Name: _____

Foundation Energy

Date:

Time:

Total marks available:

Total marks achieved: _____

Mark Scheme

Q1.

	Answer	Acceptable answers	Mark
	☒ **B** conservation of energy		**(1)**

Q2.

	Answer	Acceptable answers	Mark
	kinetic (energy)	Movement (energy) KE	**(1)**

Q3.

Question Number	Answer	Additional guidance	Mark
(i)	kinetic (1)	**only** (adding another incorrect alternative negates)	**(1)** AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	any one of increase the speed (of spinning) (1) increase the mass / weight (of the flywheel) (1)	 accept (idea of) faster ignore make it bigger	**(1)** AO 2 1

Q4.

Question Number	Answer	Additional guidance	Mark
	an explanation linking use of lubrication / oil (1) to reduce friction (between parts) (1)		**(2)** AO 2 1

Q5.

Question Number	Answer	Acceptable answers	Mark
(i)	electrical	electric	**(1)**

Question Number	Answer	Acceptable answers	Mark
(ii)	chemical		**(1)**

Q6.

	Answer	Acceptable answers	Mark
	light → electrical → **chemical** energy energy energy (1) (1)	These answers must be in the correct order	**(2)**

Q7.

Question Number	Answer	Additional guidance	Mark
	substitution (1) ½ x 8 x 1.5(^{2}) calculation of v^2 (1) 2.25 evaluation (1) 9(.0) (J)	9000 (J) scores 2 marks 6(.0)(J) scores 2 marks 6000 (J) scores 1 mark award full marks for the correct answer without working	**(3)**

Q8.

	Answer	Acceptable answers	Mark
(i)	1400 – 1300 (= 100) (kJ) (1)		**(1)**
(ii)	Substitution (1) 1300 / 1400 × 100 Evaluation (1) 93(%) or 0.93	A value which rounds to 93(%) or 0.93 Correct answer with no working scores 2 marks	**(2)**

Q9.

	Answer	Acceptable answers	Mark
	Description including 3 of the following: • (Gravitational) potential energy (transferred) to KE(1)	(G)PE (transferred) to KE Allow gravitational energy for GPE Energy transferred to heat because of	**(3)**

	• Idea of energy transfer to heat/sound whilst descending (1) • Chemical energy is transferred to heat energy in Andrew (1) • Idea of energy dissipated on stopping (1)	air resistance/ friction The energy goes to heat as he stops. Energy is transferred to the surroundings	

Q10.

	Answer	**Acceptable answers**	**Mark**
(i)	12 (J) Ignore any unit given by candidate.	20 - 8 (J)	**(1)**
(ii)	An explanation linking any **two** of • (For the) same amount of {electrical/supplied} (energy/power) (1) • (CFL/it) has a greater output (of light energy) (1) • (CFL/it) wastes less (electrical energy) (1)	Same input (energy) gives out/produces more {light/useful} (energy) Do not accept more energy is used in the (CFL/it) Ignore brightness. (CFL/it) produces less thermal/heat (energy) Accept explanations using data from the energy transfer diagrams as comparisons eg (CFL/it) is four times as efficient gains both marks	**(2)**

Q11.

Question Number	Answer	Acceptable answers	Mark
(i)	20 (J)	200 – 180 (even if calculated value from this is incorrect)	**(1)**

Question Number	Answer	Acceptable answers	Mark
(ii)	(changed to) {thermal energy / heat}	dissipated (lost) to {surroundings / motor / air / atmosphere} sound / noise **reject** if kinetic, light or chemical is mentioned	**(1)**

Question Number	Answer	Acceptable answers	Mark
(iii)	$\frac{180}{200} \times 100$ (1) 90 (%) (1)	award full marks for correct answer with no working $\frac{180}{200}$ 0.9, 9/10 Or [100 – (20/200)] % not needed but if a unit is given then maximum score is 1	**(2)**

Q12.

