

7 (a) Define *capacitance*.

.....  
 .....[1]

(b) Three capacitors of capacitances  $C_1$ ,  $C_2$  and  $C_3$  are initially uncharged. They are then connected in series to a battery, as shown in Fig. 7.1.

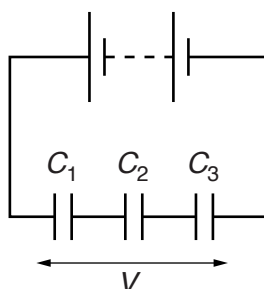


Fig. 7.1

The battery applies a potential difference  $V$  across the three capacitors.

Show that the combined capacitance  $C$  of the capacitors is given by

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}.$$

[2]

(c) A battery of e.m.f. 12V and negligible internal resistance is connected to a network of two capacitors and a resistor, as shown in Fig. 7.2.

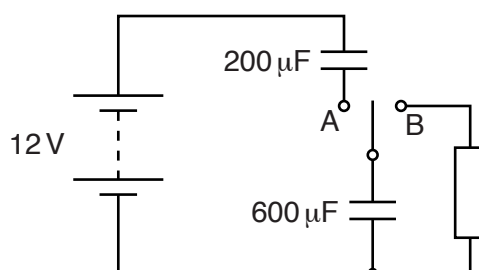


Fig. 7.2

The capacitors have capacitances of  $200\mu\text{F}$  and  $600\mu\text{F}$ . The switch has two positions, A and B.

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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1. Question part 2/2 | 9702 Feb-March 2016 P4 V2 Q7

(i) The switch is moved to position A.

Calculate

1. the combined capacitance of the two capacitors,

combined capacitance = .....  $\mu\text{F}$  [1]

2. the charge on the  $600\mu\text{F}$  capacitor,

charge = ..... C [1]

3. the potential difference across the  $600\mu\text{F}$  capacitor.

potential difference = ..... V [1]

(ii) The switch is now moved from position A to position B.

Calculate the potential difference across the  $600\mu\text{F}$  capacitor when it has discharged 50% of its initial energy.

potential difference = ..... V [3]

[Total: 9]

2. Question part 1/2 | 9702 May-June 2016 P4 V1 Q7

- 7 A student sets up the circuit shown in Fig. 7.1 to measure the charge on a capacitor  $C$  for different values of potential difference across the capacitor.

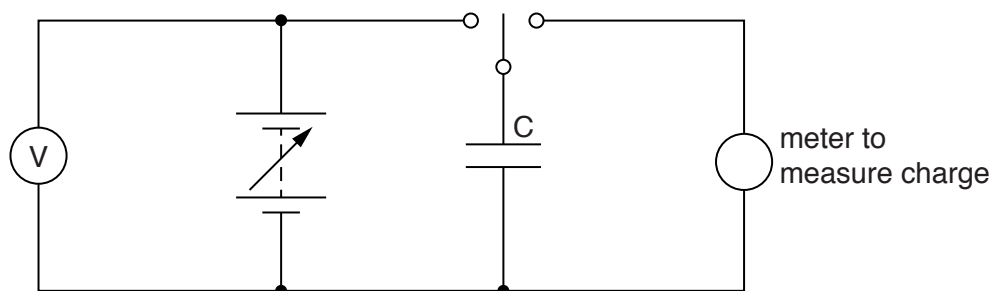


Fig. 7.1

The variation with potential difference  $V$  of the charge  $Q$  stored on the capacitor is shown in Fig. 7.2.

