GCSE Science - Physics 1

Marking Scheme - Summer 2014

HIGHER TIER

Question				Marking details	Marks
1.	(a)	(i)		Alpha / α / helium nucleus	1
		(ii)		1 000 [counts per minute]	1
		(iii)		1 000 [counts per minute]	1
	(b)	(i)		Plots (allow ± ½ small square division) (2) -1 for each error to a maximum of 2 <u>Smooth curve between 10 and 50 mm</u> allow ± ½ small square division (1) **Don't allow** wispy, wobbly, thick, double lines	3
		(ii)		As the thickness increases, the counts per minute (count rate) decreases (1) in smaller and smaller intervals / at a decreasing rate (1) **Treat as neutral:** in a non-linear way **or** gradient decreases as the thickness increases **ecf** from graph **Award 2 marks for:** every 10 mm the count rate halves	2
		(iii)	(I)	1 000 (1) but not on answer line ¼ expressed in any terms **or** 0.25 (1) **Accept** 25%	2
			(II)	125 (1) [counts per minute] The count rate halves every 10 mm (1) **Accept** is a quarter of the 40 mm value **or** half the 50 mm value **Or** extrapolated graph (1) value between 50 – 200 (1)	2
				Question total	**[12]**
2.	(a)	(i)		**Indicative content:** Mass of measuring cylinder (from the first diagram)= 112 g Mass of measuring cylinder + liquid(from the second diagram)= 172 g Volume of liquid (from the third diagram) = 75 cm^3 Mass of liquid = 60 g $\text{density} = \dfrac{\text{mass}}{\text{volume}} = \dfrac{60}{75} = 0.8 \text{ g/cm}^3$ **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.	6

Question				Marking details	Marks
		(ii)		**3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit. **Any 2 ×(1) from:** • Better resolution / more precise / smaller increments / smaller divisions on balance / cylinder • Use a cylinder that measures to the nearest ml • Use a balance that measures to 1 decimal place • Take measurements at eye level • Bigger volume (amount) of liquid • Use a pipette **or** burette **or** volumetric flask **or** syringe • Take repeat readings with different volumes of oil	2
(b)	(i)		(I)	1.4 MW (**unit with answer** for the mark)	1
			(II)	Density is bigger **accept** density of air is smaller	1
		(ii)		Water flow / tides (**NOT** waves) is more constant / more regular / more reliable (1) <u>so</u> the power output is more constant (1) **Alternative:** Water turbines are below the water / out of sight (1) <u>so</u> visual / noise pollution is less (1) **Alternative:** Water turbines are <u>smaller</u> (1) <u>so</u> cheaper to build / can be sited more densely / sited in shallow water / less harmful to wildlife (1) **To award both marks both statements must be linked.**	2
				Question total	**[12]**

Question				Marking details	Marks
3.	(a)			Units used = 1.5 ((1) for conversion)	4
				×(8 × 14) **or** 112 (1) = [168]	
				Cost = units used × cost per unit	
				2 520 = 168 **(ecf)** × cost per unit	
				Cost per unit = $\dfrac{2520}{168}$ ((1) substitution and manipulation)	
				= 15 [p] ((1) for answer)	
				Answer of £15 p loses the answer mark	
				N.B.1. Failure to convert 1 500 W to 1.5 kW loses conversion mark and gives an answer of 0.015 p – **Award 3 marks**	
				N.B.2. Failure to convert £25.20 to 2 520 p gives an answer of 0.15 p - **Award 3 marks**	
				N.B.3. Failure to include 8 or 14 loses 2nd mark only and gives an answer of 1.875 p (accept 1.88 or 1.9) and 1.071 p (accept 1.1) respectively. **Award up to the 3 other marks**	
				N.B.4. Failure to include 1.5 gives an answer of 112 units and a cost of 22.5 p – **Award 3 marks**	
				N.B.5. Failure to convert to 1.5 kW and failure to convert to 2 520 p gives an answer of 0.00015 p – **Award 2 marks**	
	(b)			$E = P \times t = 1\,500 \times 14 \times 8$ **or** 168 000 (1)	2
				60 × 60 **or** 3 600 (1)	
				[= 604 800 000 J]	
				N.B. Award **1 mark** only for:	
				28 800, 50 400, 403 200, 5.4×10^6, 43.2×10^6, 75.6×10^6, 5.4×10^3, 43.2×10^3, 75.6×10^3	
				Question total	**[6]**

