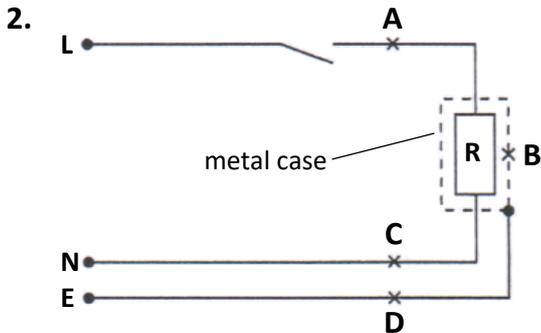


# Practical Electricity – Practice 3 (ANS) [18 v 1.0]

## MCQ

1. An electric washing machine is protected by an earth wire.  
To which part of the washing machine should the earth wire be connected?

- A the fuse  
B the live wire  
C the metal case  
D the switch ( C )



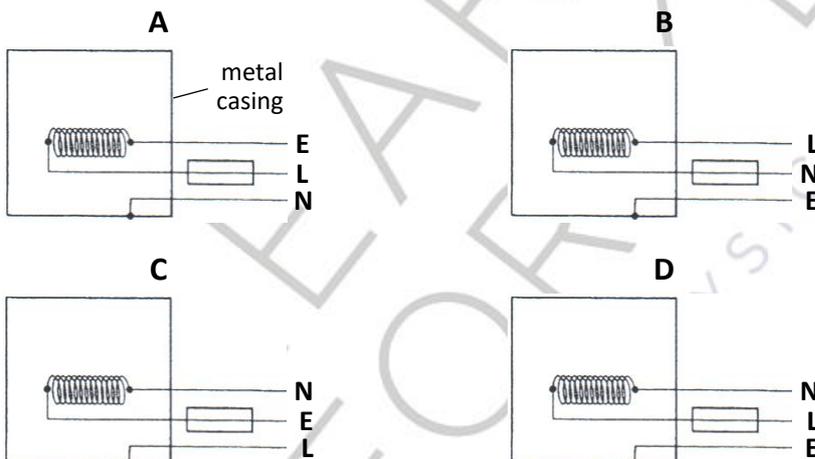
The diagram shows an electrical appliance R with a metal case, indicated by the dotted line, connected to a mains supply.

Where should the fuse be placed?

( A )

**Concept:** The appliance will still be live if the fuse is placed in the neutral wire.

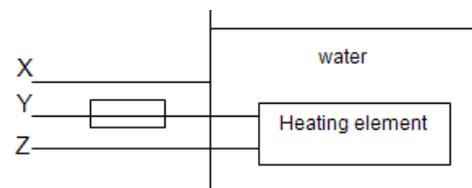
3. The diagrams show the possible wiring to a heating element.  
Which one shows the correct arrangement of wires?



( D )

4. The diagram shows the electrical wiring to a hot water metal tank.

What are the current values in the three wires when the water tank works normally?



	X	Y	Z
A	0 A	2 A	2 A
B	2 A	2 A	2 A
C	0 A	2 A	0 A
D	2 A	2 A	0 A

( A )

5. Many electrical appliances have metal cases.

To prevent the case from becoming 'live', with the possibility of an electric shock, the earth wire of the electric cable is attached to the case.

How does the earth wire prevent an electric shock?

- A It allows a current to flow to earth, so that the appliance continues working.
- B It allows a large current to flow to earth, blowing the fuse.
- C It prevents the fuse from blowing.
- D It reduces the current to a safe level. ( B )

6. An electric kettle has a metal casing. The cable for the kettle contains a wire that is connected to the earth pin of the plug.

Which danger does this guard against?

- A the cable to the kettle becoming too hot
- B the casing of the kettle becoming live
- C the casing of the kettle becoming wet on the outside
- D the casing of the kettle overheating ( B )

7. The current in a filament lamp is 0.25 A when working normally. The lamp is connected to a plug and the mains a.c. supply. When the lamp is switched on, it does not light.

