

Unit R113 – Electronic Principles

Electrical hazards

Instructions and answers for teachers

These instructions should accompany the OCR resource ‘Electrical hazards’ activity which supports OCR Cambridge Nationals in Engineering.



The Activity:

This resource comprises of 1 task.



This activity offers an opportunity for maths skills development.

Associated materials:

‘Electrical hazards’ activity sheet

Suggested timings:

Task 1: 2 hours

Task 1

The task will give the learners an opportunity to identify a number of electrical hazards visually using pictures. It will also give them the opportunity to research Portable Appliance Testing (PAT) and how Residual Current Devices (RCDs) provide continual fault protection.

Learners will probably need an introduction with some context on electrical hazards before they can attempt the Task.

Internet resources might be used to show learners electrical hazards and their consequences and to set the scene. For example: <http://www.youtube.com/watch?v=Hg8wN-pUaqw>

The teacher should ensure, by questioning throughout the Task, that learners can:

- appreciate the types of unsafe electrical conditions that can be detected through visual inspection;
- understand the reasons for PAT testing and explain what it involves;
- understand what the function of an RCD device is (with examples of where it is used), and explain how it works.

The teacher might wish to deepen understanding by explaining in more detail (or getting learners to research) the particular electrical tests a PAT tester performs:

- Earth continuity test
- Insulation resistance test
- Polarity of live and neutral test
- Earth leakage test

Alternative or complementary approach:

An alternative or complementary approach for teaching about electrical hazards and safety might be to develop practical activities for learners to undertake. If available, real electrical hazards could be shown to learners for them to identify. If access to a PAT tester is available, learners could perform a PAT test for real. Alternatively, the teacher might be able to ask a PAT test professional to demonstrate this to learners. It might also be possible to see and test RCD devices.

1. What is unsafe about this mains adapter?



The case is broken exposing live components – risk of fire or shock.

2. What is unsafe with the kettle cable shown?



The insulation is damaged on the cable.

3. What is wrong with the wiring of this plug?



The live and neutral wires have been transposed.

4. Is this plug safe to use – and if not why not?



No – there is a risk of shock or fire as there are exposed terminals.

5. What two things are unsafe about this plug?



- *The fuse has been replaced by tin foil – hence appliance is un-fused.*
- *The cable has been clamped by its wires, and not by its insulation.*

6. This plug is connected to a Type I appliance, but something is missing from the wiring in this plug – what is it?



Type I appliances require an earth connection – the earth is missing (not connected) in the plug.

7. Portable Appliance Testing (PAT) involves both visual inspection and electrical testing.
- a) Explain in detail what PAT testing is, when it is performed, and why it is done.

PAT testing is an annual check performed on portable electrical equipment.

It involves both visual inspection to identify potential electrical hazards (eg bare insulation, broken casing, wrong fuse etc) and also a series of electrical tests using a PAT test device.

It is done to ensure that the portable appliance is safe to use.

- b) Explain what Type I, Type II and Type III appliances are.

Type I: appliances with an earth connection

Type II: appliances that have no earth, but are double-insulated

Type III: extra low voltage applications

- c) What *four* electrical tests does a PAT tester perform?

In addition to visual inspection, the PAT tester can also perform the following electrical tests:

- Earth continuity test
- Insulation resistance test
- Polarity of live and neutral test
- Earth leakage test

[The learner may be asked to explain each test in more detail].

- d) Can anyone perform a PAT test and place a PASS or FAIL label on the appliance?

No – PAT testing is required to be undertaken by a competent person.

8. The details have been removed from the picture of a PAT test PASS label.



- a) What information should the label contain?

Missing from the label:

- Equipment serial number (for tracking purposes).
- Date of test.
- Date of next test.
- Who carried test out (testers initials or id number).

- b) What colour would the label be if the appliance failed the PAT test?

A FAIL label would be RED and may include the phrase 'Do Not Use' or 'Unsafe'.

9. This is a picture of a Residual Current Device (RCD).

State its purpose, and explain how it works.



A fixed (switchboard, fuse box) RCD device.

Its purpose is to disconnect the mains supply in the event of detecting a fault to earth.

Works by detecting leakage of current to earth from the live conductor of the protected circuit. When a certain leakage current is detected (eg due to faulty equipment, or through someone touching the live conductor) then RCD device turns off the supply (trips). Leakage current is usually extremely small (eg 30mA), and RCD device is very fast acting.

10. Look at the picture below.



a) What is being shown in the picture?

A portable RCD device.

b) Give, with reasons, typical applications of where it might be used in the home.

Domestic applications might include DIY equipment (drill, sander) in order to protect against shock risks. Other applications might be in the garden (eg lawn mower, water feature) where the risk of electric shock could be greater due to the environment.

c) What is the blue button for?

Blue button is a test button and simulates a fault current to earth. Device should trip when button is pressed – and this is a way of checking that the RCD is functioning correctly.



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