

O Level Pure Physics Structured

Practical Electricity Test 1.0

Q1

Fig. 11.3 shows part of the mains electrical circuit in a house. The mains supply is 240 V.

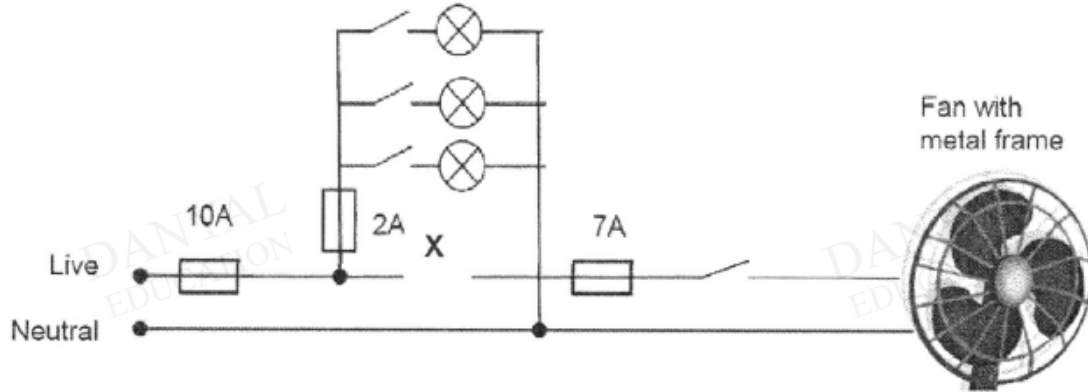


Fig. 11.3

Three identical lamps are connected to the live wire through a fuse labelled X. An electrical fan is connected to the live wire through a 7 A fuse. There is a 10 A fuse to protect the whole circuit.

(a) Explain what is meant by

(i) *live wire*,

.....
..... [1]

(ii) *neutral wire*.

.....
..... [1]

(b) Each of the lamps is rated 100 W, 240 V.

(i) Calculate the amount of current drawn by each lamp.

current = [1]

- (ii) Suggest a suitable fuse rating for X.
Support your answer with appropriate calculations.

fuse rating = [2]

- (c) The electrical fan is not connected to an earth wire. Explain how this will affect the safety of the user.

.....
.....
..... [2]

- (d) If the live wire touches the neutral wire inside the fan, state and explain what will happen to the fan, the lamps and the fuses.

.....
.....
..... [3]

Q2

Fig. 9.1 shows the electrical wiring in a table lamp.

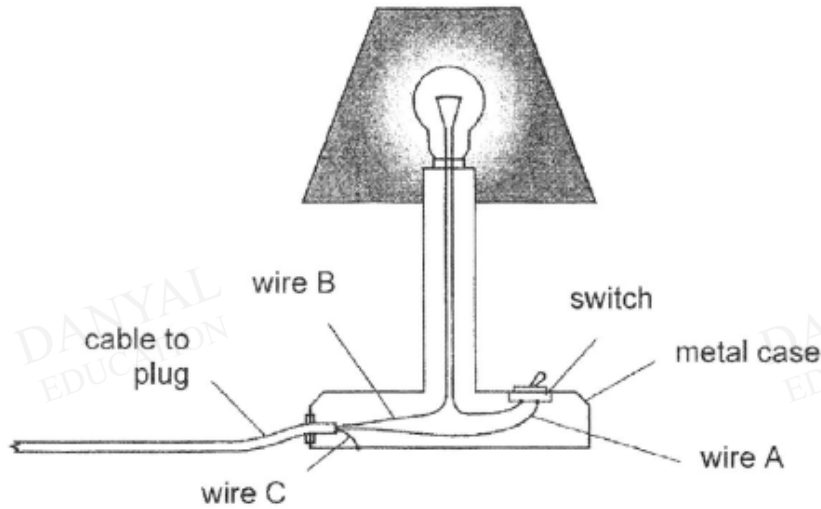


Fig. 9.1

- (a) Explain why wire A rather than wire B is connected to the live terminal in the plug. [2]
- (b) The cable is connected to a plug which contains a fuse. Explain the purpose and action of the fuse. [2]
- (c) Wire A becomes loose and touches the metal case. Explain why a person who touches the metal case feels no shock and is not harmed. [3]
- (d) The lamp is marked "230 V, 100 W". Calculate the resistance of the lamp when it is working normally. [2]
- (e) There is another lamp with no wire connected to the case. Suggest a possible reason why this lamp is safe to use. [1]

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Q3

Fig. 10.1a shows a room heater. Fig. 10.1b is a diagram of the electric circuit of the heater.