What is a possible cause for this?

- A The earth wire in the plug is not connected.
- B The fuse in the plug is 3 A.
- C The lamp only works on a d.c. power supply.
- D The live wire in the plug is not connected. ( D )

8. The extract shown is part of a Safety Officer's report on how electrical items were being used in a house.

'The hair-dryer had a plastic case with double insulation, so only the live and neutral leads were connected to the plug. When not in use, the dryer was kept in a metal cabinet but it was taken into the bathroom to be used.'

Which underlined comment indicates an electrical hazard?

- A plastic case with double insulation
- B only the live and neutral leads were connected to the plug
- C kept in a metal cabinet
- D taken into the bathroom to be used ( D )

9. What causes the fuse to blow in a mains electrical circuit?

- A a person touches the live wire
- B a person touches the neutral wire
- C the live wire touches the earth wire
- D the neutral wire touches the earth wire ( C )

[Be Discussed as a Class]

10. The fuse in a particular circuit 'blows' regularly. This could be because there is a direct connection between

- I the live and neutral wire.
- II the live and earth wire.
- III the earth wire and the body of the appliance.

- A I and II are true
- B I and III are true
- C I, II and III are true
- D III is true only

( A )

11. An electrical cable contains three wires: live, neutral and earth. The cable is correctly wired to a plug which contains a 3A fuse. The insulation becomes damaged and bare metal wires show.

Five possible events can occur.

- A person touches the earth wire
- A person touches the neutral wire
- A person touches the live wire
- The live wire touches the neutral wire
- The live wire touches the earth wire

How many of these five events cause the fuse in the plug to blow?

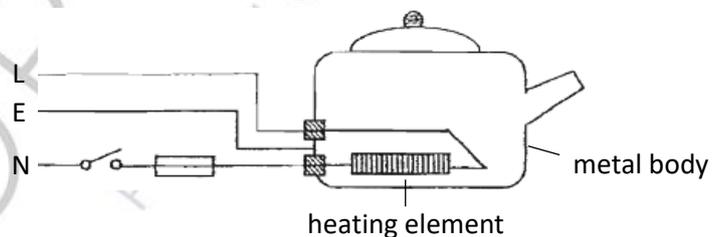
- A 1
- B 2
- C 3
- D 4

( B )

[Be Discussed as a Class]

12. The diagram shows the circuit of an electric kettle that has been wrongly wired.

The kettle will still operate but



- A the fuse will not blow when there is a high current flowing through the circuit.
- B when the live wire accidentally touches the body of the kettle, current cannot be conducted to earth.
- C the heating element will remain at the high potential of 240 V even if the switch is open.
- D the earth wire will conduct current away and prevent electrocution when the switch is closed.

( C )

[Be Discussed as a Class]

13. An electric heater consists of a heating element mounted on a metal reflector. The reflector is connected to earth.

Where should the switch for the heating element be connected?

- A between the earth wire and the reflector
- B between the live wire and the heating element
- C between the live wire and the neutral wire
- D between the neutral wire and the heating element

[Be Discussed as a Class]

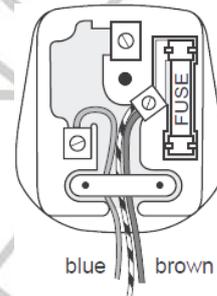
( B )

14. A plug is wrongly wired as shown. It is connected to an old vacuum cleaner, which has a metal case.

What is the effect of using the plug wired in this way?

- A The fuse in the plug blows.
- B The metal case is live.
- C The neutral wire melts.
- D The vacuum cleaner catches fire.

