1]	
	(iii)	gradient is reciprocal of the e.m.f.	{1}	[1]	
	(c)(i)	e.g. $\frac{0.18-1.16}{7.2-6.7}=-\frac{0.98}{0.5}=-1.98$ correct approach for gradient	{1}		
		1.96, 1.97, 1.98 as values for accuracy mark	{1}		
		– sign scores 1	{1}	[3]	

(ii)	$g \alpha 1/r^2$ OR g inversely proportional to the square of the distance from the centre of the Earth	{1}	[1]	14

4. **(a)** solid → liquid

not much change in separation	{1}	
increase in speed only associated with increase in temperature	{1}	
more random movement in liquids	{1}	
more vibration in solids	{1}	
some change in p.e. component of internal energy	{1}	
other sensible suggestion	{1]	
MAXIMUM 4		[4]

liquid → gas

separation vastly increased	{1}	
speed in, say water at 100 °C = speed in steam at 100 °C	{1}	
molecules in gas have random movement	{1}	
increased distance of travel (between collisions)	{1}	
p.e. component of internal energy increased (to nearly zero)	{1}	
MAXIMUM 4		[4]

solid → liquid compared with liquid → gas

solid → liquid takes place at lower temperature	{1}	
speed of molecules less	{1}	
smaller increase in internal energy	{1}	
change of state in both cases	{1}	
MAXIMUM 2		[2]
OVERALL MAXIMUM 9		

(b)	less energy at 200 K than at 200 000 000 K	{1}		
	at 200 K hydrogen gas is in molecular form	{1}		
	2 atoms per molecule, each atom 1p and 1e	{1}		
	at 200 000 000 K hydrogen is a plasma	{1}		
	no molecular form OR enough energy to separate atoms / electrons	{1}		
	electrons separated from protons OR a soup of electrons and protons	{1}		
	fusion possibility between protons (to make He)	{1}		
	MAXIMUM 3		[3]	12

5. **(a)** e.g. gaining dirt/ moisture from the atmosphere {1}

e.g. cleaning, scratching, dropping {1} [2]

do not allow change in temperature or change in pressure

(b) 1 part in 10^9 {1}

percentage uncertainty = 10^{-7} ALLOW ecf to this part from incorrect 1st line {1} [2]

(c) **(i)** volume = $4\pi r^3/3$ {1}

= $4\pi x\ 0.0470^3/3$ = (0.0004349) {1}

density = mass / volume ALLOW ecf to this part from incorrect volume {1}

= 1/0.0004349 = 2299 (kg m^{-3}) {1} [4]

(ii) uncertainty in volume is three times uncertainty in diameter {1}

uncertainty in diameter needs to be to 2/3 parts in 10^8 {1} [2]

(d) e.g the mass of impurity atoms will be different {1}

so dividing 1 kg by the number of silicon atoms will be incorrect {1}

OR if the structure is not regular then there will be spaces where atoms ought to be {1}

so the number of atoms assumed to be present will be incorrect {1}

i.e. {1} for the idea and {1} for its consequence [2]

(e) **(i)** atoms with the same number of protons (in the nucleus) but with different numbers of neutrons {1} [1]

(ii) the mass of each of the isotopes is different {1}

so the average mass of a silicon atom can only be known accurately if the proportions of each of the three isotopes is known {1} [2]

(iii) e.g. the isotopes cannot be separated by conventional (chemical) methods {1}

mass spectrometer/ diffusion methods might have to be used to separate the isotopes{1}

separation has to depend only on the atoms difference in mass {1} [2] 17

MAXIMUM [2]

[Total : 60]