

YEAR 2 | MODULE 6 | PACK 02

Charging, discharging and circuit models

Official past-paper questions

2017-2023 | OCR A H556 | 6.1.1(c)-(e); 6.1.3(a)-(e)

23 marks | 8 question entries

One practice session

Use: attempt the session after learning its content. Try without notes; record any help used. Mark the session, identify the reason for lost marks, then revisit those questions after a few days.

Format: all MCQs appear first with their complete answer boxes. Written extracts retain the original paper's answer space. Only the subparts named in the source reference are assigned.

Reserved: all 2024 and 2025 papers are excluded. These files contain official examination questions only; no sample, specimen or practice papers.

Name: _____

First attempt: _____ Score: _____ / 23

[Official data, formulae and relationships booklet](#)

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CP identifiers are stable across the question packs and mark schemes; Q numbers refer to this pack. All MCQs appear first.

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Q01 | CP02

1 mark

June 2017 | H556/02 | Q8

- 8 A capacitor discharges through a resistor. At time $t = 0$, the charge stored by the capacitor is $600\mu\text{C}$. The capacitor loses 5.0 % of its charge every second.

What is the charge **left** on the capacitor at time $t = 4.0\text{ s}$?

- A $111\mu\text{C}$
- B $120\mu\text{C}$
- C $480\mu\text{C}$
- D $489\mu\text{C}$

Your answer

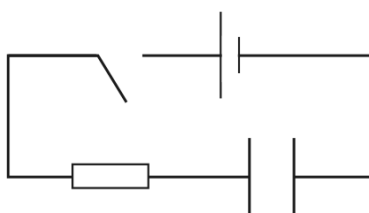
[1]

Q02 | CP07

1 mark

June 2018 | H556/02 | Q9

- 9 A capacitor is charged through a resistor.



The cell has e.m.f. 1.50 V and negligible internal resistance.
The capacitor is initially uncharged. The time constant of the circuit is 100 s .
The switch is closed at time $t = 0$.

What is the potential difference across the capacitor at time $t = 200\text{ s}$?

- A 0.20 V
- B 0.55 V
- C 0.95 V
- D 1.30 V

Your answer

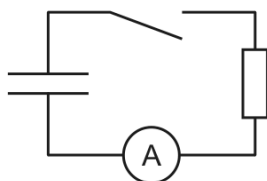
[1]

Q03 | CP10

1 mark

June 2019 | H556/02 | Q14

- 14 A capacitor is discharged through a resistor.



The capacitor is fully charged at time $t = 0$. The time constant of the circuit is 10 s. The switch is closed at time $t = 0$. The current in the resistor is I .

Which row is correct?

	Current I at $t = 0$	Current I at $t = 10$ s
A	maximum	0
B	maximum	37% of the current at $t = 0$
C	0	63% of the current at $t = \infty$
D	0	37% of the current at $t = \infty$

Your answer

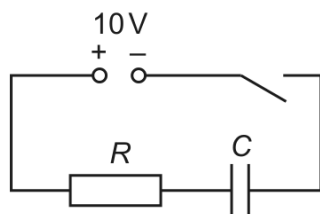
[1]

Q04 | CP13

1 mark

November 2020 | H556/02 | Q7

- 7 The diagram below shows a circuit used to charge a capacitor.



The power supply has electromotive force (e.m.f.) 10 V and negligible internal resistance.
The capacitor has capacitance C and the resistor has resistance R .
The switch is closed at time $t = 0$.
The table below shows potential difference V across the resistor at various values of time t .

V/V	10	6.3	5.0	3.7
t/s	0	2.8	4.2	6.0

What is the product $C \times R$ for this circuit?

- A 0 s
- B 2.8 s
- C 4.2 s
- D 6.0 s

Your answer

[1]

Q05 | CP16

1 mark

November 2021 | H556/02 | Q6

- 6 A student is modelling the decay of charge for a capacitor discharging through a resistor using the equation $\frac{\Delta Q}{\Delta t} = -0.2Q$.

The student decides to use $\Delta t = 0.5\text{ s}$.

The initial charge on the capacitor is $1000\mu\text{C}$.

Part of the modelling spreadsheet from the student is shown below.

t/s	Charge Q left on capacitor at time $t/\mu\text{C}$	Charge ΔQ decaying in the next $0.5\text{ s}/\mu\text{C}$
0	1000	100
0.5	900	
1.0		
1.5		

What is the value of Q in μC at $t = 1.5\text{ s}$?

- A 700
B 720
C 729
D 800

Your answer

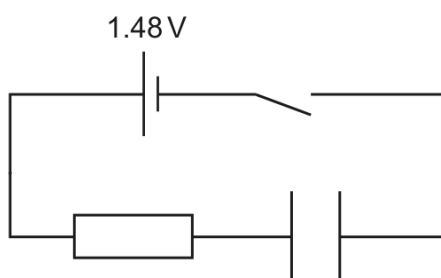
[1]

Q06 | CP17A

4 marks

November 2021 | H556/02 | Q20(a)

20 (a) The diagram below shows a circuit to charge a capacitor.