[Be Discussed as a Class]

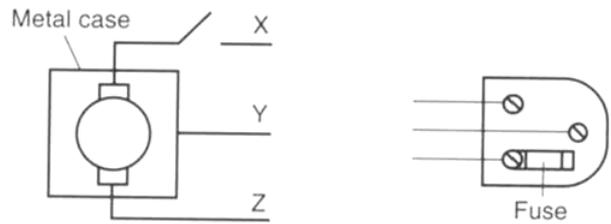


( B )

**Structured**

1. An electric motor is rated 240 V, 300 W. The motor is to be connected to the mains supply as shown in the figure.

- a) Complete the wiring on the figure to show how the wires X, Y and Z should be connected to the terminals of the three-pin plug. [2]



X connects to Fuse  
 Y connects to middle pin (Earth)  
 Z connects to top pin (Neutral)  
**All 3 correct: 2 marks ; 1 correct: 1 mark**

- b) Given the following fuse ratings: 1A, 2A and 5 A, which would be the most appropriate fuse. **Show your working clearly.** [2]

$$P = IV$$

$$I = \frac{P}{V}$$

$$I = \frac{300 \text{ W}}{240 \text{ V}}$$

$$I = 1.25 \text{ A}$$

Thus, a **2 A {1}** fuse should be used.

- c) Electrical energy costs \$0.20 per kWh. Calculate the cost of switching on the motor for 10 hours. [2]

$$\text{Energy used} = P \times t$$

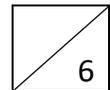
$$= 0.3 \text{ kW} \times 10 \text{ h}$$

$$= 3 \text{ kW h}$$

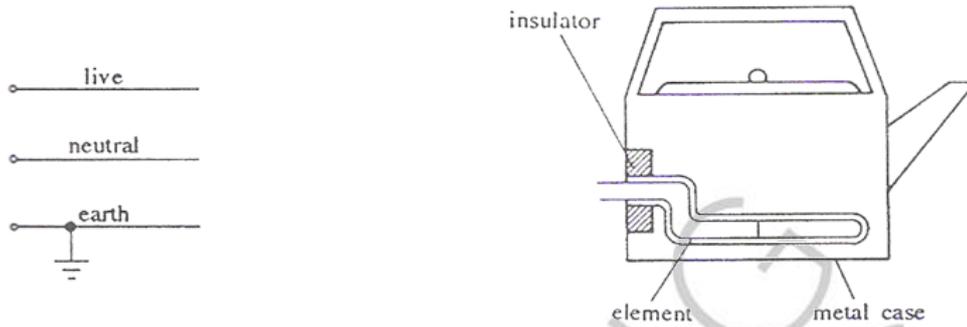
$$\text{Cost} = E \times \text{rate}$$

$$= 3 \times \$ 0.20$$

$$= \$ 0.60 //$$



2. The figure below shows an electrical kettle and the live, neutral and earth wires of a household electricity supply.



- (a) Draw lines on the diagram to show how the kettle should be connected to the supply. **Include a switch and a fuse** in the diagram. [2]
- (b) The insulation of the mains cable has worn away. The live wire touches the outer metal casing of the electrical kettle.
- (i) Explain the hazard that results if the outer metal casing is not earthed. [2]

**Expl:** The casing will become live / at high potential {1}.

**State:** A user that touches the casing can get electrocuted {1}.

5054 Mark<sup>®</sup> Scheme

casing becomes live/at high voltage

B1

current through user/user electrocuted/user shocked

B1

- (ii) Explain how connecting the earth wire to the outer casing and using a fuse of a suitable rating removes this hazard. [2]

**Expl:** The earth wire provides a low resistance path for current to flow {+}.

This causes the current to become high {+},

which in turn causes the fuse to blow {1},

**State:** Thus, the oven is disconnected from the live wire, making it safe {1}.

5054 Mark<sup>®</sup> Scheme

fuse blows/melts/breaks

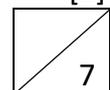
B1

fuse in live wire/(microwave) disconnected/circuit broken/no current

B1

- (c) State why some appliances do not require an earth wire. [1]

They have **double insulation** {1}.



Practical Electricity – Practice 3 [17 v 1.0]

3. Figure A shows a cable containing three wires coloured brown, blue and yellow/green, and a mains plug with the cover removed.

