

# P2

## Living for the future

### OCR specification match

P2a	2.1 Electricity from the Sun
P2a	2.2 Other ways to use energy from the Sun
P2b	2.3 The dynamo effect, AC, and generators
P2b	2.4 Generating and distributing electricity
P2b	2.5 Fossil fuels and biomass
P2b	2.6 Nuclear power
P2c	2.7 Global warming
P2d	2.8 Power and paying for electricity
P2e	2.9 Alpha, beta, and gamma radiation
P2e	2.10 Uses of radioactivity
P2f	2.11 The Solar System
P2g	2.12 Asteroids, comets, and the Moon
P2h	2.13 The Big Bang
P2h	2.14 The life cycle of stars
P2h	2.15 Changing ideas on the Universe

### Module summary

### OCR Upgrade

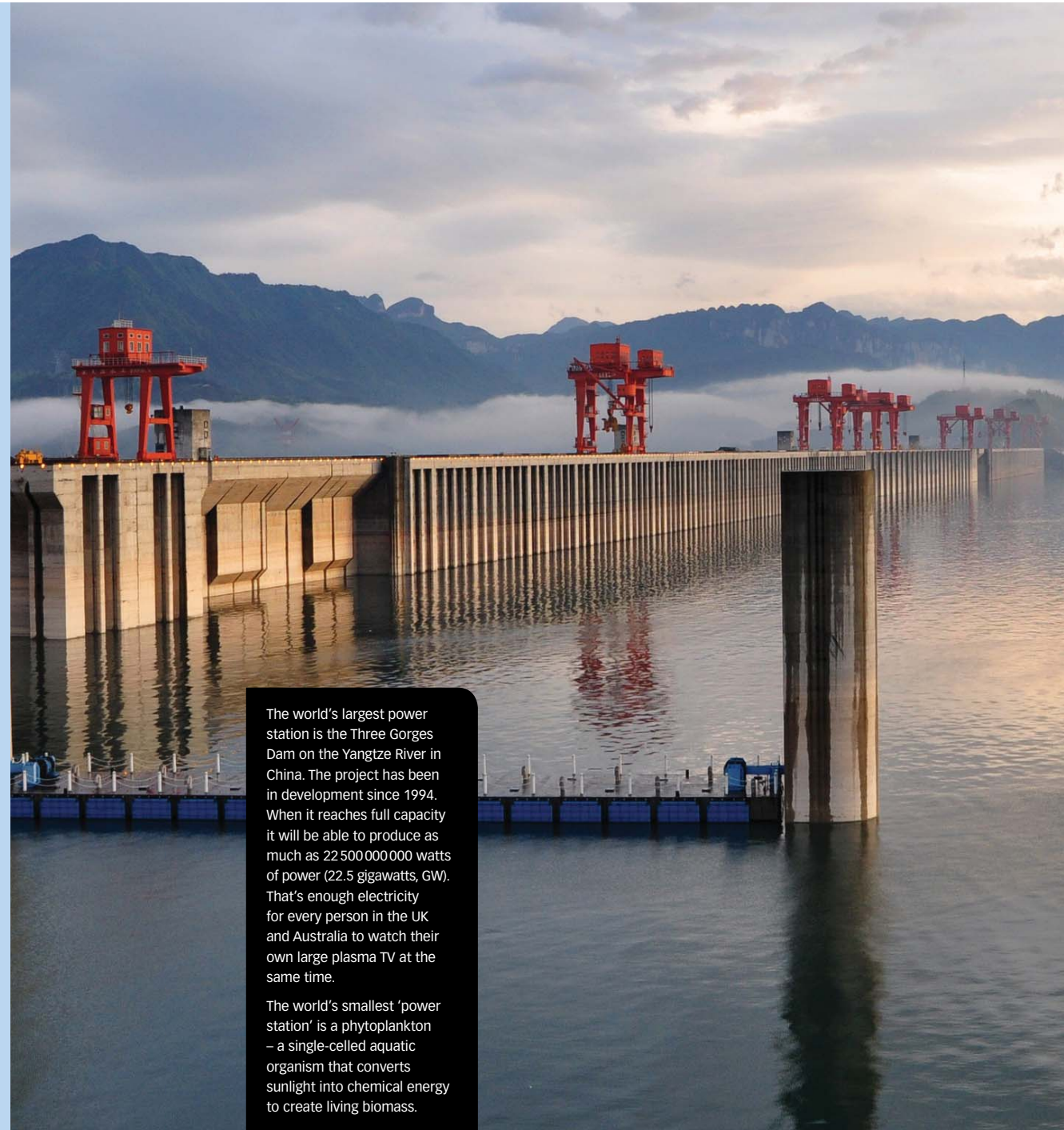
### Why study this module?

