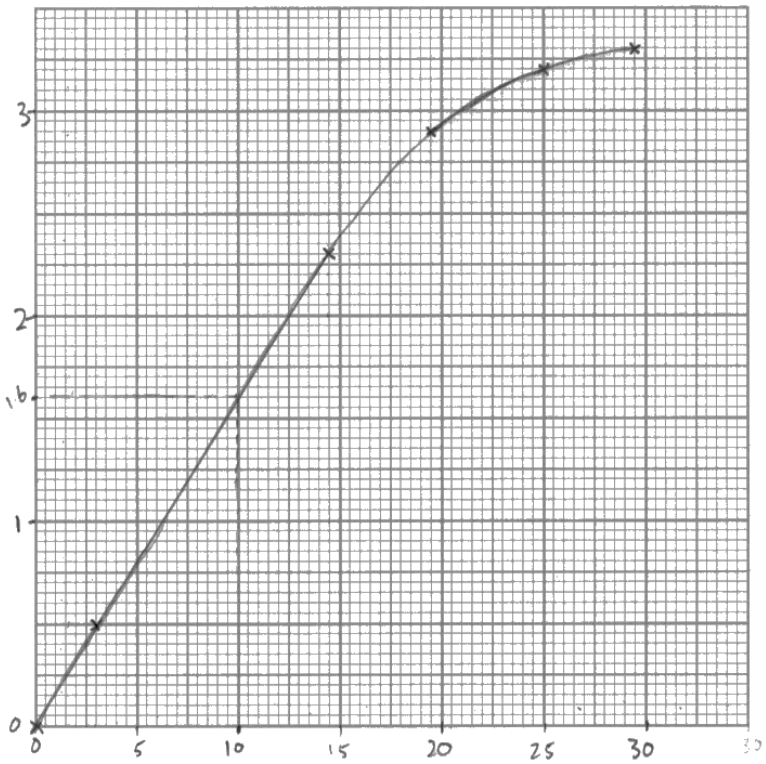
Question number	Answer	Notes	Marks
1 (a)	A		1
(b) (i)	suitable scales; 6 points plotted;; curve of best fit;	• Must use > half width and half height of grid • to nearest ½ square, up to two marks available for this, -1 each error • reject dot to dot • allow a reasonably smooth curve, points should be evenly distributed about the line	4



Voltage across X in V	Current in X in A
0	0
3.0	0.5
14.5	2.3
19.5	2.9
25.0	3.2
29.5	3.3

(ii)	V= I x R	in words, or accepted symbols or rearranged	1
(iii)	value of I from graph; rearranged equation/sub into equation; evaluation; unit; e.g. I= 1.6 (±1/2 a small square) 10 = 1.6 x R OR R = 10/1.6 R= 6.3 Ω / ohms	allow ECF from graph answers without working can gain full marks R= 6.25 allow answers which round to a number in the range 5.8 to 6.3	4
(iv)	any three descriptions from:- MP1. as V increases I increases (at first); MP2. constant gradient/constant R (at first); MP3. I is proportional to V; MP4. gradient changes at high voltage/eq; MP5. ΔI smaller (than previously) for V > 15V;	allow as I increases V increases graph line linear (at first) nonlinear above ~ 15 V graph is less steep at high voltage R increases for V > 15V (to ~8Ω) ignore slows down positive correlation	3

(v)	any two conclusions from:- MP1. resistance is constant at first; MP2. resistance is not constant / resistance increases as V (or I) increases; MP3. because X gets hot(ter); MP4. X is a filament lamp; total marks = 15	allow V and I are proportional at first, it obeys Ohms law at first non-ohmic /does not obey Ohms law / V and I are not proportional increasing temperature	2

Question number	Answer	Notes	Marks
2 (a)	any 3 of: MP1. idea of {rubbing / tearing} of {materials / surfaces}; MP2. idea of movement / transfer of electrons; MP3. electrons have negative charge; MP4. (object becomes) negatively charged by gaining electrons OR positively charged by losing electrons; MP5. need for insulating material(s);	movement of positive {charge / electrons} can only score MP1 and MP5 ignore 'friction'	3
(b)	any 2 of: MP1. idea of opposite charges OR positive and negative charges; MP2. idea of attraction; MP3. idea of an (attractive) force larger than the weight of the loose end of tape;	reject if mentions positive electrons ignore 'different' condone 'unlike'	2