Question Number	Answer	Mark
(i)	The only correct answer is **C 20 m/s** A is not correct because 0.2 m/s is too slow B is not correct because 2 m/s is too slow D is not correct because 200 m/s is too fast	**(1)**

Question Number	Answer	Additional guidance	Mark
(ii)	recall (1) (ΔGPE) = m × g × Δh substitution (1) (ΔGPE =) 75 x 10 x 20 evaluation (1) 15 000 (J)	NO PoT error NO ecf from wrong equation mgh or m x g x h 75 x 10 x 20 scores the first 2 marks accept 14700 (J) from using g = 9.8 (N/kg) award full marks for the correct answer without working	(3)

Q13.

	Answer	Acceptable answers	Mark
(i)	(Bow and arrow:) kinetic (1) (Electric kettle:) heat (thermal) (1) (Microphone:) sound (1)	Heat/thermal	(3)
(ii)	Any **one** from (transferred into) {thermal/heat/sound}(energy) (1) (Energy) is dissipated (1)	Do not accept light energy or it disappears goes into surroundings/air (energy) is wasted/lost	(1)

Q14.

Question Number	Answer	Additional guidance	Mark
(i)	substitution (1) (ΔGPE =) 65 x 10 x 200 evaluation (1) 1.3 x 10^5 / 130 000 (J)	 allow substitution mark with 65000 (g) allow 1 mark for answers that round to 1.3 with any other power of ten do not allow 13000 award full marks for the correct answer without working	**(2)** AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	substitution (1) (KE) ½×65×36(^{2}) squaring (1) 36^2 (=1296) (completing) evaluation (1) 42 120 / 4.2(1) x 10^4 (J)	 using 36 → 1170 (J) OR 36x2 → 2340 (J) scores 2 marks (apply power of ten error as well if occurring e.g. 117000 (J) gets 1 mark) award full marks for the correct answer without working allow 2 marks for answers that round to 4.2 with any other power of ten omitting ½ gives 84240(J) scores 2 marks	**(3)** AO 2 1

Q15.

Question Number	Answer	Additional guidance	Mark
(i)	1840 (J) (1)		(1)

Question Number	Answer		Mark
(ii)	substitution (1) (efficiency =) $\frac{160}{2000}$ evaluation (1) 0.08 OR 8 (%)	 Ignore any units award full marks for the correct answer without working	(2)

Question Number	Answer	Additional guidance	Mark
(iii)	reference to : thermal (energy) (1) OR (lost to) environment /surroundings/dissipated (1) OR transferred/changed to another form of energy (1)	IGNORE gets re-used / recycled heat OR (to) atmosphere / (to) the air /sky/ steam accept named form of energy	(1)

Question Number	Answer	Additional guidance	Mark
(iv)	an answer that makes reference to **any two from** produces/ releases/makes/gives off carbon dioxide / CO_2 /greenhouse gases (1) produces carbon monoxide / CO (1) produces air pollution (1) produces sulphur dioxide/ SO_2 (1) produces soot /smoke (1) mining coal (1)	IGNORE unqualified pollutes/pollution IGNORE ozone layer IGNORE non-renewable IGNORE 'fumes' (causes) greenhouse effect OR contributes to global warming/climate change allow CO2 causes carbon monoxide poisoning accept (harmful) particles /dust causes <u>acid rain</u> blackens/ stains buildings/statues slag heaps/ mining damages the landscape/habitats/ecosystem OR ground needs to be dug up	**(2)**

Q16.

