

21.2 Rectification and smoothing

Name: _____ Class: _____ Date: _____

Total: 14 marks

Objective

Build the skills to answer exam questions on **rectification** and **smoothing**.

You must be able to:

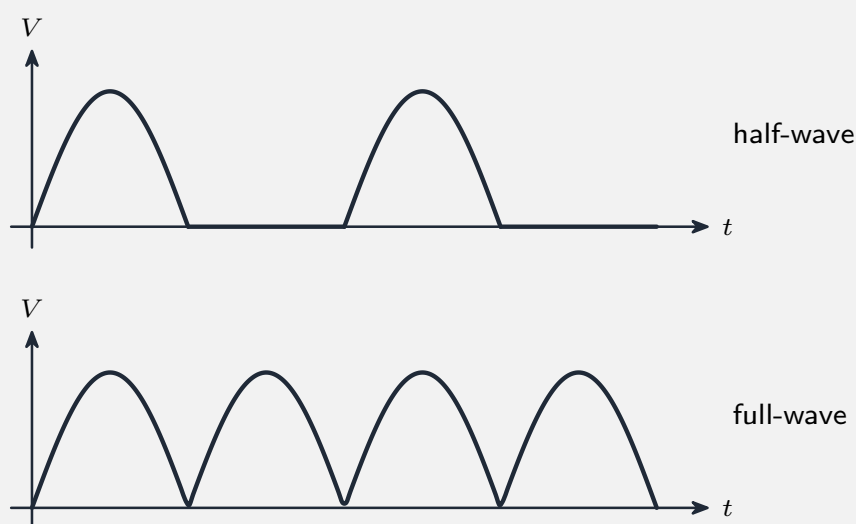
- distinguish **half-wave** and **full-wave** rectification
- explain the **single diode** and the **bridge rectifier**
- explain capacitor **smoothing**

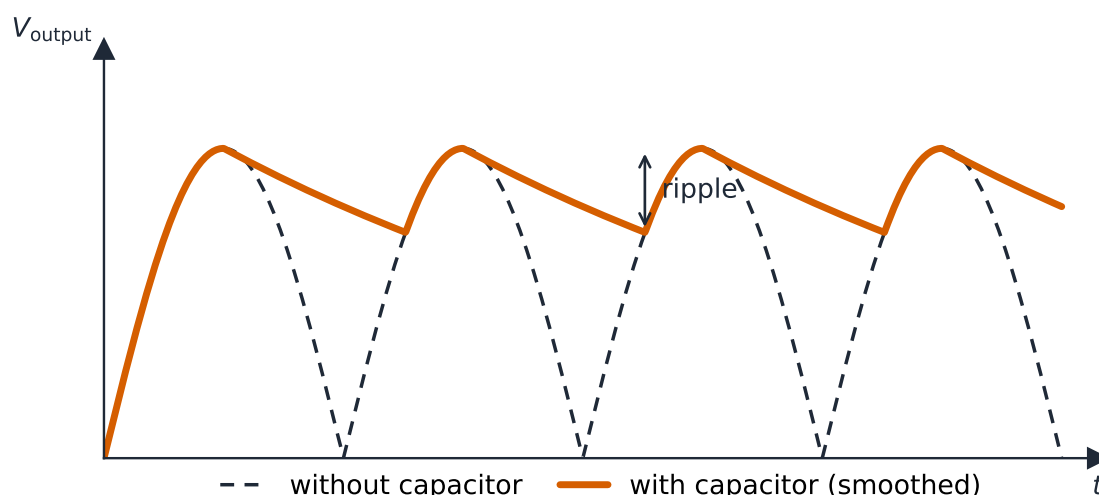
1 Worked examples

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.

■ Rectification

Rectification turns a.c. into one-direction (d.c.-like) voltage using **diodes**:





A smoothing capacitor after rectification

- **half-wave** (single diode): passes only positive half-cycles —half the input wasted;
- **full-wave** (4-diode **bridge rectifier**): uses every half-cycle, giving continuous humps at **twice** the frequency.

■ Smoothing

A **capacitor** across the load charges on each peak and discharges through the load in the gaps, reducing the **ripple**. A **larger** capacitance (or larger load resistance) gives **smoother** output (larger time constant RC).

2 Practice

Now apply the methods above.

2.1 State what **rectification** does. [1]

2.2 State how many **diodes** a bridge rectifier uses. [1]

2.3 State the difference between **half-wave** and **full-wave** output. [2]

2.4 State the purpose of a **smoothing capacitor**. [1]

3 Exam-style questions

3.1 A **single diode** in series with a load produces: [1]

- **A** full-wave rectification
 - **B** half-wave rectification
 - **C** smoothed d.c.
 - **D** alternating current
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3.2 Explain how a single diode produces **half-wave** rectification. [2]

3.3 Describe how a **bridge rectifier** (four diodes) achieves **full-wave** rectification. [3]

3.4 Explain how a **capacitor** smooths the output, and what happens to the smoothing if the **capacitance is increased**. [3]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **21.2 Rectification and smoothing** past-paper sheet in the Library, or try these in **Practice mode**:

- 9702/42 N25 —Q7 (rectification of an a.c. voltage)
- 9702/44 N25 —Q6 (rectification and smoothing)
- 9702/41 J25 —Q6 (bridge rectifier)
- 9702/44 J25 —Q8 (smoothing capacitor)
- 9702/43 J25 —Q6 (rectification)

Solutions

2.1 Turns an **alternating** voltage/current into a **one-direction** (d.c.-like) one.

2.2 Four.

2.3 Half-wave keeps **only the positive half-cycles** (with gaps); full-wave **inverts the negative half-cycles** too, giving a continuous run of positive humps at twice the frequency.

2.4 To **smooth** the output —reduce the ripple, giving a steadier d.c..

3.1 B —half-wave rectification.

3.2 The diode conducts only when **forward-biased** (positive half-cycle); on the negative half-cycle it is **reverse-biased** and blocks the current, so only positive humps pass.

3.3 Four diodes are arranged so that on **each** half-cycle a **different pair** conducts; whichever a.c. terminal is positive, the current through the load flows the **same way**; so every half-cycle is used, giving full-wave output.

3.4 The capacitor **charges** to the peak and **discharges** slowly through the load during the dips, filling the gaps and reducing the ripple; a **larger** capacitance increases the time constant RC , so it discharges more slowly and the output is **smoother** (smaller ripple).