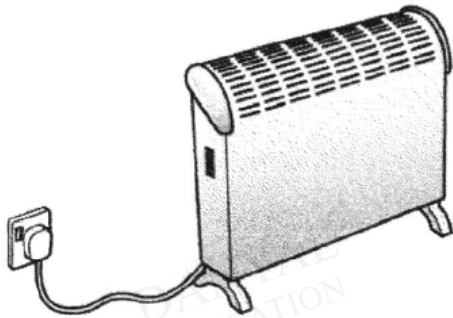


Fig. 10.1a

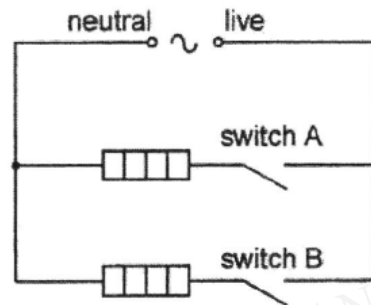


Fig. 10.1b

The fuse has not been drawn on the circuit diagram in Fig. 10.1b.

(a) (i) On Fig. 10.1b, draw the symbol for a fuse in the correct position. [2]

(ii) State which part of the heater is the earth wire connected to.
[1]

(iii) The earth wire reduces the chance of an electric shock if a fault develops in the room heater. Explain how an earth connection prevents an electric shock.

[2]

(b) Fig 10.2 shows the power output of the room heater when each switch is closed.

	Power/W
Switch A only closed	600
Switch B only closed	
Both switches closed	2100

Fig 10.2

(i) Determine the power output of the room heater when only switch B is closed.

power output = [1]

(ii) The room heater is used with both switches closed for 2.5 hours.

Calculate the energy of the room heater

1. in kilowatt-hours,

energy = kWh [2]

2. in joules.

energy = J [2]

Q4

A kettle rated at 2.0 kW, 240 V is shown in Fig. 8.1. A 1.0 A fuse is used in the kettle.

Fig 8.1 shows how an electrician measures the potential difference across terminals P2 and N1 with a voltmeter. The voltmeter measures a potential difference of 240 V.