		Indicative Content	
QWC	*	A discussion including some of the following points	

Energy saving lamp	Filament lamp
Advantages • Saves energy / uses energy more efficiently • Cost efficient • Lasts longer • Lower power (needed) • Less fossil fuels burnt • Cool to touch • Efficiency 20% • Lasts 9000 hours longer • Lasts 10 times longer • Produces 4 times as much light energy for every 100J of electrical energy supplied. • More readily available **Disadvantages** • Higher initial cost • May contain harmful gases • Takes longer to reach maximum brightness • Not such a bright light • Costs 5 times as much • Costs £1.20 more	**Disadvantages** • Wastes more energy • Less efficient • Shorter lifetime • Higher power (needed) • More fossil fuels burnt • Gets very hot • Only 5% efficient • Wastes 95% of energy sup • Uses 4 times as much pow • Less readily available **Advantages** • Costs less to buy • Do not contain harmful gas • Lights immediately • Bright light

Table of information given in the question

Energy saving lamp	Filament lamp
power =15 W	power =60W
Cost = £1.50	Cost = £0.30
Lifetime = 10 000 hours	Lifetime = 1000 hours
Produces 20J of light energy for every 100J of electrical energy supplied	Produces 5J of light e for every 100J of ele energy supplied

Level	**0**	No rewardable content
1	**1 - 2**	• A limited description of one advantage or one disadvantage e.g. energy saving lamps last a long time/ filament lamps get very hot **OR** A correct value quoted from information with no comparison. • The answer communicates ideas using simple language and uses limited scientific terminology • Spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• A simple description of two different advantages / disadvantages e.g. energy saving lamps cost more but last longer / filament lamps have a short life time and use more power **OR** Correct values quoted from table and used to provide two comparisons without calculations • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• A detailed description of two different advantages / disadvantages using a **quantitative**comparison.

		e.g. energy saving lamps cost 5 times more but last 10 times longer. / Energy saving lamps produce 4 times as much light energy for every 100J of electrical energy supplied and are much more efficient. / Energy saving lamps last 9,000 hours longer than and they use less power. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q17.

	Answer	**Acceptable answers**	**Mark**
(i)	Substitution: (1) 60 × 10 × 50 or 600 × 50 Evaluation: (1) 30 000 Unit: (1) J / Nm	 give two marks for correct answer no working j / joule 30 kJ for full marks	**(3)**
(ii)	After falling 50 m / when the cord becomes straight/when cord starts to stretch	tension starting to increase at terminal velocity ignore maximum velocity/speed	**(1)**
(iii)	An explanation linking any two of not all GPE is transferred to KE (1) some {of the GPE transfers to thermal energy /work is done} (1) due to drag (1)	 not all GPE goes to KE maximum energy is same (value) as GPE before falling /speed does not reach the speed at which he should fall some lost as heat/sound (of rope or movement through air) (air) resistance / friction ignore wind	**(2)**

Q18.

		Indicative Content	
		A discussion including some of the following points • Both HEP and Solar power are renewable • Both HEP and Solar power would save fossil fu • HEP only possible in some locations • HEP requires reservoirs and damming of rivers • This can damage environment /takes a lot of la • Energy from solar power installation is current than energy from fossil fuel powered station • Solar power only suitable in certain locations • Solar power reliability dependent on constant • Neither of them cause atmospheric pollution	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description such as at least one relevant detail of each resource eg: Solar power doesn't give off atmospheric pollution. HEP generates more power than solar power. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple discussion such as one which gives comparisons between the two or at least an advantage and disadvantage of both. eg: HEP does not use fossil fuels but it can damage the environment where is it located. Solar power will never run out but it requires lots of light/land. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed comparison such as one which relates advantages and disadvantages of **both**HEP and solar power to a particular situation for possible large scale use e.g.: Solar power uses a renewable energy source but it currently does not produce as much energy as fossil fuel station where there is little sunlight. HEP can produce a lot more energy where there are hills and water but only possible in certain geographical locations. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q19.

