

# 11.2 Power Generation & Transmission

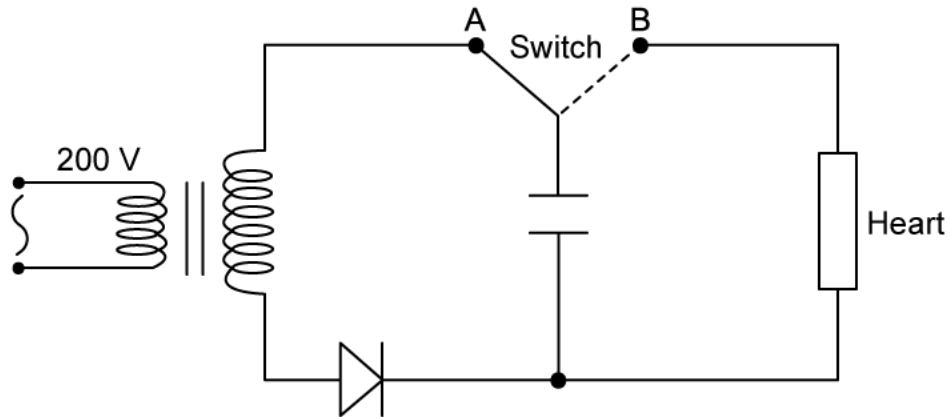
## Question Paper

Course	DPIB Physics
Section	11. Electromagnetic Induction (HL only)
Topic	11.2 Power Generation & Transmission
Difficulty	Easy

**Time allowed:** 60  
**Score:** /49  
**Percentage:** /100

### Question 1a

A defibrillator device sends an impulse of electrical energy to maintain a regular heartbeat in a person. The device is powered by an alternating current (ac) supply connected to a step-up transformer that charges a capacitor.



- (a)  
State two reasons for placing the diode in the circuit.

[2]

[2 marks]

### Question 1b

The e.m.f. across the primary coil of the transformer is 200 V. The number of turns on the primary coil is 5 and the number of turns on the secondary coil is 50.

- (b)  
Calculate the e.m.f. across the secondary coil.

[3]

[3 marks]

**Question 1c**

(c)

Calculate the fraction  $\frac{I_s}{I_p}$  between the primary and secondary coils of the transformer.

[2]

**[2 marks]****Question 1d**

In rectification to produce a steady direct current from an alternating current a smoothing capacitor is necessary.

(d)

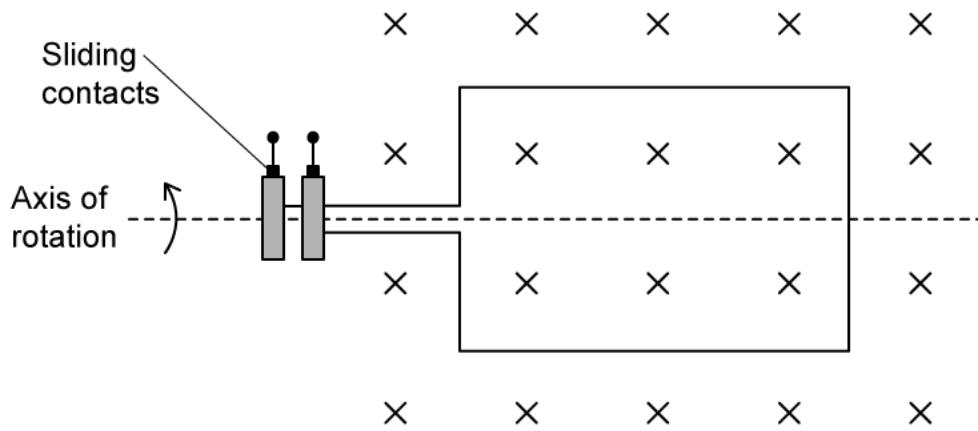
Define smoothing.

[1]

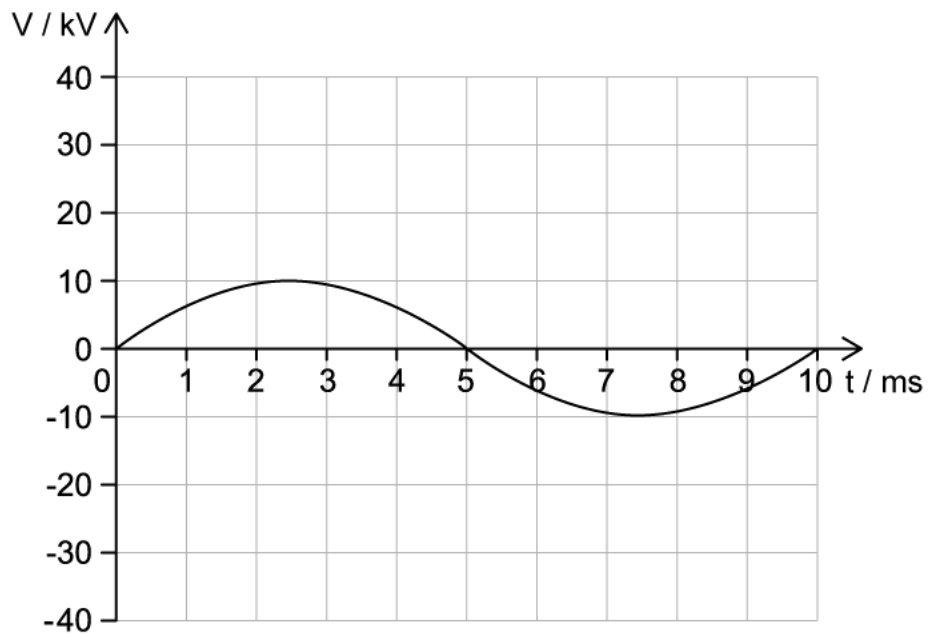
**[1 mark]**

**Question 2a**

The diagram shows an alternating current generator with a rectangular coil rotating at a constant frequency in a uniform magnetic field.