The electromotive force (e.m.f.) E of the cell is 1.48 V and it has negligible internal resistance. The resistance of the resistor is $120\text{ k}\Omega$ and the capacitance of the capacitor is $2000\text{ }\mu\text{F}$. At time $t = 0$ the capacitor is uncharged. The switch is closed at time $t = 0$.

Calculate the time t when the potential difference across the capacitor is 1.00 V .

$t = \dots\dots\dots\text{ s}$ [4]

Only (a) is assigned. The original charging circuit and all component values are retained; no answer from (b) is needed.

Q07 | CP04B

4 marks

June 2017 | H556/02 | Q21(b)(i)-(ii)

(b) Fig. 21 shows a circuit.

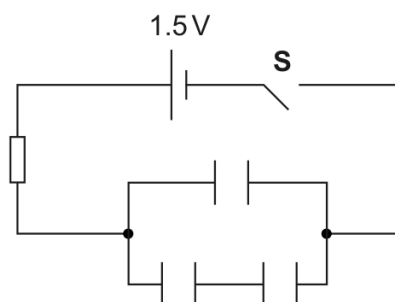


Fig. 21

The capacitance of each capacitor is $1000\,\mu\text{F}$. The resistance of the resistor is $10\,\text{k}\Omega$. The cell has e.m.f. 1.5V and negligible internal resistance.

(i) Calculate the total capacitance C in the circuit.

$C = \dots\dots\dots \mu\text{F}$ [2]

(ii) The switch **S** is closed at time $t = 0$. There is zero potential difference across the capacitors at $t = 0$.
Calculate the potential difference V across the resistor at time $t = 12\text{s}$.

$V = \dots\dots\dots \text{V}$ [2]

Only (b)(i)-(ii) are assigned. The original network diagram and all component values are retained. The capacitance calculated in (i) is available for the charging calculation in (ii); the permittivity calculation in (a) is omitted.

Q08 | CP19

10 marks

June 2022 | H556/03 | Q6

- 6 (a) Define the **time constant** of a circuit containing a capacitor of capacitance C and a resistor of resistance R .

.....
 [1]

- (b) The capacitor circuit shown in **Fig. 6.1** can be used to smooth oscillating electrical signals.

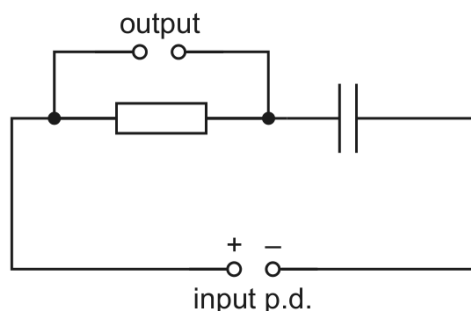


Fig. 6.1

- (i) **Fig. 6.2** shows the input signal of potential difference (p.d.) V against time t .

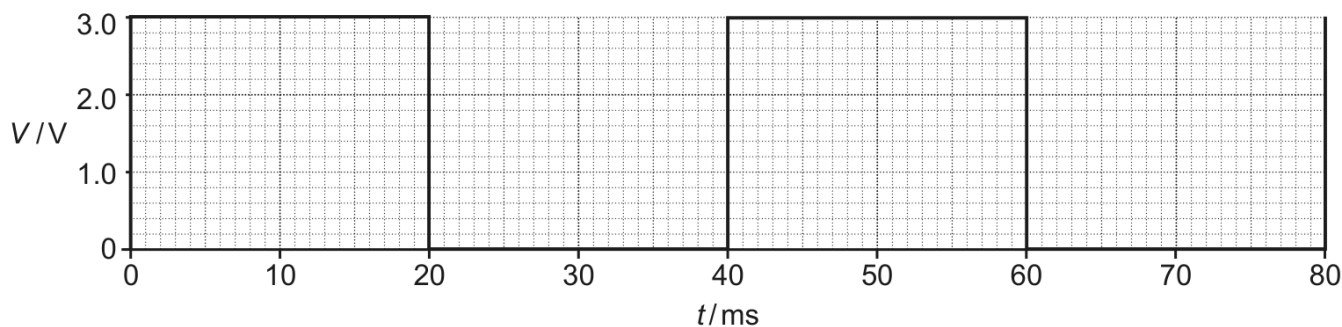


Fig. 6.2

Calculate the frequency f of this input signal.

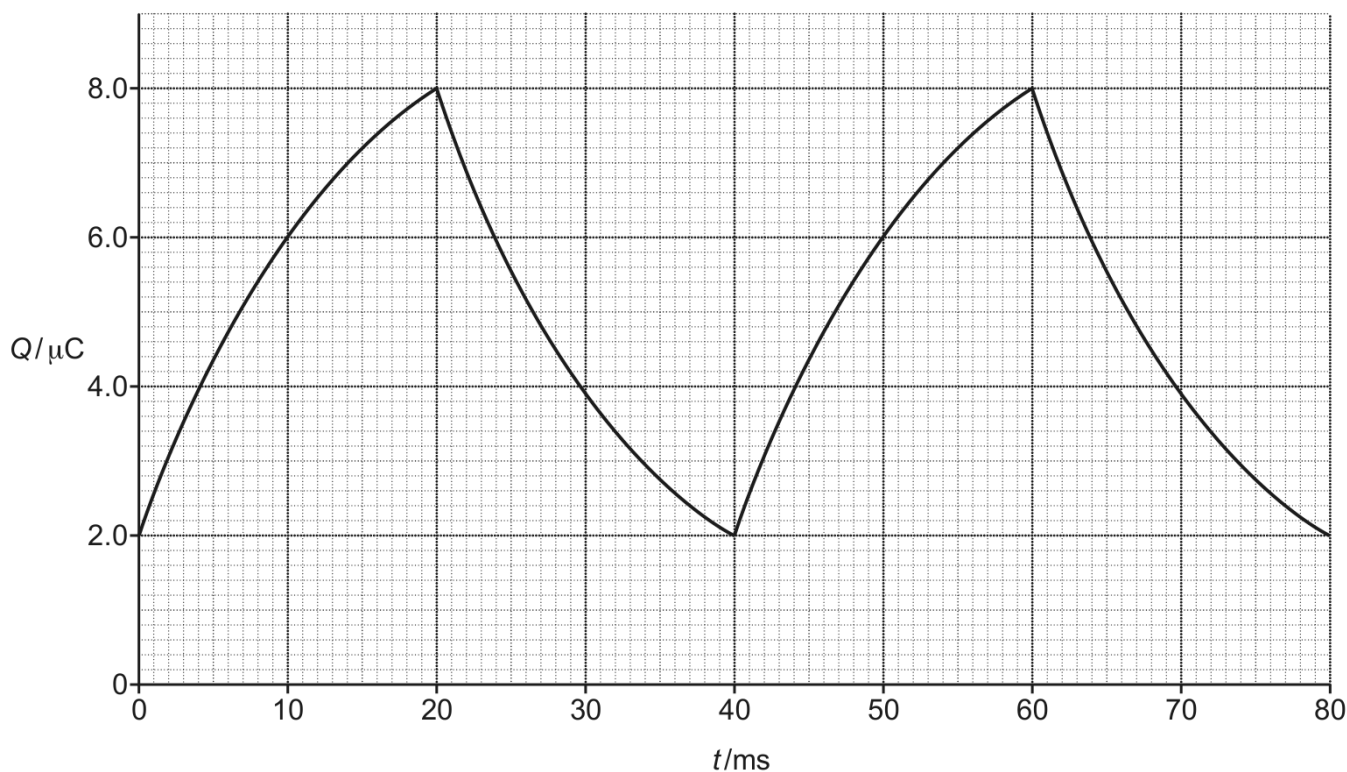
$f =$ Hz [2]

Q08 | CP19 - continued

10 marks

June 2022 | H556/03 | Q6

- (ii) **Fig. 6.3** shows the variation of the charge Q on the positive plate of the capacitor with time t .

**Fig. 6.3**

Use a discharging section of the graph in **Fig. 6.3** to determine the time constant of the circuit. Give your answer in ms.

time constant = ... ms [2]

- (iii) By drawing a suitable tangent to the graph in **Fig. 6.3**, calculate the maximum current in the resistor.

maximum current = ... A [2]

The complete question is assigned. Both input and charge graphs, the current-sketch axes and all linked calculations are retained. The following general additional-answer page is not part of this question.

Q08 | CP19 - continued

10 marks

June 2022 | H556/03 | Q6

- (iv) On Fig. 6.4 below, sketch the variation of the current I in the resistor with time t . Include an appropriate label and scale on the vertical axis.

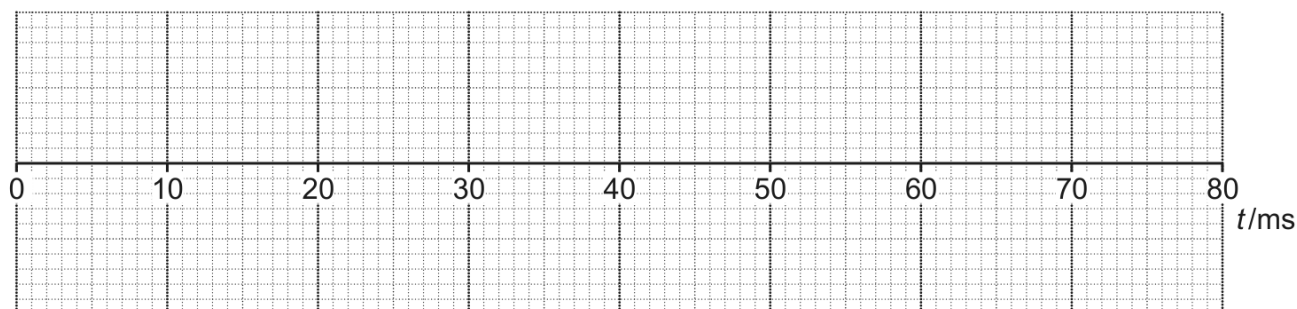


Fig. 6.4

[3]

The complete question is assigned. Both input and charge graphs, the current-sketch axes and all linked calculations are retained. The following general additional-answer page is not part of this question.