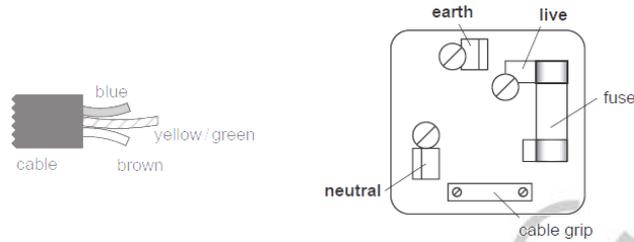


Figure A

- (a) Describe how to connect the cable and the three wires correctly and safely to the plug. [3]

5054 Mark<sup>®</sup> Scheme

yellow/green to earth  
 blue to neutral and brown to live  
 tighten terminal screws  
 cable (outer cover) under grip  
 no bare metal on wires  
 earth wire longest  
 put cover back on

ANY 4 (-1 each clearly wrong answer beyond 4)

B4

- (b) The table lamp shown in Figure B is made from plastic. It has only two wires in the cable to connect it to the plug.

The lamp has a power rating of 100 W and is used with a 230 V supply.

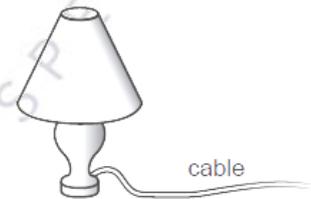


Figure B

- (i) Which wire, earth, live or neutral, is **not** needed in the cable for the lamp? [1]

5054 Mark<sup>®</sup> Scheme: earth

B1

- (ii) Why the lamp is safe to use even though it has only two wires in the cable? [1]

5054 Mark<sup>®</sup> Scheme

plastic/lamp/cover/base made from insulator/does not conduct electricity **or**  
 doubly insulated **or** plastic/lamp/cover/base cannot be live **or** cannot  
 electrocute/shock

B1

- (iii) Explain what is meant by a *power rating of 100 W*. [2]

It meant the lamp **converts energy {1}** at a rate of **100 J per second {1}**.

5054 Mark<sup>®</sup> Scheme

100 J (100 J/s first mark only)

B1

(electrical)(energy) used/transformed/converted/delivered/arrives per second

B1

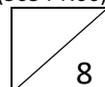
- (iv) The lamp is used for 12 hours each day. Calculate the electrical energy supplied to the lamp in 30 days. [2]

$$E = Pt$$

$$= 0.1 \text{ kW} \times (30 \times 12) \text{ h or } 100 \text{ W} \times (30 \times 12 \times 3600) \text{ s}$$

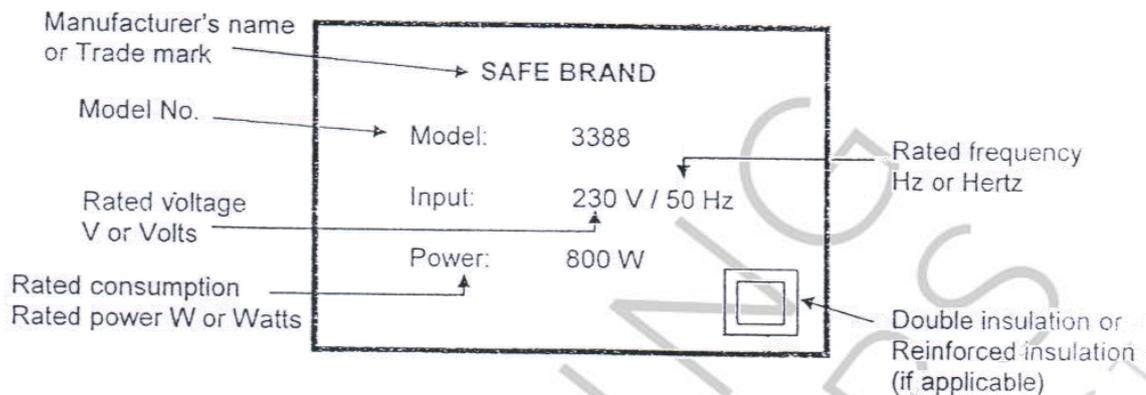
$$= 36 \text{ kWh or } 129\,600\,000 \text{ J}_{//}$$