The graph shows how the output voltage  $V$  from the generator varies with time  $t$ .



(a)  
Use the graph to determine the maximum output voltage.

[2]

[2 marks]

### Question 2b

(b)

Calculate the root mean squared voltage,  $V_{\text{rms}}$ .

[3]

[3 marks]

### Question 2c

The average power output of the generator is  $4.8 \times 10^5 \text{ W}$ .

(c)

Calculate the root mean squared current,  $I_{\text{rms}}$ .

[4]

[4 marks]

### Question 2d

(d)

Sketch a line on the graph to show the  $V_{\text{rms}}$ .

[2]

[2 marks]

### Question 3a

A transformer inside the charger of a household appliance has a primary coil at 230 V and a secondary coil at 80 V. The number of turns in the primary coil is 1650.

(a)

Calculate the number of turns in the secondary coil.

[3]

[3 marks]

### Question 3b

(b)

Hence, state whether this is a step-up or step-down transformer. Explain your answer.

[2]

[2 marks]

### Question 3c

The appliance has an output power of 30 W.

(c)

Calculate the output current for the appliance.

[3]

[3 marks]

**Question 3d**

(d)

Outline how eddy currents are reduced in the core of a transformer.

[2]

**[2 marks]****Question 4a**

(a)

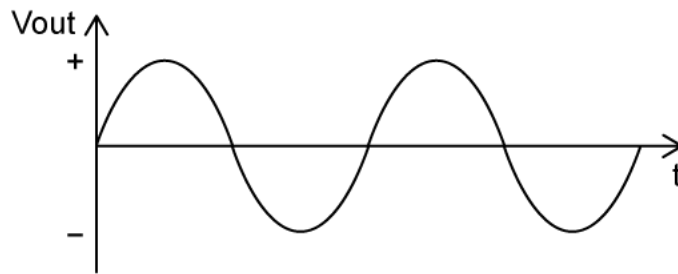
State the meaning of rectification.

[1]

**[1 mark]**

### Question 4b

The graph shows the voltage output from an alternating current supply.



(b)

Sketch how the graph changes during:

(i) Half-wave rectification



[1]

(ii) Full-wave rectification



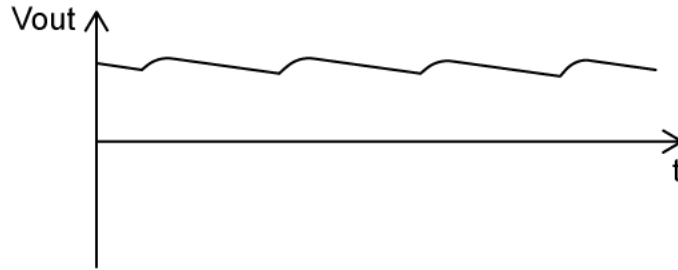
[1]

[2 marks]



### Question 4c

In rectification, a smoothing capacitor is often necessary. The resulting graph of the output current against time gives a 'ripple' shape.



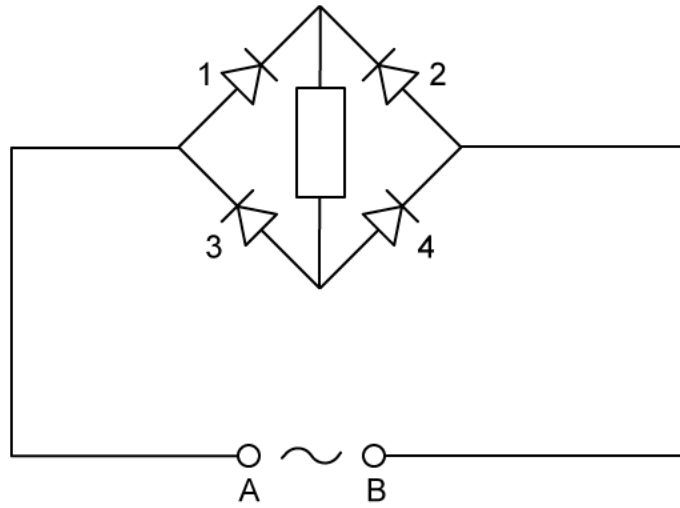
(c)  
State how the 'ripples' in the graph can be reduced.

[2]

[2 marks]

### Question 4d

The circuit shows a diode bridge circuit.



(d)  
State the diodes that will conduct when

(i) A is positive.

[1]

(ii) B is positive.

[1]

[2 marks]

### Question 5a

The following paragraph explains the operation of a basic a.c. generator.

An a.c. generator consists of a coil rotating in a \_\_\_\_\_ field. The ends of the coil are attached to \_\_\_\_\_ rings that rotate along with the coil. These touch \_\_\_\_\_ that transfer the current into an external circuit. The magnetic \_\_\_\_\_ changes as the coil rotates and an \_\_\_\_\_ is induced. An ac generator converts \_\_\_\_\_ energy into \_\_\_\_\_ energy.

(a)

Complete the sentences using keywords from below.

You may use any keyword once, more than once, or not at all.

e.m.f. flux electrical field magnetic

brushes mechanical slip electric

[5]

[5 marks]

### Question 5b

A generator produces an rms voltage of 35 V.

(b)

Show that the peak voltage for the generator is around 50 V.

[3]

[3 marks]

**Question 5c**

The average power output of the generator is 0.25 kW.

(c)

Calculate the peak current produced by the generator.

[4]

**[4 marks]**

**Question 5d**

(c)

Outline the effect of the output if the frequency of an ac generator is increased.

[1]

**[1 mark]**