

YEAR 2 | MODULE 6 | PACK 05

Capacitance chapter test

Official past-paper mark scheme

2017-2023 | OCR A H556 | Mixed 6.1.1-6.1.3; graphs and experimental reasoning

25 marks | 4 question entries

Suggested time: 35 minutes

Match each extract using its question number and stable CP identifier. Original OCR answers, examiner guidance, alternatives, diagrams and level descriptors are preserved.

The heading gives the maximum marks for the assigned subparts. Alternative methods and "any n from" lists offer routes to those marks; do not add every printed point together.

Click a source reference to open OCR's full official mark scheme. Keep this file closed while attempting the questions.

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

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 CP09	1	3
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Q01 | CP09

1 mark

June 2019 | H556/02 | Q13

Question	Answer	Marks	Guidance
13	A	1	

Q02 | CP14

1 mark

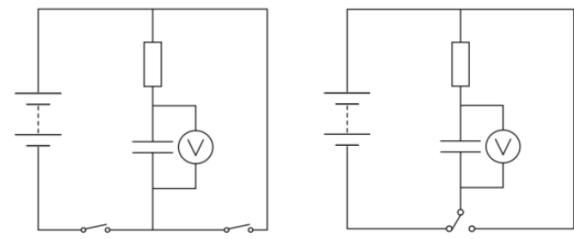
November 2020 | H556/02 | Q8

Question	Answer	Marks	Guidance
8	B	1	

Q03 | CP20

13 marks

June 2023 | H556/02 | Q20

Question			Answer	Mark	Guidance
20	(a)		Circuit showing (6V) supply in series with a capacitor and resistor, with a voltmeter in parallel with the capacitor. Switch/switches allowing discharging of the capacitor through the resistor.	B1 B1	No labels required. ALLOW any suitable symbol for d.c. supply ALLOW this mark if resistor and capacitor in parallel if switch will allow the discharge Examples of correct circuit for both marks e.g. 
	(b)		Charge = $1.0 \times 10^{-6} \times 6.0 = 6.0 \times 10^{-6}$ (C)	A1	ALLOW correct answer to 1 significant figure
	(c)		(CR =) $1 \times 10^{-6} \times 10 \times 10^3$ CR / Time constant / $\tau = 0.010$ (s) Time constant / τ is time taken to fall to 1/e (37%) of initial value The time it takes to record the variation of pd / the capacitor to discharge is far less than (human) <u>reaction time</u> OR	C1 A1 B1 B1	ALLOW POT error for capacitance if same as in (b) ALLOW 1sf ALLOW t for τ NOT fallen <u>by</u> 37%

Q03 | CP20 - continued

13 marks

June 2023 | H556/02 | Q20

Question			Answer	Mark	Guidance
			$V = V_0 e^{-\left(\frac{t}{CR}\right)}$ to give $0.6 = 6.0 e^{-\left(\frac{t}{1.0 \times 10^{-6} \times 10 \times 10^3}\right)}$ $t = 0.023 \text{ (s)}$ 0.6 is the voltage when it has fallen to 10% of the initial voltage The time it takes to record the variation of pd / for the capacitor to discharge is far less than human <u>reaction time</u> OR $V = V_0 e^{-\left(\frac{t}{CR}\right)}$ to give $V = 6.0 e^{-\left(\frac{0.02}{1.0 \times 10^{-6} \times 10 \times 10^3}\right)}$ $V = 0.81 \text{ V}$ 0.02 s is a very short amount of time The time it takes to record the variation of pd / for the capacitor to discharge is far less than human <u>reaction time</u>	(C1) (A1) (B1) (B1) (C1) (A1) (B1) (B1)	Substitution into exponential decay equation to fall to a value of V less than $0.9V_0$ ($<5.4\text{V}$). ALLOW calculation in log form e.g $\ln 0.6 = \ln 6.0 - t/0.01$ Justification/explanation for using a given voltage Substitution into exponential decay equation with a time less than 0.1s ($t < 0.1\text{s}$). ALLOW calculation in log form $\ln V = \ln 6.0 - 0.02/0.01$ Justification/explanation for using a given time
	(d)		Use an oscilloscope / data logger with a voltmeter probe	B1	ALLOW connect a voltmeter to a datalogger
	(e)	(i)	$V = V_0 e^{-\left(\frac{t}{CR}\right)}$ to give $4.12 = 6.0 e^{-\left(\frac{t}{1.0 \times 10^{-6} \times 10 \times 10^3}\right)}$ $= 3.76 \times 10^{-3} \text{ (s)}$	C1 A1	ALLOW in terms of logs eg $\ln 4.12 = \ln 6.0 - \frac{t}{0.01}$ Correct to at least 2 significant figures IGNORE minus sign in final answer

Q03 | CP20 - continued

13 marks

June 2023 | H556/02 | Q20

Question			Answer	Mark	Guidance
		(ii)	Change in energy = $\frac{1}{2} CV_1^2 - \frac{1}{2} CV_2^2$ $= (\frac{1}{2} \times 1 \times 10^{-6} \times 6^2) - (\frac{1}{2} \times 1 \times 10^{-6} \times 4.12^2) = 9.5 \times 10^{-6} \text{ (J)}$ rate = $9.5 \times 10^{-6} / 3.76 \times 10^{-3}$ $= \mathbf{2.53 \times 10^{-3} \text{ (Js}^{-1}\text{)}}$	C1 C1 A1	ALLOW POT error from (e)(i) Ecf from (e)(i) Correct to at least 2 significant figures

Part (c) is worth 4 marks. OCR prints alternative methods and their continuation; these are alternatives, not additional marks.

Q04 | CP15

10 marks

November 2020 | H556/03 | Q2

Question			Answer	Marks	Guidance
2	(a)		(initial charge) $Q = EC_0$ or (Q conserved so final) $Q = V(C + C_0)$ (as capacitors are in parallel) <u>so</u> $EC_0 = V(C + C_0)$ (and hence $V = C_0 E / (C + C_0)$)	M1 A1	At least one correct expression for Q for first mark The two correct expressions equated for the second mark
		(b)	(i) $1/V = 1/E + C/EC_0$ (and compare to $y = c + mx$)	B1	Mark is for rearrangement into linear equation
		(ii)	$1/EC_0 = 51 = 1/(9.1 C_0)$ giving $C_0 = 1/(51 \times 9.1)$ F $C_0 = 2.2$ (mF)	B1 B1	$C_0 = 2.1547 \times 10^{-3}$ F Answer must be correct, rounded correctly and given in mF Candidate's answer must be given to 2 SF
		(iii)	(at least) one correct worst fit line drawn gradient calculated correctly using a large triangle uncertainty = $C_0 - 1/(\text{wfl gradient} \times 9.1)$ uncertainty given is to the same number of decimal places as C_0	B1 B1 B1 B1	Top and bottom points chosen must be from opposite extremes of uncertainty limits, accurate to within half a small square $\Delta x \geq 1.5 \times 10^{-3}$; expect 59 ± 1 or 44 ± 1 (or 0.059 or 0.044); allow ECF from poorly drawn line; readings must be accurate to within half a small square ECF from b(ii) ; expect uncertainty of up to 0.4 (mF) ECF from b(ii) If no value for C_0 given in b(ii) , allow any answer given to 1dp
	(c)		Only effect is to slow the charging and/or discharging (of capacitor(s)) <u>and so</u> the final charges are unchanged / the values for V are unchanged / the graph is unchanged / the gradient is unchanged / there is no effect on the experiment (results)	B1	Allow and so the experiment takes longer