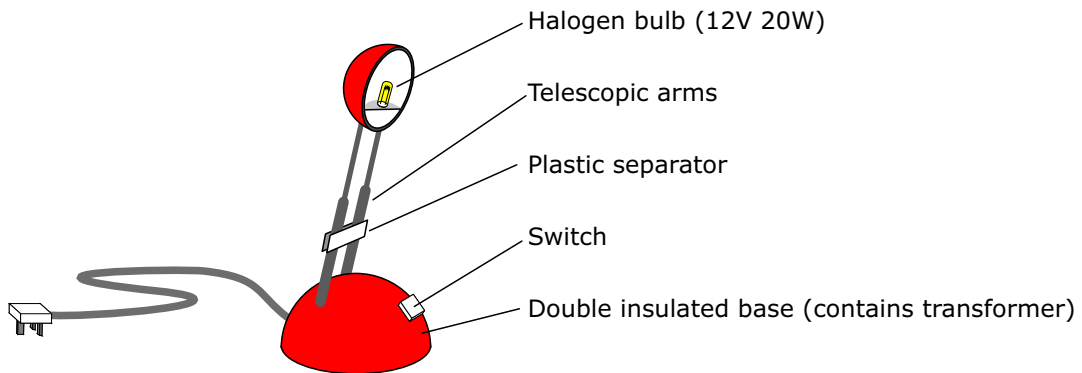


Transformers 2

Name & Set

- 1 Halogen lamps work at much higher temperatures than ordinary filament lamps. This means that they emit more visible light for their size and power consumption than filament lamps, and so can work at low voltages. However, at high temperatures glass softens, so the envelope of a halogen lamp is made of quartz and not glass. Furthermore, being so hot they also emit ultraviolet, which can harm the eyes. Which is why a u.v. filter is fitted to the lamp.

The bulb of a typical low voltage reading lamp is a halogen lamp rated at 12V, 20W. It operates from a 240 V mains via a transformer housed in the base of the lamp.



- (i) Is the transformer step-up or step-down? Give a reason for your answer.

_____ [3]

- (ii) There are 200 turns on the primary coil of this transformer. How many turns are there on the secondary coil?

_____ [3]

- (iii) Assuming the transformer is 100% efficient, how much power does the lamp draw from the mains?

_____ [1]

- (iv) What is the current through the halogen lamp?

_____ [2]

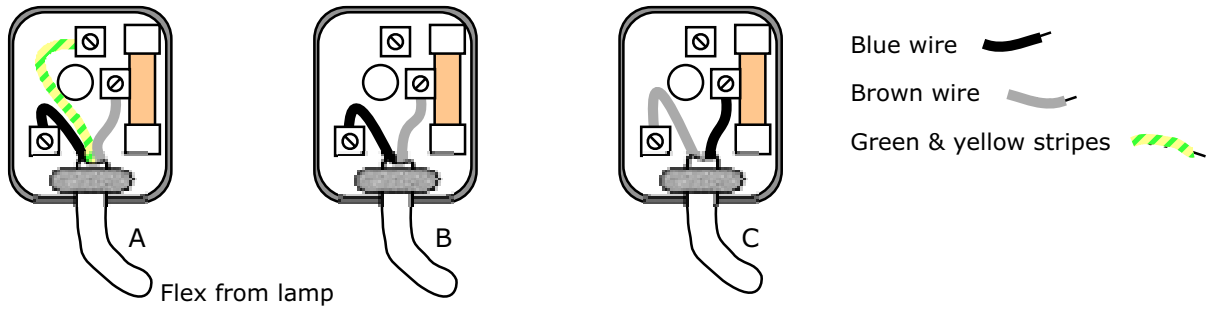
- (v) What current does the lamp draw from the mains?

_____ [2]

- (vi) The lamp is double insulated. What does this mean?

_____ [3]

(vii) Since the lamp is double insulated the plug is wired accordingly. What would you expect to see if you opened the plug? The diagram shows three possibilities: A, B and C. Choose the one that shows how the plug for a double insulated device should be wired, and explain your choice.



[3]

(viii) What is the rating of the fuse that should be used in the plug?

