

YEAR 2 | MODULE 6 | PACK 04

Capacitance links to electric fields

Official past-paper questions

2017-2023 | OCR A H556 | 6.1 applied with 6.2.3(a)-(b) and 6.2.4(c)

20 marks | 7 question entries

Later applications - use after the required topics

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.

Do this pack after the relevant electric-fields content. These are capacitor questions that also need parallel-plate geometry, permittivity, field strength or spherical capacitance; they are separate from the core chapter test.

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: _____ / 20

[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.

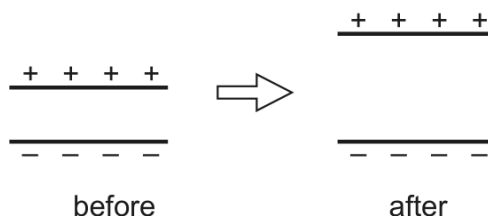
Question / source	Marks	Page
Q01 CP03	1	3
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Q01 | CP03

1 mark

June 2017 | H556/02 | Q9

- 9 Two isolated parallel capacitor plates have an equal and opposite charge. The separation between the plates is doubled. The charge on each plate remains the same but the potential difference between the plates doubles.



Which statement is correct?

- A The capacitance of the capacitor doubles.
- B The energy stored by the capacitor is halved.
- C The permittivity of free space doubles.
- D The electric field strength between the plates remains the same.

Your answer

[1]

Q02 | CP06

1 mark

June 2018 | H556/02 | Q8

- 8 An isolated metal sphere is charged using a power supply.

Which single quantity can be used to determine the capacitance of the sphere?

- A The diameter of the sphere.
- B The charge on the sphere.
- C The resistance of the metal.
- D The e.m.f. of the power supply.

Your answer

[1]

Q03 | CP04A

2 marks

June 2017 | H556/02 | Q21(a)

Requires: Parallel-plate capacitance and permittivity.

- 21 (a)** A capacitor of capacitance 7.2 pF consists of two parallel metal plates separated by an insulator of thickness 1.2 mm . The area of overlap between the plates is $4.0 \times 10^{-4}\text{ m}^2$. Calculate the permittivity of the insulator between the capacitor plates.

permittivity = ... F m^{-1} [2]

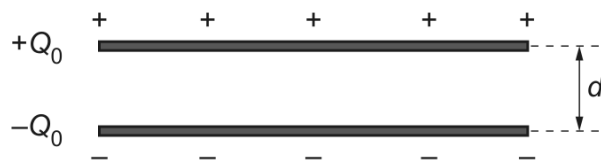
Only (a) is assigned. All plate dimensions and the capacitance are given; no result from (b) is required.

Q04 | CP18A

4 marks

June 2022 | H556/02 | Q22(a)

Requires: Parallel-plate capacitance and electric forces between charged plates.

22 (a) The diagram below shows a simple capacitor.

The capacitor consists of two horizontal metal plates in a vacuum. The magnitude of the charge on each plate is Q_0 . The potential difference (p.d.) between the plates is V_0 . The capacitor plates have capacitance C_0 . The separation between the plates is d . The energy stored by the capacitor is E_0 .

The top plate is moved vertically upwards. The new separation between the plates is $2d$. The charge on each plate remains the **same**. The energy stored by the capacitor **increases**.

(i) Determine the new:**1** capacitance in terms of C_0 capacitance = ... C_0 [1]**2** p.d. between the plates in terms of V_0 p.d. = ... V_0 [1]**3** energy stored in terms of E_0 .energy = ... E_0 [1]**(ii)** Explain, in terms of forces between the plates, why the energy stored increases.

.....

..... [1]

Only (a) is assigned. The original plate diagram and fixed-charge conditions are retained; the discharge experiment in (b) is not required.

Q05 | CP11A

4 marks

June 2019 | H556/02 | Q22(a)(i)-(ii)

Requires: Parallel-plate capacitance.

- 22 (a)** Fig. 22.1 shows two horizontal metal plates in a vacuum.

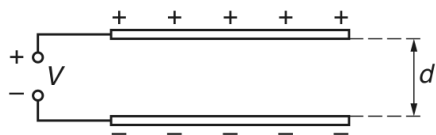


Fig. 22.1

The plates are connected to a power supply. The potential difference V between the plates is constant. The magnitude of the charge on each plate is Q . The separation between the plates is d .

Fig. 22.2 shows the variation with d of the charge Q on the positive plate.

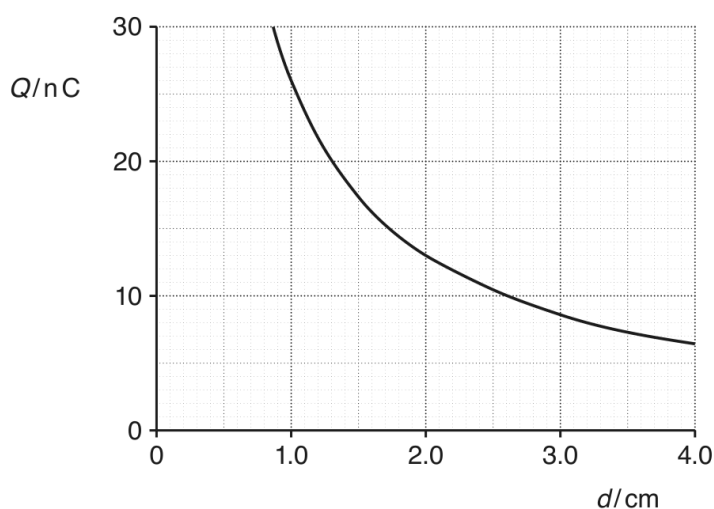


Fig. 22.2

- (i) Use Fig. 22.2 to propose and carry out a test to show that Q is inversely proportional to d .