Human activity is leading to changes in climates and we are rapidly using up our natural resources. Scientists are working on solutions to these problems. We consume vast amounts of electricity every day, to power our TVs, mobiles and computers. In the future, how will we generate enough to meet our needs? In this module you will learn about how electricity is generated, and the advantages and disadvantages of the different technologies, from large coal-fired power stations to small solar cells on calculators.

Our planet is in a delicate balance. In this module you will be introduced to the science behind global warming and the impact of humans on the environment. You will learn about Earth's place in the Universe, where it fits into the Solar System, how humans have explored space, and about the threats posed by asteroid impact. Finally, you will study scientific ideas about the origin of the Universe, how these ideas have changed over time, and how our Sun will eventually expand and incinerate the Earth.

### You should remember

- 1 All human activity has an impact on the environment.
- 2 The law of conservation of energy states that energy cannot be created or destroyed.
- 3 Electricity may be generated in different types of power station.
- 4 The Earth is one of a number of planets in our Solar System, all in orbit of the Sun.



The world's largest power station is the Three Gorges Dam on the Yangtze River in China. The project has been in development since 1994. When it reaches full capacity it will be able to produce as much as 22 500 000 000 watts of power (22.5 gigawatts, GW). That's enough electricity for every person in the UK and Australia to watch their own large plasma TV at the same time.

The world's smallest 'power station' is a phytoplankton – a single-celled aquatic organism that converts sunlight into chemical energy to create living biomass.

**Learning objectives**

After studying this topic, you should be able to:

- ✓ understand how electricity can be generated from the Sun
- ✓ list some advantages and disadvantages of photocells

**Key words**

photocell, direct current, renewable, intensity

**Energy from the Sun**

The Sun is a stable source of energy. It transfers energy to the Earth as light and infrared radiation.

Energy from the Sun can be used to generate electricity directly. **Photocells** absorb light energy and transform it into electrical energy. They produce **direct current** (DC). A direct current is in the same direction all the time. Cells (batteries) produce direct current.

The amount of current that a photocell produces depends on the area of solar cell that has light shining on it.

- A** What is direct current?  
**B** What energy transfer takes place in a photocell?

Solar cells do not need much maintenance and there is no need for a fuel. They have a long life and do not produce any waste. They are a **renewable** energy resource.

There is no need for power cables and so they can be used in remote locations, to provide electricity for mobile phone masts, lights and phone boxes. They are even used in space, for example on satellites orbiting the Earth. You can also use them to recharge mobile phones and mp3 players.



▲ Photocells provide the electrical energy for the light on this speed warning sign



▲ Photocells can be used to recharge electronic appliances

On the other hand, you would need a very large area of photocells to generate the amount of electricity that is used by a small town. Photocells only work when the Sun is shining, and not at night or in bad weather.



▲ A photocell power station

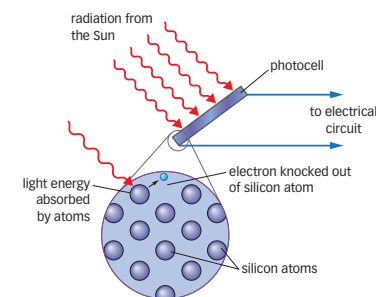
**How a photocell transforms light into electrical energy**

When light shines on a photocell, energy is absorbed by silicon atoms in the photocell. Electrons are knocked out of the silicon atoms. These electrons are then free to flow, creating the direct current.

The amount of electricity produced by a solar cell also depends on the **intensity** of the light shining on it and how far the solar cell is from the light source.



▲ The Hubble Space Telescope uses photocells to transform light energy from the Sun into electrical energy



▲ How a photocell works

**Questions**

- 1** What is a photocell? L
- 2** Draw up a table to summarise the advantages and disadvantages of photocells. S
- 3** Why are photocells used to provide a source of electrical energy for the Hubble Space Telescope? H
- 4** Describe how a photocell works.
- 5** Photocells are used to provide electricity to garden lights. What is needed so that the lights can work at night?

**Exam tip OCR**

- ✓ Remember a photocell cannot produce electricity at night.