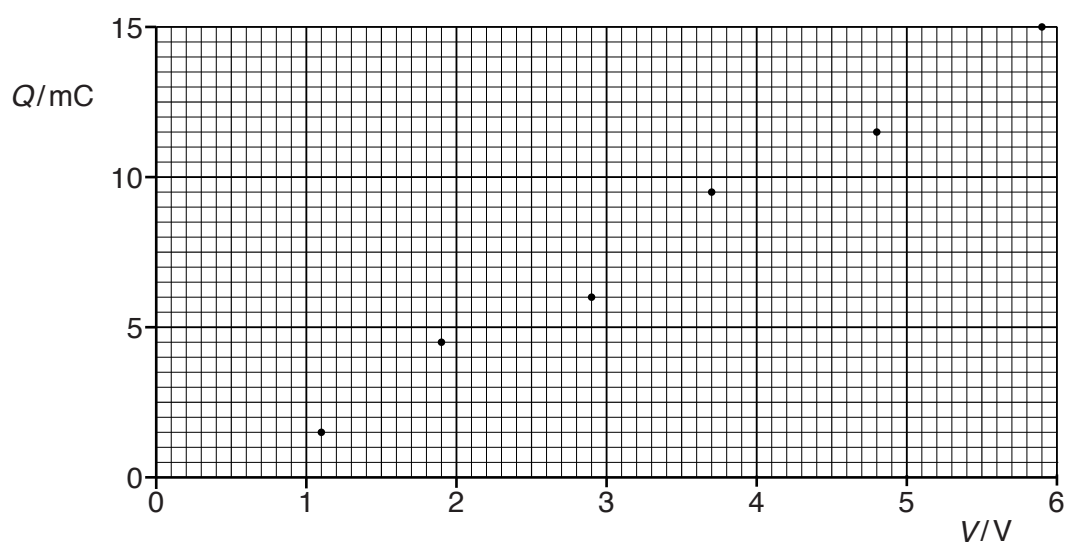


Fig. 7.2

- (a) State and explain how Fig. 7.2 indicates that there is a systematic error in the readings of one of the meters.

.....

.....

..... [2]

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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2. Question part 2/2 | 9702 May-June 2016 P4 V1 Q7

**(b)** Use Fig. 7.2 to determine the capacitance, in  $\mu\text{F}$ , of capacitor C.

capacitance = .....  $\mu\text{F}$  [3]

**(c)** Use your answer in **(b)** to determine the additional energy stored in the capacitor C when the potential difference across it is increased from 6.0 V to 9.0 V.

energy = ..... J [3]

[Total: 8]

3. Question part 1/2 | 9702 May-June 2016 P4 V2 Q7

7 (a) State two uses of capacitors in electrical circuits, other than for the smoothing of direct current.

1. ....

2. ....

[2]

(b) The combined capacitance between terminals A and B of the arrangement shown in Fig. 7.1 is  $4.0\ \mu\text{F}$ .

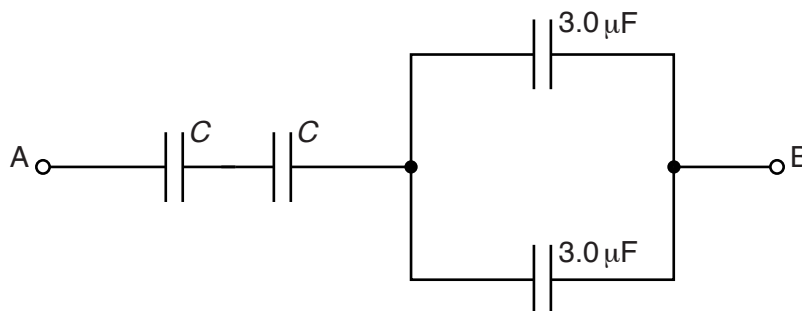


Fig. 7.1

Two capacitors each have capacitance  $C$  and the remaining capacitors each have capacitance  $3.0\ \mu\text{F}$ .

The potential difference (p.d.) between terminals A and B is  $12\ \text{V}$ .

(i) Determine the capacitance  $C$ .

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

(ii) Calculate the magnitude of the total positive charge transferred to the arrangement.

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

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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3. Question part 2/2 | 9702 May-June 2016 P4 V2 Q7

**(iii)** Use your answer in **(ii)** to state the magnitude of the charge on one plate of

**1.** a capacitor of capacitance  $C$ ,

charge = .....  $\mu\text{C}$

**2.** a capacitor of capacitance  $3.0\mu\text{F}$ .

charge = .....  $\mu\text{C}$   
[2]

[Total: 8]

4. Question part 1/2 | 9702 May-June 2016 P4 V3 Q7

- 7 A student sets up the circuit shown in Fig. 7.1 to measure the charge on a capacitor  $C$  for different values of potential difference across the capacitor.