Total 5 marks

Question number		Answer	Notes	Marks
3 (a)		C (kinetic energy to electrical energy)		1
(b) (i)		Conversion to seconds; Substitution into correctly rearranged equation; Calculation; e.g. (time =) 60 (s) $\frac{39\ 000\ 000}{(490 \times 60)}$ 1300 (V)	No mark for stating the formula, since E = I x V x t is given on page 2 60 seen in working 1330, 1327, 1326.5 (V) Correct answer without working scores full marks Allow 1.3 kV for THREE marks Allow Power of Ten error , for a maximum of TWO marks e.g. 1.326×10^{-3}, 1.33, 130	3
(ii)		Any four of MP1 (High voltage leads to) low current; MP2 mention of a relevant equation e.g. $P=IV$, $P=I^2R$; MP3 Less energy is lost (from the wires); MP4 More efficient; MP5 can use thinner wires;	 Allow less heat loss Ignore cost argument Allow: Can transmit the energy further	4
(c) (i)		Current that changes direction (continuously); 100 times per second;	Allow switches from +ve to –ve Allow 50 times/cycles per second. Allow time period e.g. 0.01 s, 0.02 s, 1/50s	2
(ii)		Transformers change the voltage / current; Transformers use alternating current / a.c.;	Allow step-up, step-down Allow reverse argument	2

Total for question 6 = 12 marks

Question number	Answer	Notes	Marks
4 (a) (i)	idea that Energy source which cannot be replaced;	allow: • can't be used again • supply is limited in time • can't be replenished (for a long time) • can't be regenerated ignore: • can' be recycled • can't be stored • unqualifie 'finite/limited/will run out' • not sustainable • can be used up	1
(ii)	Any from for 1 mark; Coal Oil or named fuel Gas	allow: crude oil fossil (fuel(s)) petrol diesel gasoline kerosene paraffin methane butane propane ignore: burning fuel(s)	1

Question number	Answer	Notes	Marks
4 (b) (i)	AT WIND FARM: any one from • Step-up transformer used at the wind farm; • volt ge increased (for transmission); DURING TRANSMISSION: any one from • transmitted at (high voltage and) low current; • no/little energy is wasted during transmission; AT CITY END: any one from • Step down transformer at 'other end'/OWTTE; • voltage reduced to 230V/for safety/for homes;	allow: description of a transformer Allow small voltage loss in transmission	3

Question number	Answer	Notes	Marks
4 (b) (ii)	Answer to a maximum of SIX marks to include: up to 4 ideas from advantages and up to 4 ideas from disadvantages Annotate with ticks /underlining advantages 1. Renewable energy resource; 2. No /little carbon emission or air pollution OR will not add to global warming OR little pollution; 3. Source of energy is free OR low running costs; 4. Brings employment/construction to some remote areas OR good for the local economy; 5. Lots of energy available OR abundant source OR wind farm can generate large amounts of electricity; 6. wind turbines can be more efficient than conventional power stations; disadvantages 1. Unsightly/ugly OR can damage views/ blight landscapes / local people may find them an intrusion; 2. Can be noisy/ causes noise pollution; 3. Only work when the wind blows/ above certain wind speed OR no constant output of electricity OR not reliable; 4. Each generator can only generate a small amount of electricity OR many are needed to supply the amount of electricity required for a city; 5. Costly to construct /maintain; 6. can only be placed in certain areas OR require large areas;	If a single word list, penalise by ONE mark accept suitable/sensible alternatives ignore: • environmentally friendly • cheaper than fossil fuels • kills birds /harming animals • unqualified 'expensive' /'high costs' • safer • carbon-neutral • unqualified 'more efficient'/ 'high efficiency'	6
		Total	**11**