Question				Marking details	Marks
4.	(a)	(i)		Output power = 99% × 2 ×10^9 = 1.98 × 10^9 [W]	1
		(ii)		Input Voltage = $\dfrac{P}{I} = \dfrac{2 \times 10^9}{4 \times 10^4}$ (1) for substitution 5 × 10^4 [V] (1) Output voltage = 8 × (5 × 10^4) **(ecf)** = 4 × 10^5 [V] (1) Output current = $\dfrac{1.98 \times 10^9}{4 \times 10^5}$ **(ecf on both values)** = 4.95 × 10^3 [A] (1) for answer **Alternative:** **Award 2 marks for:** Output current = Input current ÷8 = 5 × 10^3 [A] **Then award another 2 marks for**: 5 × 10^3 × 99% = 4.95 × 10^3 [A]	4
	(b)			[Step-up] transformer reduces the current **or** makes the current low[er] / increases the voltage **or** makes the voltage high[er] (1) to <u>reduce</u> energy / heat losses [in the cables] / increase efficiency (1). **To award both marks both statements must be linked.** [Step-down] transformers reduce the voltage (1) to a safe[r] level (1). **To award both marks both statements must be linked.**	4
				Question total	**[9]**

Question				Marking details	Marks
5.	(a)	(i)		Straight line / as one increases the other increases at a steady rate / goes up in equal steps (1) through the origin (1). **Award 2 marks for** doubling the velocity doubles the distance.	2
		(ii)		Age of universe will be bigger (1). [Value of constant will decrease] meaning the gradient is lower (1). **To award both marks both statements must be linked.**	2
	(b)			4×10^8 (1) $\times 9.5 \times 10^{12} = 3.8 \times 10^{21}$ [km] (1) If 10^8 is omitted **award 1 mark for** answer of 3.8×10^{13}	2
	(c)			Wavelength = (669.4 – 13.1) nm = 656.3 nm (1) = 656.3×10^{-9} m (1) for conversion $c = f \lambda$ so $f = \dfrac{c}{\lambda}$ (1) for manipulation $= \dfrac{3 \times 10^8}{656.3 \times 10^{-9}}$ (1) for substitution $= 4.571 \times 10^{14}$ [Hz] (1) N.B.1. If nm is not converted to m then: $\lambda = 656.3$ (1) and $f = \dfrac{c}{\lambda}$ (1- manipulation) $= \dfrac{3 \times 10^8}{656.3}$ (1-substitution) $= 4.571 \times 10^5$ [Hz] (1) **so award 4 marks.** N.B.2. If 13.1 is <u>added</u> then: $\lambda = 682.5$ nm(no mark) $= 682.5 \times 10^{-9}$ m (1-conversion) and then $f = \dfrac{c}{\lambda}$ (1- manipulation) $= \dfrac{3 \times 10^8}{682.5 \times 10^{-9}}$ (1-substitution) $= 4.396 \times 10^{14}$ [Hz] (1) (must apply correct rounding if done) **so award 4 marks.** N.B.3. <u>If no attempt to use 13.1</u> then: $\lambda = 669.4$ nm(no mark) $= 669.4 \times 10^{-9}$ m (1-conversion) and then $f = \dfrac{c}{\lambda}$ (1- manipulation) $= \dfrac{3 \times 10^8}{669.4 \times 10^{-9}}$ (1-substitution) $= 4.482 \times 10^{14}$[Hz] **so award 3 marks.**	5

Question				Marking details	Marks
	(d)	(i)		Gamma [rays] / short wavelength radiation (1) have stretched / increased wavelength / reduced frequency [over time as the Universe expanded] (1) **To award both marks both statements must be linked.**	2
		(ii)		**Any 2 ×(1) from:** • Because their wavelengths will get longer / waves stretched • Because frequencies decrease • Lower energy of waves **To award both marks both statements must be linked.**	2
				Question total	**[15]**
6.				**Indicative content:** A geostationary / geosynchronous satellite orbits the Earth in 24 hours – the same time as the rotation period of the Earth. It therefore stays above the same point on the Earth so that ground satellite dishes do not have to be moved. A minimum of three satellites are needed to relay messages around the world. They relay only microwaves which carry TV, telephone and other signals. Signals can also be relayed along optical fibres which transfer via coded infra-red signals and radio waves can be reflected off the atmosphere. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6
				Question total	**[6]**
				Higher tier paper total	**[60]**