UNIT 1: ELECTRICITY, ENERGY AND WAVES
FOUNDATION TIER

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

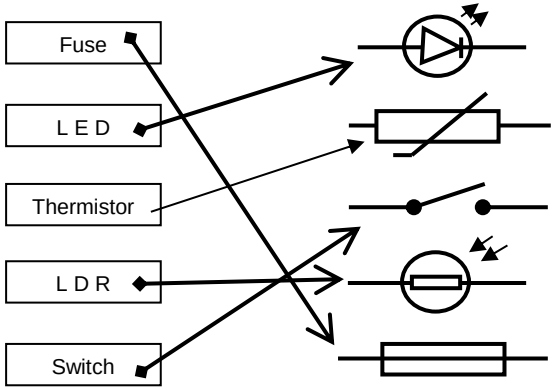
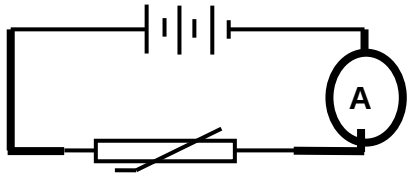
Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			 3 or 4 correct - **3 marks** 2 correct - **2 marks** 1 correct - **1 mark** 0 correct - **0 mark**	3			3		
	(b)	(i)		 Correct ammeter symbol (1) Complete series circuit (1)	2			2		2
		(ii)		All 5 points correctly plotted within ±½ small square division (2) 4 points correctly plotted within ±½ small square division (1) 0-3 points correctly plotted within ±½ small square division (0) Smooth curve of best fit within ± ½ small square division of all points (1) Don't accept thick, double, whispy lines		3		3	3	3

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Current increase as temperature increases (1) at an increasing rate (1)		2		2		2
	(c)	(i)		Changing the temperature of the thermistor changes its resistance (1) so that the brightness of the bulbs will change (1)			2	2		2
		(ii)		Lamp A is now off (1) because the circuit is broken / incomplete / no charge flows (1)			2	2		2
				Question 1 total	**5**	**5**	**4**	**14**	**3**	**11**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			$\frac{725\,000}{250} = 2\,900$ (1) 2 900 (**ecf**) $\times$ 7 = 20 300 (1)			2	2	2	
	(b)			Box 2 - pressure = $\frac{\text{force}}{\text{area}} = \frac{500}{100} = 5\,\text{N/cm}^2$	1			1	1	
	(c)			15 $\times$ 100 = 1 500 [cm^2] (1) 5 (**ecf**) $\times$ 1 500 = 7 500 [N] (1) **or** Force = 500 $\times$ 15 (1) = 7 500 [N] (1)		2		2	2	
	(d)			Gases can be compressed / gas molecules squeezed together when force applied at X (1) The force at Y would be much smaller (1)			2	2		
				Question 2 total	**1**	**2**	**4**	**7**	**5**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i) (ii) (iii)		conduction (1) convection (1) conductor (1) radiation (1)	4			4		
	(b)	(i)		100 [kJ]		1		1	1	
		(ii)		Substitution: $\frac{300}{400} \times 100$ (1) % efficiency = 75 (1)	1	1		2	2	
		(iii)		Band C **or** (69 to 80) (allow **ecf** from (ii))		1		1		
		(iv)		Less energy wasted / more energy usefully converted (1) better for the environment / less impact on environment (1) and will save the user money (1)		3		3		
	(c)	(i)		$6 \times 3 = 18$ [kWh]		1		1	1	
		(ii)		Substitution: 18 (**ecf**) $\times$ 15 (1) Cost = 270 [p] (1)	1	1		2	2	
	(d)			If the current exceeds the fuse rating it melts (1) The circuit is broken (1) [and avoids a potential fire risk] Fuse selected = 30 [A] (1)	1 1	1		3		
				Question 3 total	**8**	**9**	**0**	**17**	**6**	**0**

Question				Marking details	Marks Available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
4		(i)		Glass B (1) Diagram 2 shows critical angle at 39^{o} / grazing emergence shown (1)			2	2	1	
		(ii)		Two TIR (1) Relatively equal angles of incidence (1)		2		2		
		(iii)		CT scan uses X rays that are ionising (1) which may potentially damage cells (1) (accept opposite argument)	2			2		
				Question 4 total	**2**	**2**	**2**	**6**	**1**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			**Indicative content:** The seven waves are grouped together because they have properties that are identical. The em waves all travel at the same speed (3×10^8 m/s) in a vacuum, they are transverse, they travel in straight lines, they travel through a vacuum and transfer energy. However, they do have different wavelengths, frequency and energy. Their order, from left to right in the diagram, is from long to short wavelength. The frequency and energy of the waves is from low to high. Gamma waves have the highest frequency and energy but the shortest wavelength. The higher the frequency or energy the more ionising the radiation. **5 – 6 marks** Detailed description of the em spectrum that includes both their identical properties and two differences. *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3 – 4 marks** A brief description of some identical properties of the em waves and at least one of their differences. *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1-2 marks** A basic description of either some of their identical properties or differences. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure*. *The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.*	6			6		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				0 marks *No attempt made or no response worthy of credit.*						
	(b)			Ultra-violet may cause cancer / cell damage (1) Infra-red can result in instant burns (1) Ultra-violet waves are higher energy / ionising compared to infra-red (1)	3			3		
				Question 5 total	**9**	**0**	**0**	**9**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
6	(a)	(i)		3		1		1		
		(ii)		$\frac{90}{3}$ = 30 [m]		1		1	1	
	(b)	(i)		0.5 [Hz]		1		1	1	
		(ii)		Wave speed = frequency × wavelength (1) Substitution: 0.5 (**ecf**) × 30 (**ecf**) (1) Speed =15 [m/s] (1)	1 1	1		3	3	
		(iii)		Arrow pointing down [at P]			1	1		
				Question 6 total	**2**	**4**	**1**	**7**	**5**	**0**

Question				Marking details	Marks Available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
7	(a)	(i)		Less fossil fuels used to generate electricity (1) so less CO_2 produced (1)		2		2		
		(ii)		Reduction in gas used to generate electrical energy (1) The other energy sources remain similar (1)		2		2		
		(iii)		National Grid [connects users to power stations via a network of cables] (1) Electrical energy can be transferred from other parts of UK (1)	2			2		
		(iv)		28 000 + 23 000 = 51 000 [GWh] (1) 51 000 – 45 000 = 6 000 [GWh] (1)		2		2	2	
	(b)	(i)		Solar PV	1			1		
		(ii)		Wind shows a significant increase in 2011 / whereas the other renewable sources are pretty constant between 2004 to 2011 (1) due to more wind farms constructed / windier weather (1)			2	2		
	(c)			Bar will be taller / longer (1) as more electricity generated by renewable sources (1) Wind may continue to follow upward trend but solar PV would increase (1)			3	3	1	
				Question 7 total	**3**	**6**	**5**	**14**	**3**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		Current Z to Y = second finger (1) B field N to S first finger (1) Thumb up for upward force (1)		3		3		3
		(ii)		Reverse battery / swap magnetic poles		1		1		1
	(b)			**Any 2 × (1) from:** Stronger magnets More coils Larger current Iron core added	2			2		2
				Question 8 total	**2**	**4**	**0**	**6**	**0**	**6**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	5	4	14	3	11
2	1	2	4	7	5	0
3	8	9	0	17	6	0
4	2	2	2	6	1	0
5	9	0	0	9	0	0
6	2	4	1	7	5	0
7	3	6	5	14	3	0
8	2	4	0	6	0	6
TOTAL	**32**	**32**	**16**	**80**	**23**	**17**