Test proposed:

.....

Working:

[2]

Only (a)(i)-(ii) are assigned. The original fixed-voltage statement and charge-separation graph are retained. The oil-drop and charged-foil questions are omitted.

Q05 | CP11A - continued

4 marks

June 2019 | H556/02 | Q22(a)(i)-(ii)

- (ii) Use capacitor equations to show that Q is inversely proportional to d .

[2]

Only (a)(i)-(ii) are assigned. The original fixed-voltage statement and charge-separation graph are retained. The oil-drop and charged-foil questions are omitted.

Q06 | CP18B2

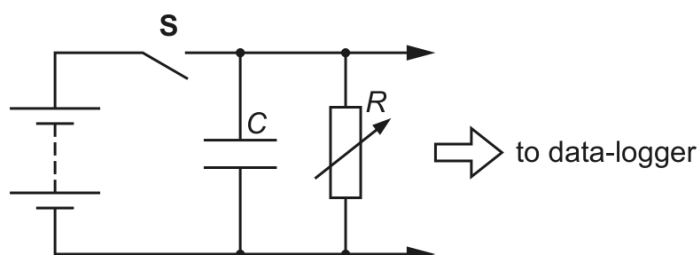
2 marks

June 2022 | H556/02 | Q22(b)(ii)2

Requires: Parallel-plate capacitance and permittivity.

Given result from omitted (b)(ii)1: the capacitance C is $7.8 \times 10^{-9} \text{ F}$.

- (b) A student discharges a capacitor of capacitance C through a variable resistor of resistance R using the arrangement below.



The capacitor is made from two parallel metal plates separated by a sheet of paper of thickness $8.0 \times 10^{-5} \text{ m}$. The area of overlap between the plates is $3.1 \times 10^{-2} \text{ m}^2$.

The capacitor is charged fully by closing switch **S**. At time $t = 0$, **S** is opened and the capacitor discharges through the resistor. After $t = T$, the potential difference across the capacitor is halved. The student repeats this for several values of R .

- 2 Use your answer in (ii)1 to calculate the permittivity ϵ of the paper.

$\epsilon = \dots\dots\dots \text{ F m}^{-1}$ [2]

Only (b)(ii)2 is assigned. The original plate dimensions are retained, and the earlier capacitance result is supplied explicitly. You can answer this extract without the omitted graph calculation.

Q07 | CP08B

6 marks

June 2018 | H556/02 | Q22(b)

Requires: Parallel-plate capacitance and permittivity.

22 A student wishes to determine the permittivity ϵ of paper using a capacitor made in the laboratory.

The capacitor consists of two large parallel aluminium plates separated by a very thin sheet of paper.

The capacitor is initially charged to a potential difference V_0 using a battery. The capacitor is then discharged through a fixed resistor of resistance $1.0\text{ M}\Omega$.

The potential difference V across the capacitor after a time t is recorded by a data-logger. The student uses the data to draw the $\ln V$ against t graph shown in Fig. 22.

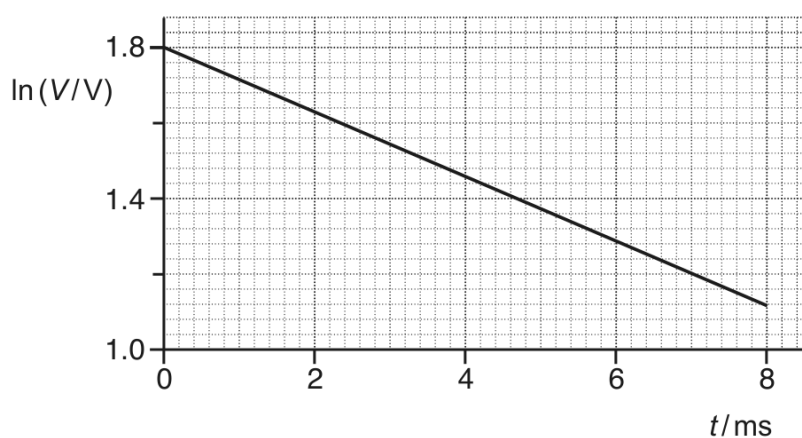


Fig. 22

Only (b) is assigned. The original discharge graph, resistance and capacitor description are retained. No numerical result from (a) is required; its gradient relationship is part of the charging/discharging content.

Q07 | CP08B - continued

6 marks

June 2018 | H556/02 | Q22(b)

- (b)*** Use Fig. 22 to determine the capacitance C of the capacitor. Describe how the student can then use this value of C to determine a value for ϵ .
In your description, mention any additional measurements required on the capacitor.

[6]

Only (b) is assigned. The original discharge graph, resistance and capacitor description are retained. No numerical result from (a) is required; its gradient relationship is part of the charging/discharging content.