		Indicative Content	
QWC	*	a description including some of the following points: • chemical to kinetic while in his hand • kinetic (gradually) to potential while rising / fr	

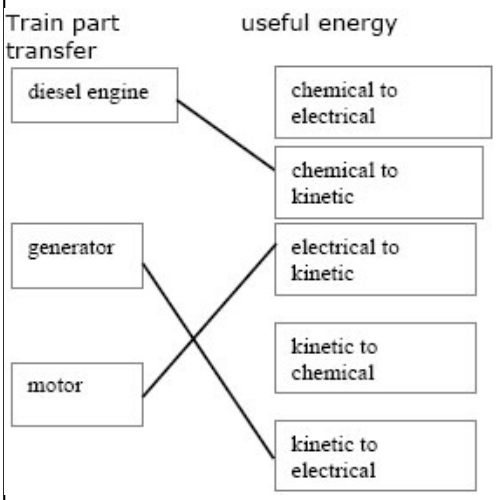
		• eventually all potential at 10 m with a little the energy • some mention of conservation of energy • potential (gradually) to kinetic as falls / 10 m-0 • with a little more thermal (heat) energy • at 0 m sound energy • at 0 m thermal (heat) energy
Level	**0**	No rewardable content
1	**1 - 2**	• a limited description which identifies a change in one relevant type energy or a transfer of energy from one form to another e.g. kinetic energy increases OR kinetic energy changes to sound. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• a simple description giving detail of a relevant energy change/transfer e.g. kinetic energy changes into potential energy as it moves upwards OR kinetic energy increases as it falls. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed description of a sequence of relevant energy changes /transfers e.g. kinetic energy is transferred into potential energy as it rises. This then changes back into kinetic energy as it falls back down. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q20.

	Answer	**Acceptable answers**	**Mark**
(a)(i)	An explanation linking • 60 % of {total/electrical/input/output} energy (is used/transferred) (1) • into/is kinetic/useful energy (1) If no other marks scored accept: 60% (of the energy produced by the motor) is useful/40% is wasted for 1 mark	**Accept reverse argument ie** 40 % of {total/electrical/input/output} energy (is/transferred) into/lost as/thermal (heat)/waste energy	**(2)**
(a)(ii)	☒**B** energy		**(1)**
(a)(iii)	substitution	Power of 10 error maximum of 1 mark	

	20 × 15 (1) evaluation 300 (J) (1) If no other mark scored award 1 mark for correct transposition ie E= P × t Ignore any unit given by candidate	eg 300 000 (J) gains 1 mark Give full marks for correct answer, no working	**(2)**
(a)(iv)	substitution 18 ÷ 24 (× 100) (1) evaluation 0.75 or 75% (1) Ignore any unit given by candidate	Power of 10 error maximum of 1 mark give full marks for correct answer, no working	**(2)**
(b)	☒**B** conservation of energy		**(1)**

Q21.

	Answer	**Acceptable answers**	**Mark**
(ai)	A line connecting a train part with a useful energy transfer as shown below (1)  	Lines need not be straight Ignore any arrow heads drawn Note: if more than one line is drawn from a train part then zero mark for that train part.	**(3)**
(aii)	(transfer of energy to) thermal (1)	heat/sound	**(1)**
(bi)	1400 – 1300 (= 100) (kJ) (1)		**(1)**
(bii)	Substitution (1) 1300 / 1400 × 100 Evaluation (1) 93(%) or 0.93	 A value which rounds to 93(%) or 0.93	**(2)**

		Correct answer with no working scores 2 marks	
(c)	Any one from black is a good thermal radiator (1) (helps to) prevent motors overheating (1)	 (good) emitter (helps to) remove wasted energy/ heat (from the motor)	**(1)**

Q22.

	Answer	**Acceptable answers**	**Mark**
(ai)	Model A because Model A (can produce up to)7200kWh per year (at 13mph) / will produce 6000 kWh (with given wind speed). (1)	Model B produces less than 6000kWh per year at 13mph /requires wind speed of more than 13mph to produce 6000kWh	**(1)**
(aii)	Substitution (1) 0.14 × 6000 Evaluation (1) (£)840	Allow incorrect conversion of p to £ such as 0.014 × 6000 for 1 mark only 84 000 p correct answer with no working shown gains both marks	**(2)**
(aiii)	Divide the installation cost by the annual saving (to find the time in years) (1)	£840 for annual saving	**(1)**
(aiv)	A suggestion linking (energy saving lamps) would not transfer so much thermal energy (1) he may have to use additional heating / lights (which would cost money to run/ purchase) (1)	 not get hot / produce so much heat reverse argument such as insufficient heat for chicks to thrive (Ignore references to light output.)	**(2)**