(5054-N06)

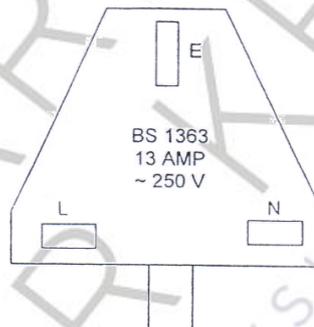


4. Read the following passage about household electrical safety from an instruction manual.

1. Electrical appliances must display the proper markings as shown below or be accompanied with a note indicating the same information.



2. Apart from fixed electrical appliances (e.g. ceiling luminaries and electric water heaters) which do not receive power supply from socket outlets, an electrical appliance must be fitted with a 3-pin plug which complies with the safety requirements.



3. Any electrical appliance of rated voltage less than 200 V a.c. (e.g. kettle rated at 110 V a.c.) must not be connected directly to the 230 V a.c. household power supply system in Singapore.
4. All electrical appliances must be effectively earthed. Electrical appliances without earth connection must be of double insulation or reinforced insulation design, and such appliances usually bear a symbol "□".
5. Switch on an electrical appliance only after firmly plugging it into a socket outlet, and unplug an electrical appliance only after switching it off. Otherwise, it may cause electrical fires.
6. It is recommended that only one multi-plug adaptor or one extension unit should be inserted into a socket outlet. No multi-plug adaptor should be inserted into any extension unit or vice versa.

- (a) Why must the electrical appliance of rated voltage less than 200 V a.c. not be connected directly to the 230 V a.c household supply as suggested in (3) in the passage. [2]

Connecting an appliance to a higher voltage source will cause a **higher current** to flow through the appliance than the amount of current it is built to accept {+}.

This **causes overheating {1} and could lead to a fire {1}**.

- (b) Explain how may electrical fires result in (5) in the passage. [1]

Unplugging when the switch is in the “on” position could **produce sparks**, which may lead to fire.

When contact is broken, the current flowing across opening contacts is sufficient to ionize the air molecules across the tiny gap between the contacts as the switch is opened, forming a *gas plasma*, also known as an *electric arc*. The plasma is of low resistance and is able sustain power flow, even with the separation distance between the switch contacts steadily increasing. The plasma is very hot and is capable of eroding the metal surface of the switch contacts.

An arc can also form as the switch is closed and the contacts approach. The arc is sustained until the switch closes completely.

Switches use spring-operated *tipping-point mechanism* to quickly make or break contact, regardless of the speed at which the switch control is operated by the user. Movement of the switch control lever applies tension to a spring until a tipping point is reached, and the contacts suddenly snap open or closed as the spring tension is released.

- (c) Explain why is it recommended that no adaptors should be inserted to any extension unit in (6) in the passage? [2]

This allows more appliances to be connected to the extension unit.  
This causes **too much current** to flow through the extension unit {1},  
which can **cause overheating and could lead to fire {1}**.

**Sockets of extension units have 13 A fuses. Triple socket adaptors are required to be fused.** Still, 13 A running in extension units and socket adaptors can cause overheating especially when they are placed in confined spaces.

- (d) A lamp is marked as shown in (1) in the passage. However the plug utilized is marked as shown in (2). Comment on the fuse rating of the plug and suggest a reason for the choice of fuse rating. [2]

The lamp is rated to run on **3.5 A (800 W / 230 V) current. 13 A fuse is too high {1}**.  
The **fuse is likely to be rated for the plug cable instead {1}**.

**BS 1363:** BS stands for **British Standard**. BS 1363 is common standard for plugs and sockets in UK, SG, MY and many other countries. The standard requires the **fuse** to be **no higher than 13 A**. This is because most cables are found to be safe up to 13 A.

