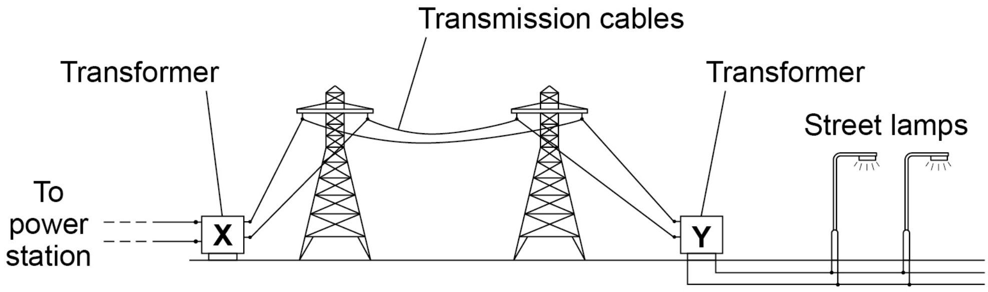
0 3 **Figure 7** shows how the National Grid transfers energy from a power station to some street lamps.

Figure 7



0 3 . 1 Explain how transformer **X** increases the efficiency of the National Grid.

[3 marks]

Do not write outside the box

0 3 . 2 The potential difference across the primary coil in transformer **Y** is 400 000 V.

The potential difference across the secondary coil is 11 000 V.

The current in the primary coil is 660 A.

Calculate the current in the secondary coil of transformer **Y**.

Use the Physics Equations Sheet.

[3 marks]

____

____

____

____

____

Current in the secondary coil = ____________________ A

0 3 . 3 Why is the current in each street lamp less than the current in the secondary coil in transformer **Y**?

[1 mark]

Tick (✓) **one** box.

Current is used up in the cables between **Y** and each street lamp. ☐

Some of the current is dissipated to the surroundings. ☐

The cables between **Y** and the street lamps have electrical resistance. ☐

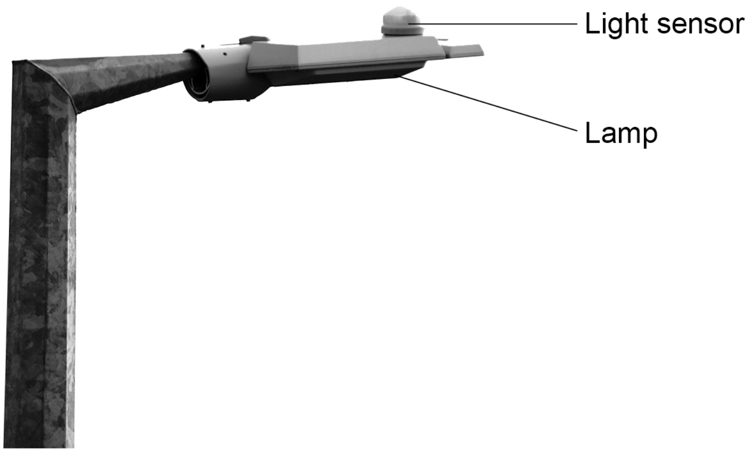
The street lamps are connected in parallel. ☐

Turn over ►

Do not write outside the box

0 3 . 4 **Figure 8** shows the top of a street lamp.

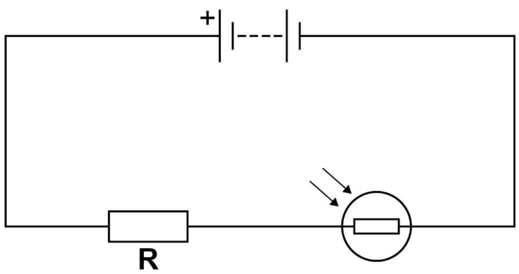
Figure 8



The light sensor detects if it is day or night.

Figure 9 shows part of the circuit in the light sensor.

Figure 9



Explain what happens to the potential difference across resistor **R** as the light intensity decreases.

[3 marks]

Do not write outside the box

0 3 . 5 When the current in resistor **R** is 20 mA, the power transferred by resistor **R** is 6.0 W.

Calculate the resistance of resistor **R**.

Use the Physics Equations Sheet.

[4 marks]

Resistance = ____________________ Ω

14

Turn over for the next question

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	potential difference is increased	allow transformer **X** is a step up transformer	1	AO1 6.2.4.3
	(and) current decreases		1	
	(so) energy/power losses in the transmission cables decrease	allow (so) there is less heating in the transmission cables	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$11\,000 \times I_s = 400\,000 \times 660$		1	AO2 6.2.4.3
	$I_s = \frac{400\,000 \times 660}{11\,000}$		1	
	$I_s = 24\,000$ (A)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	the street lamps are connected in parallel		1	AO3 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	resistance (of the LDR) increases	allow resistance (of the circuit) increases	1	AO1
	(so) the current decreases	allow so the LDR has a greater (share of the) potential difference	1	AO3
	(so) the potential difference across R decreases	dependent on MP1	1	AO3 6.2.1.4 6.2.1.3 6.2.2 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	20 mA = 0.020 A		1	AO2 6.2.4.1
	$6.0 = 0.020^2 \times R$	allow a correct substitution using an incorrectly / not converted value of current.	1	
	$R = \frac{6.0}{0.020^2}$	allow a correct re-arrangement using their incorrectly / not converted value of current.	1	
	$R = 15000\ (\Omega)$ **OR** 20 mA = 0.020 A (1) $V = \frac{6.0}{0.020} = 300$ (1) $R = \frac{300}{0.020}$ (1) $R = 15000\ (\Omega)$ (1)	allow an answer consistent with their incorrectly / not converted value of current	1	

Total Question 3	**14**