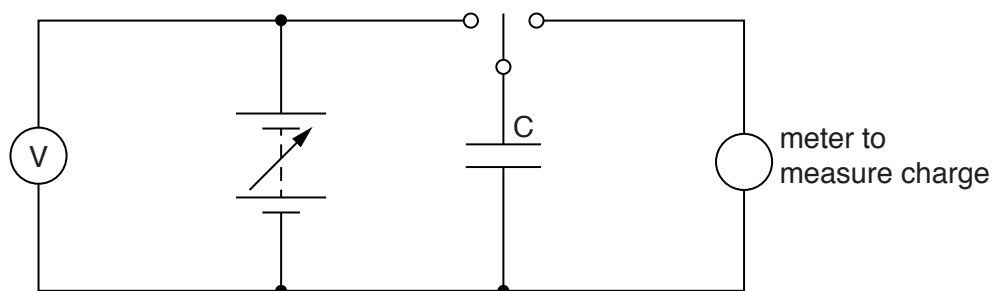


Fig. 7.1

The variation with potential difference  $V$  of the charge  $Q$  stored on the capacitor is shown in Fig. 7.2.

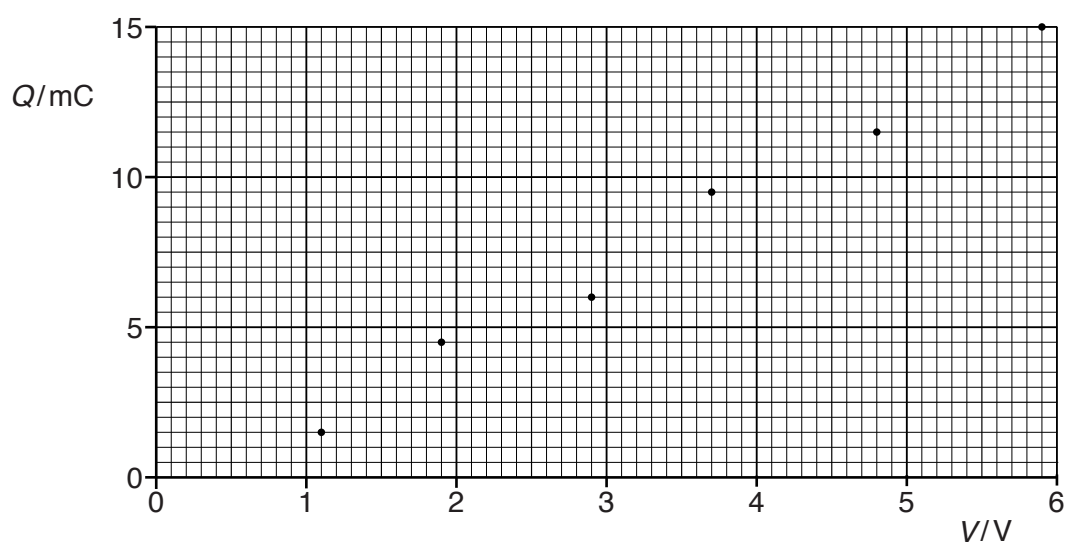


Fig. 7.2

- (a) State and explain how Fig. 7.2 indicates that there is a systematic error in the readings of one of the meters.

.....

.....

..... [2]

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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4. Question part 2/2 | 9702 May-June 2016 P4 V3 Q7

**(b)** Use Fig. 7.2 to determine the capacitance, in  $\mu\text{F}$ , of capacitor C.

capacitance = .....  $\mu\text{F}$  [3]

**(c)** Use your answer in **(b)** to determine the additional energy stored in the capacitor C when the potential difference across it is increased from 6.0 V to 9.0 V.

energy = ..... J [3]

[Total: 8]

**7 (a) (i)** Define *capacitance*.

.....  
 .....[1]

**(ii)** Use the expression for the electric potential due to a point charge to show that an isolated metal sphere of diameter 25 cm has a capacitance of  $1.4 \times 10^{-11} \text{ F}$ .

[2]

**(b)** Three capacitors of capacitances  $2.0 \mu\text{F}$ ,  $3.0 \mu\text{F}$  and  $4.0 \mu\text{F}$  are connected as shown in Fig. 7.1 to a battery of e.m.f.  $9.0 \text{ V}$ .

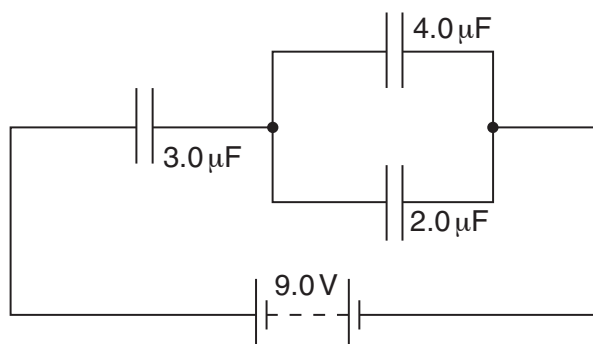


**Fig. 7.1**

Determine

**(i)** the combined capacitance of the three capacitors,

capacitance = .....  $\mu\text{F}$  [1]

