A-LEVEL PHYSICS • EXERCISE SHEET

14.2 Temperature scales

Name: _____ Class: _____ Date: _____ **Total: 11 marks**

Objective

Build the skills to answer exam questions on **temperature scales** —thermometry, kelvin/Celsius, and absolute zero.

You must be able to:

- name **physical properties** used to measure temperature
- convert between **kelvin** and **Celsius** ($T/\mathrm{K} = \theta/^\circ\mathrm{C} + 273.15$)
- explain **absolute zero** and the thermodynamic scale

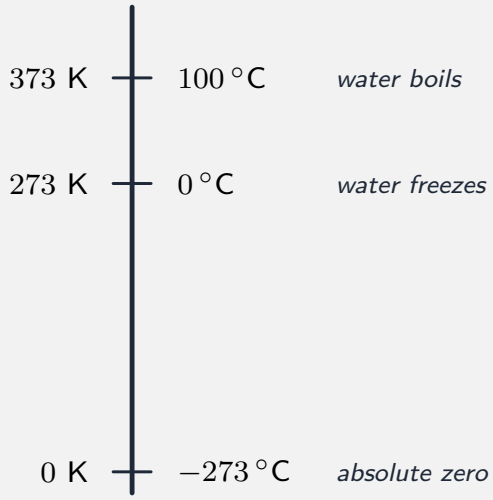
1 Worked examples

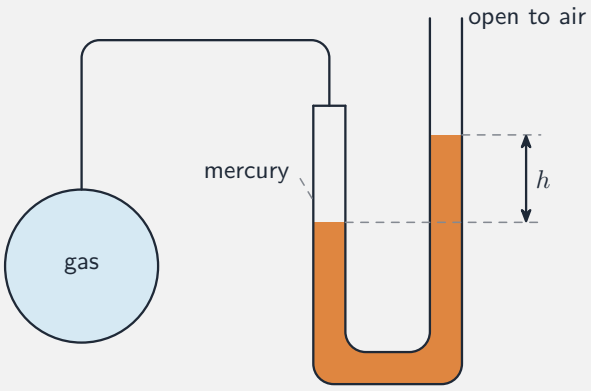
Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

Thermometers

Any **physical property** that changes repeatably with temperature can make a thermometer: density of a liquid, volume of a gas, **resistance** of a metal, or the **e.m.f. of a thermocouple**.

The two scales





A gas thermometer and absolute zero

$$T/\mathrm{K} = \theta/^\circ\mathrm{C} + 273.15.$$

The **thermodynamic** scale does **not** depend on any one substance. The lowest possible temperature is **absolute zero** (0 K = −273.15 °C), where a system has its least internal energy.

2 Practice

Now apply the methods above.

2.1 Convert 27 °C to **kelvin**. [1]

2.2 Convert 200 K to **degrees Celsius**. [1]

2.3 State the value of **absolute zero** in °C. [1]

2.4 Name **two** physical properties used in thermometers. [2]

3 Exam-style questions

3.1 A temperature of 100 °C in kelvin is: [1]

- **A** 173 K
- **B** 373 K

- **C** 273 K
- **D** 100 K

3.2 State what is meant by **absolute zero**. [2]

3.3 Convert 310 K to **degrees Celsius**. [1]

3.4 Explain why the **thermodynamic** (kelvin) scale is preferred over a scale based on a single physical property. [2]

---

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **14.2 Temperature scales** past-paper sheet in the Library, or try these in **Practice mode**:

- 9702/41 N25 —Q4 (temperature scales, calculation)
- 9702/43 N25 —Q4 (kelvin and Celsius)

Solutions

2.1 $T = 27 + 273 = 300$ K.

2.2 $\theta = 200 - 273 = -73$ °C.

2.3 −273 °C (−273.15).

2.4 Any two: density of a liquid; volume of a gas; resistance of a metal; e.m.f. of a thermocouple.

3.1 B —373 K.

3.2 The **lowest possible temperature**, at which a system has its **minimum internal energy** (least particle motion).

3.3 $\theta = 310 - 273 = 37$ °C.

3.4 A property-based scale depends on **how that property changes** (it may not be linear), so different thermometers can disagree; the thermodynamic scale is defined independently of any substance, so it is consistent.