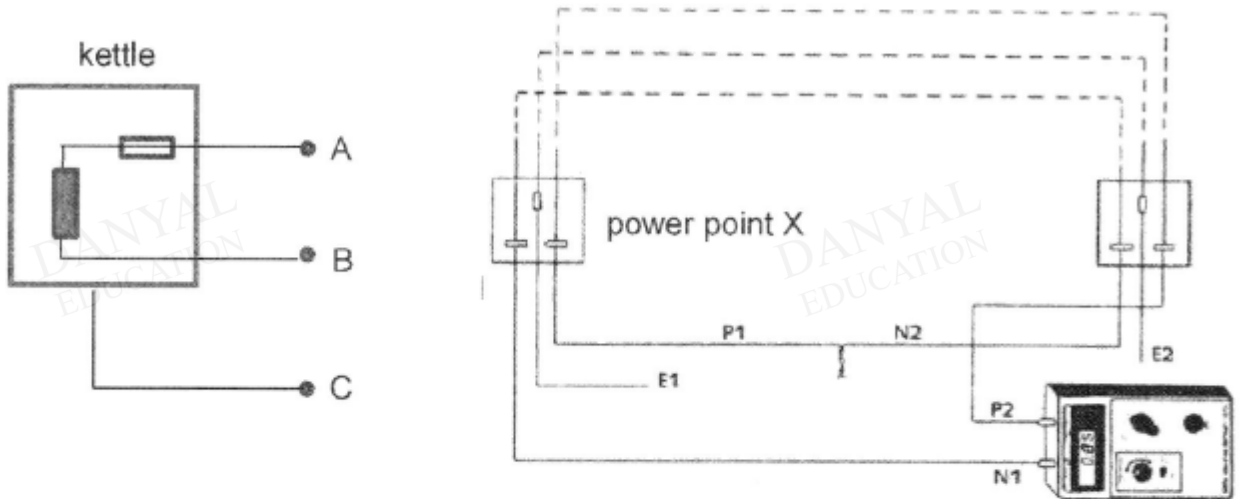


Fig. 8.1

Fig. 8.2

- (a) State what is meant by "the potential difference is 240 V".

.....
 [1]

- (b) A kettle in Fig. 8.1 is to be connected to power point X in Fig. 8.2.

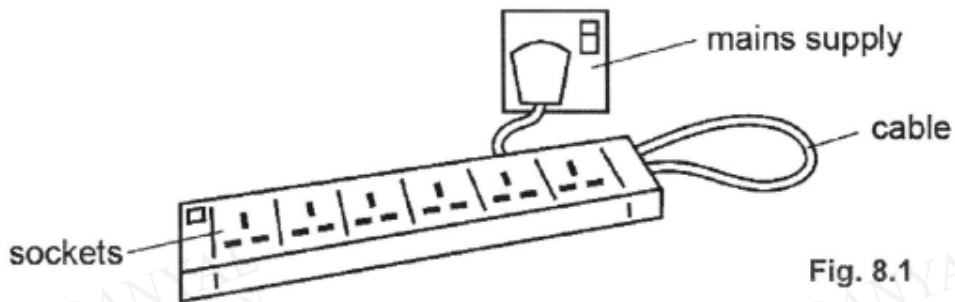
- (i) Connect points A, B and C to the correct points at power point X in Fig 8.2. Include an open switch in your sketch. [2]
- (ii) Describe and explain what would happen to the fuse when the switch is closed.

.....

 [2]

Q5

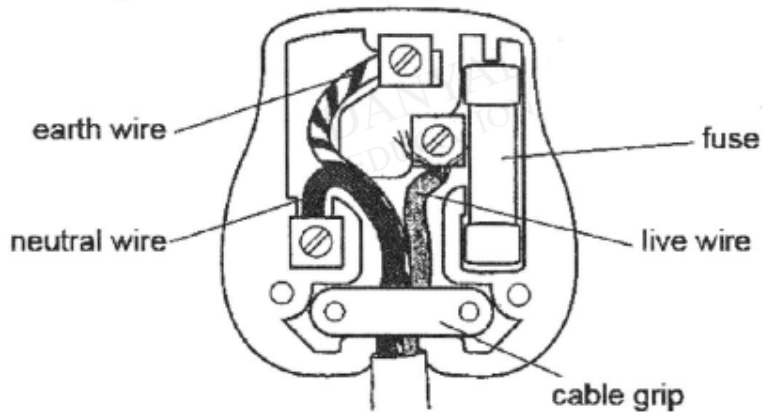
Fig. 8.1 shows a mains extension lead. The six sockets allow several electrical appliances to be connected to the mains supply through one cable. The cable connects the sockets to the mains supply.



(a) Explain why such a mains extension lead may pose an electrical hazard in the house.

.....
.....
..... [2]

Fig. 8.2 shows the wiring inside the mains plug of an electric kettle that is plugged into the extension lead.



(b) State two mistakes in the wiring of the plug.

1.
.....
2.
..... [2]

(c) Explain why it is dangerous to handle the plug with wet hands.

