

Name _____

Class _____

Date _____

By the end of this worksheet I can...

- ☐ draw a universal system diagram (input, process, output) for a given system
- ☐ draw sub-system diagrams, including feedback paths
- ☐ describe the difference between open loop and closed loop control
- ☐ draw and describe a closed loop control diagram: comparator, controller, driver, output, sensor
- ☐ describe proportional and two-state (on/off) control, and when each suits a situation

I DO

Worked example Read how a full-mark answer is built

An automatic hand dryer switches on when hands are detected under it and switches off after 10 seconds.

1 Draw a universal system diagram for the hand dryer. (3 marks)

Full-mark answer each ✓ is one mark

Input: presence of hands ✓ → Process: control/timing ✓ → Output: heat and moving air ✓.

Why marks are not awarded

"Input: IR sensor → Process: microcontroller → Output: heater and fan."

0 marks: these are components, not system-level inputs and outputs.

WE DO

Guided practice Use the starters and word bank to help you

The hand dryer runs for 10 seconds every time it is triggered.

2 State whether the dryer uses open loop or closed loop control, and justify your answer. (2 marks)

Sentence starters

1. ...
2. ...

Word bank

Feedback · whether

Tip: 2 marks = 2 separate, developed points.

YOU DO

On your own No notes. Check your answers afterwards.

3 Quick check: tick one box for each.

- a) At the comparator, the error signal is...
☐ Set + feedback ☐ Feedback $\times$ gain ☐ Set – feedback ☐ Output $\div$ input
- b) Which control type gives the smoothest approach to the set point?
☐ Open loop ☐ Proportional ☐ Two-state ☐ None
- c) On a universal system diagram, the middle block is labelled...
☐ Process ☐ Control ☐ Driver ☐ Sensor
- d) A toaster that pops up after a fixed time is...
☐ Closed loop ☐ Sensor-controlled ☐ Open loop ☐ Feedback-controlled

4 Key terms: write the letter of the matching description next to each term.

1. Universal system diagram	_____	A No feedback: the output is not checked.
2. Sub-system	_____	B Set value minus feedback value, found at the comparator.
3. Open loop control	_____	C The signal from the output returned to the input/controller for comparison.
4. Closed loop control	_____	D A sensor feeds back the actual output; the controller compares it with the set level and adjusts.
5. Feedback	_____	E One block of a system, e.g. sensor, controller, driver, output device.
6. Error signal	_____	F Input $\rightarrow$ process $\rightarrow$ output.

An incubator must keep eggs at $37.5\text{ }^{\circ}\text{C} \pm 0.2\text{ }^{\circ}\text{C}$.

5 Explain why two-state (on/off) control is unsuitable for the incubator. (2 marks)

A motor speed controller uses proportional control.

6 Describe how proportional control works. (2 marks)

A greenhouse heater keeps the temperature at 22 °C using a thermistor.

7 Describe how the closed loop control system keeps the temperature at 22 °C. (3 marks)

Check and reflect

Mark your answers with the answer sheet. Go back to the checklist on the site and re-rate each “I can” statement above. Which one still needs work?