		Indicative Content	
QWC	***(b)**	A discussion including some of the following points • Both HEP and Solar power are renewable • Both HEP and Solar power would save fossil fu	

		• HEP only possible in some locations • HEP requires reservoirs and damming of rivers • This can damage environment /takes a lot of l • Energy from solar power installation is current than energy from fossil fuel powered station • Solar power only suitable in certain locations • Solar power reliability dependent on constant • Neither of them cause atmospheric pollution	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description such as at least one relevant detail of each resource eg: Solar power doesn't give off atmospheric pollution. HEP generates more power than solar power. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple discussion such as one which gives comparisons between the two or at least an advantage and disadvantage of both. eg: HEP does not use fossil fuels but it can damage the environment where is it located. Solar power will never run out but it requires lots of light/land. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed comparison such as one which relates advantages and disadvantages of **both**HEP and solar power to a particular situation for possible large scale use e.g.: Solar power uses a renewable energy source but it currently does not produce as much energy as fossil fuel station where there is little sunlight. HEP can produce a lot more energy where there are hills and water but only possible in certain geographical locations. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q23.

	Answer	**Acceptable answers**	**Mark**
(a)	☒ **B** charge		**(1)**
(b)	Substitution 12 × 230 (1) evaluation 2800 (W) (1)	2760 (W) give full marks for correct answer, no working Power of 10 error max. 1 mark.	**(2)**
(c)	Conversion 0.4 (kW) (1) Substitution		**(3)**

	0.4 × 10 ×15 (p) (1) or 0.4 × 10 × 0.15 (£) Evaluation 60(p) or £0.6 (1)	give marks for correct answer, no working 60(p) or £0.6 (3) 60,000(p) or £600 (2) 6 to any other power of 10 (1) (400/40/4) × 10 × (15/0.15) gains one mark if no mark can be awarded for evaluation.	

		Indicative Content	
QWC	***(d)**	A discussion including some of the following points	

Energy saving lamp	Filament lamp
Advantages • Saves energy / uses energy more efficiently • Cost efficient • Lasts longer • Lower power (needed) • Less fossil fuels burnt • Cool to touch • Efficiency 20% • Lasts 9000 hours longer • Lasts 10 times longer • Produces 4 times as much light energy for every 100J of electrical energy supplied. • More readily available **Disadvantages** • Higher initial cost • May contain harmful gases • Takes longer to reach maximum brightness • Not such a bright light • Costs 5 times as much • Costs £1.20 more	**Disadvantages** • Wastes more energy • Less efficient • Shorter lifetime • Higher power (neede • More fossil fuels burn • Gets very hot • Only 5% efficient • Wastes 95% of energ • Uses 4 times as muc • Less readily available **Advantages** • Costs less to buy • Do not contain harm • Lights immediately • Bright light

Table of information given in the question

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Lifetime = 10 000 hours	Lifetime = 1000 hours
Produces 20J of light energy for every 100J of electrical energy supplied	Produces 5J of light e for every 100J of ele energy supplied

Level	**0**	No rewardable content
1	**1 - 2**	• A limited description of one advantage or one disadvantage e.g. energy saving lamps last a long time/ filament lamps get very hot **OR** A correct value quoted from information with no comparison. • The answer communicates ideas using simple language and uses limited scientific terminology • Spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• A simple description of two different advantages / disadvantages e.g. energy saving lamps cost more but last longer / filament lamps have a short life time and use more power **OR** Correct values quoted from table and used to provide two comparisons without calculations • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• A detailed description of two different advantages / disadvantages using a **quantitative**comparison. e.g. energy saving lamps cost 5 times more but last 10 times longer. / Energy saving lamps produce 4 times as much light energy for every 100J of electrical energy supplied and are much more efficient. / Energy saving lamps last 9,000 hours longer than and they use less power. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors