

YEAR 2 | MODULE 6 | PACK 01

Charge and stored energy

Official past-paper questions

2017-2023 | OCR A H556 | 6.1.1(a), (d); 6.1.2(a)-(c)

10 marks | 3 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.

This short pack introduces capacitor energy and parallel storage networks. The torch and laser contexts provide all necessary data; the questions do not require electromagnetic-induction or nuclear-fusion calculations.

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: _____ / 10

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

Question index

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

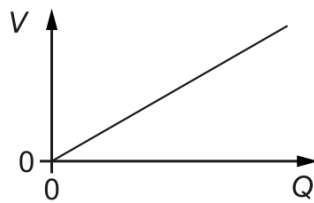
Question / source	Marks	Page
Q01 CP01	1	3
June 2017 H556/02 Q7		
Q02 CP12B	4	4
June 2019 H556/03 Q3(b)(i)-(ii)		
Q03 CP21AB	5	6
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Q01 | CP01

1 mark

June 2017 | H556/02 | Q7

- 7 The graph below shows the variation of potential difference V with charge Q for a capacitor.



Which row is correct for the gradient of the graph and the area under the graph?

	Gradient of graph	Area under the graph
A	capacitance ⁻¹	work done
B	capacitance ⁻¹	permittivity
C	capacitance	power
D	capacitance	energy

Your answer

[1]

Q02 | CP12B

4 marks

June 2019 | H556/03 | Q3(b)(i)-(ii)

- 3 Fig. 3.1 shows the design of a 'mechanical' torch.

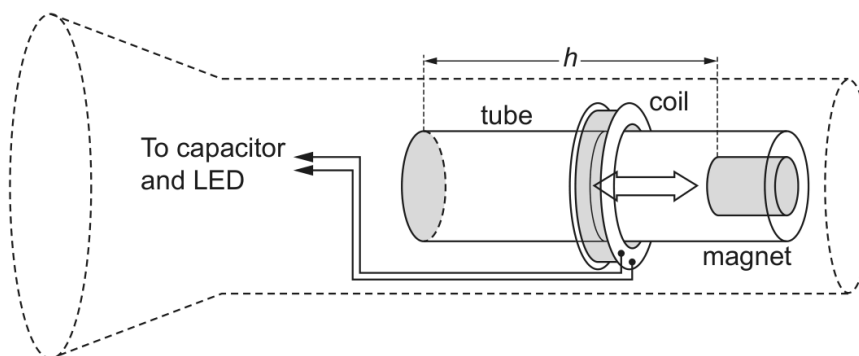


Fig. 3.1

There is no battery in the torch. Instead, when the torch is inverted, the magnet falls a short vertical distance h through the coil of wire, as shown in Fig. 3.2. This induces an electromotive force (e.m.f.) across the ends of the coil. The e.m.f. is used to store charge in a capacitor, which lights a light-emitting diode (LED) when it discharges.

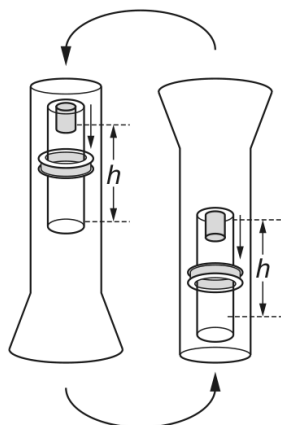


Fig. 3.2

Fig. 3.3 shows the variation with time of the e.m.f. generated as the magnet falls the distance h .

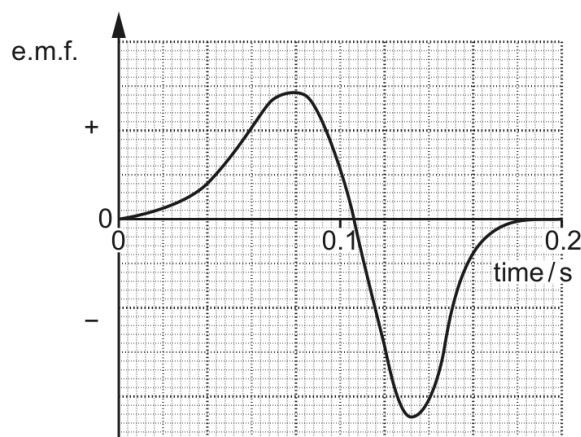


Fig. 3.3

Only (b)(i)-(ii) are assigned. The original torch diagrams, pulse graph and numerical data are retained. The energy result from (i) is available for (ii); the induction explanation and efficiency investigation are omitted.

Q02 | CP12B - continued

4 marks

June 2019 | H556/03 | Q3(b)(i)-(ii)

- (b) When the torch is inverted, the pulses of e.m.f. shown in Fig. 3.3 cause a capacitor of capacitance 0.12 F to become charged.
Each positive **and** each negative pulse adds $9.0 \times 10^{-3} \text{ C}$ to the charge stored in the capacitor.

- (i) The torch is inverted 80 times.

Calculate the total energy stored in the capacitor.

total energy = ... J [3]

- (ii) When the torch is switched on, the energy stored in the capacitor lights a 50 mW LED.

Estimate the time for which the LED lights.

time = ... s [1]

Only (b)(i)-(ii) are assigned. The original torch diagrams, pulse graph and numerical data are retained. The energy result from (i) is available for (ii); the induction explanation and efficiency investigation are omitted.

Q03 | CP21AB

5 marks

June 2023 | H556/03 | Q5(a)-(b)

- 5** Large power stations generate an electrical power of about 1 GW.

Current methods of energy production that use nuclear fusion are unable to produce enough energy for large-scale energy production. A proposed method of controlling nuclear fusion is inertial confinement fusion (ICF). ICF uses a large number of powerful lasers to create the high temperatures required for nuclear fusion to occur.

One ICF experiment uses a network of capacitors to store the energy needed to power the lasers. When the network is fully charged:

- potential difference across the network = 24 kV
- total energy stored in the network = 400 MJ

- (a) (i)** Calculate the total capacitance, C , of the network.

$C = \dots\dots\dots$ F [2]

- (ii)** Explain why the individual capacitors in the network should be connected in parallel in order to produce this total capacitance.

$\dots\dots\dots$
 $\dots\dots\dots$ [1]

- (b)** The total stored energy must be released in a time of less than 1 millisecond.

Explain, using a calculation, why the lasers are powered by the network of capacitors instead of being connected directly to the mains electricity supply.

$\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$ [2]

Only (a) and (b) are assigned. The original network voltage, stored energy and power-station data are retained. The nuclear-fusion calculation is omitted; no nuclear-physics calculation is required.