[2]

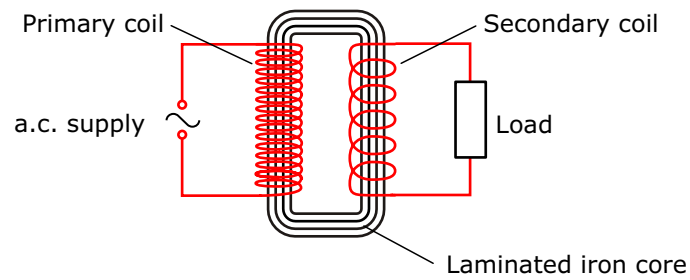
(ix) If you connect a 12V lamp across the telescopic arms, the lamp lights up. Yet you can pick the lamp up by its telescopic arms without being electrocuted. Explain this.

[3]

(x) How does the current through the halogen lamp compare with that through a standard 60W, 240V lamp?

[2]

2 The diagram shows a simple form of transformer used for stepping down an alternating voltage supply.



(a) Explain how the transformer works.

[4]

(b) A power line supplies electrical energy to a transformer in a factory. The input voltage to the transformer is 11000 V. The transformer changes this to 415 V for use in the factory. The power input to the transformer is 800 kW.

(i) Calculate the current in the primary coil of the transformer.

[2]

(ii) Calculate the current in the secondary coil of the transformer.

[2]

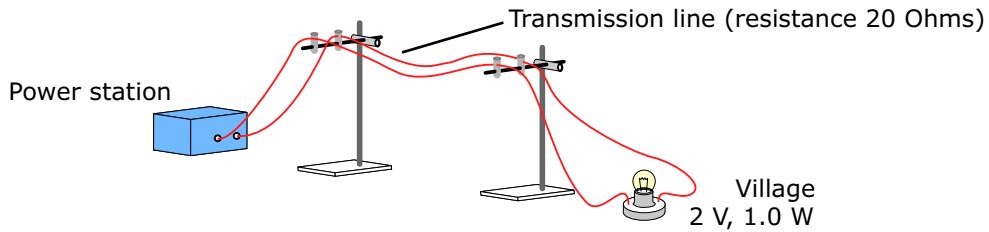
(iii) What assumption have you made about the transformer in calculating the current in the secondary coil?

[1]

(iv) The power line to the factory is operated at as high a voltage as possible. Explain why this is so.

[4]

3 (a) The diagram shows how a model electrical power distribution system could be set up in the laboratory.

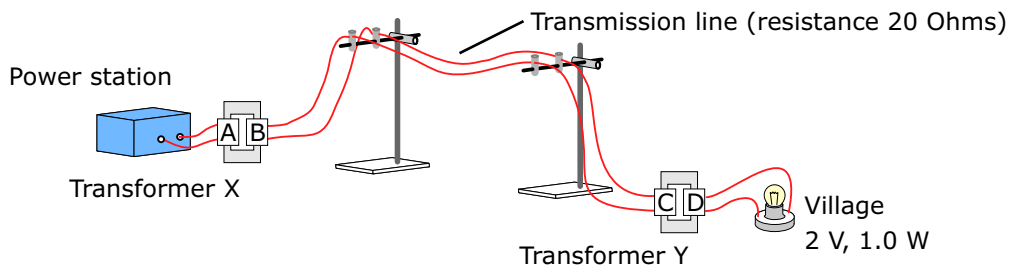


When the 'power station' is switched on the bulb at the 'village' glows very dimly despite the fact that the output p.d. of the power station is 10V.

(i) Explain why the 'village' bulb is very dim.

[2]

(b) The model is altered to include two transformers. When the 'power station' is switched on the bulb at the village glows brightly. Transformer X has 200 turns on coil and 1000 turns on coil B.



(i) Is the current from the 'power station' a.c. or d.c.? Give a reason for your answer

[2]

(ii) What is the output p.d. of transformer X?

[2]

(iii) Transformer Y has 1000 turns on its primary coil. How many turns are there on its secondary coil given that the village bulb is rated at 2 V?

[2]

(iv) What is the current through the 'village' lamp when operating at its correct p.d.?

[2]

(v) What is the current through the transmission cables ?

[2]

(vi) What is the power loss in the transmission cables?

[2]