.....
.....
..... [2]

Answers

Practical Electricity Test 1.0

Q1

ai	The live wire is <u>connected to a high potential</u> and <u>delivers current to the appliance</u> . [B1]
aii	The neutral wire is <u>connected to zero potential</u> and <u>provides a return path for the current back to the supply</u> . [B1]
bi	Current drawn = P / V = $100 / 240$ = <u>0.42 A (2 s.f.)</u> [A1]
bii	Total current drawn by 3 lamps = 0.416×3 = <u>1.25 A</u> [B1] Hence fuse rating = <u>2 A</u> [A1] Max [1] ecf if current drawn in (i) is wrongly calculated.
c	If the <u>live wire touches the metal frame</u> of the fan, the <u>fan will become live/be at a high voltage/potential</u> . [B1] The <u>user will get an electric shock</u> if he <u>touches the fan</u> . [B1]
d	The fan will not work as it will be short-circuited. [B1] The 7 A and 10 A fuses will blow due to the large current. Fuse X (2A fuse) will not blow because it is in a parallel connection. [B1] The lamps will not light up because the 10 A fuse has blown, hence the circuit becomes an open circuit/electrical supply is cut off. [B1]

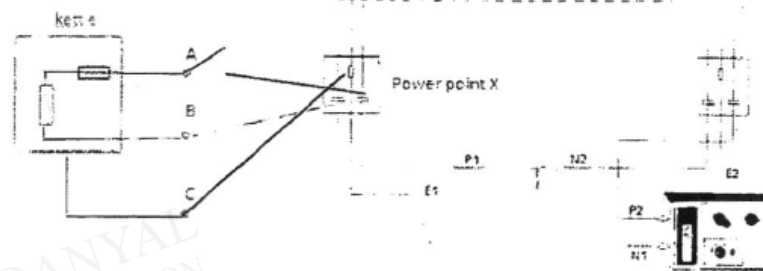
Q2

9(a)	Wire A is connected to a <u>switch</u> . When the switch is opened, the lamp will be disconnected from <u>high voltage</u> .	[1] [1]
(b)	A fuse <u>prevents excessive current flow</u> and overheating of the cable. It <u>melts and breaks the circuit</u> when excessive current flows through the cable.	[1] [1]
(c)	The metal case is <u>earthed</u> by wire C. When the metal casing becomes live, a <u>large current flows through the earth wire</u> instead of the user because it has a lower resistance than the human body. This causes the <u>fuse to melt</u> . Thus, the metal case is <u>disconnected from high voltage</u> and the user does not get an electric shock.	[1] [1] [1]
(d)	$P=V^2/R$ $100 = 230^2 / R$ $R = \underline{529 \Omega}$	[1] [1]
(e)	The outer casing is made of plastic. Current cannot flow through easily. Or The lamp has double insulation.	[1]

Q3

(a)(i)	fuse symbol correct in live junctions before two elements	[1] [1]
MC	Generally well-answered	
(a)(ii)	the metal case / outside	[1]
MC	Generally well-answered. Quite a number of students were only given half the credit if they did not mentioned metal casing but only casing.	
(a)(iii)	live wire touches metal casing; live touches person, current goes to earth; current does not go through person,	[1] [1]
MC	Many students did not get full credit because they failed to mentioned that when the live wire touches the metal casing will the current be transmitted to the earth wire instead of the person.	
(b)(i)	1500 W	[1]
MC	Generally well-done	
b)(ii)	1. $E = 2.1 \text{ kW} \times 2.5 \text{ h} = 5.25 \text{ kWh}$ 2. $E = 2100 \text{ W} \times 2.5 \times 3600 \text{ s} = 1.89 \times 10^7 \text{ J}$	[2] [2]

Q4

a	The work done needed to bring a unit charge across two points is 240 J	1
b		1 m for switch 1 m for connections
bii	Normal operating current, $I = P/V = 2000/240 = 8.3 \text{ A}$ 8.3 A is higher than 1 A fuse, fuse will blow.	1 1

Q5

(a)	<ul style="list-style-type: none"> Total current drawn by all appliances may exceed the maximum current that the mains supply can conduct safely. Live wire of mains supply will overheat (and may start a fire) 	[1] [1]
(b)	<ol style="list-style-type: none"> Some strands of live wire were not connected properly to the live pin. Cable grip should grip the outer insulation and not the inner (live, neutral & earth) wires. 	[1] [1]
(c)	<ul style="list-style-type: none"> Water is a conductor of electricity. Resistance of wet skin / hand is reduced and a larger electric current could flow through the body. 	[1] [1]