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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5. Question part 2/2 | 9702 Oct-Nov 2016 P4 V2 Q7

(ii) the potential difference across the capacitor of capacitance  $3.0\ \mu\text{F}$ ,

potential difference = ..... V [2]

(iii) the positive charge stored on the capacitor of capacitance  $2.0\ \mu\text{F}$ .

charge = .....  $\mu\text{C}$  [2]

[Total: 8]

- 7 A capacitor consists of two parallel metal plates, separated by an insulator, as shown in Fig. 7.1.

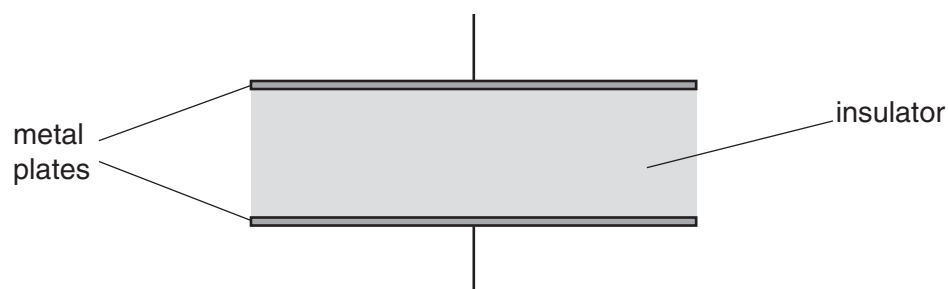


Fig. 7.1

- (a) Suggest why, when the capacitor is connected across the terminals of a battery, the capacitor stores energy, not charge.

.....  
 .....  
 .....[2]

- (b) Define the *capacitance* of the capacitor.

.....  
 .....  
 .....[2]

- (c) The capacitor is charged so that the potential difference between its plates is  $V_0$ . The capacitor is then connected across a resistor for a short time. It is then disconnected. The energy stored in the capacitor is reduced to  $\frac{1}{16}$  of its initial value.

Determine, in terms of  $V_0$ , the potential difference across the capacitor.

potential difference = .....[2]

[Total: 6]

- 6 Two capacitors P and Q, each of capacitance  $C$ , are connected in series with a battery of e.m.f.  $9.0\text{ V}$ , as shown in Fig. 6.1.

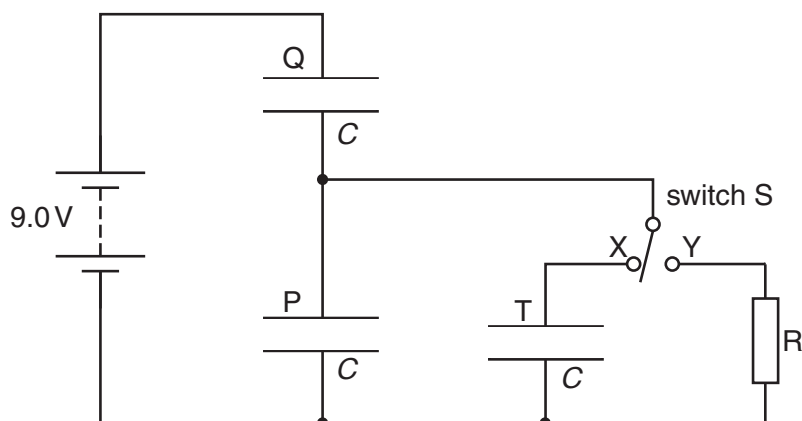


Fig. 6.1

A switch S is used to connect either a third capacitor T, also of capacitance  $C$ , or a resistor R, in parallel with capacitor P.

- (a) Switch S is in position X.

Calculate

- (i) the combined capacitance, in terms of  $C$ , of the three capacitors,

capacitance = ..... [2]

- (ii) the potential difference across capacitor Q. Explain your working.

potential difference = ..... V [2]

- (b) Switch S is now moved to position Y.  
State what happens to the potential difference across capacitor P and across capacitor Q.

capacitor P: .....  
.....  
.....

capacitor Q: .....  
.....  
.....

[4]

[Total: 8]

- 6 Two capacitors P and Q, each of capacitance  $C$ , are connected in series with a battery of e.m.f.  $9.0\text{ V}$ , as shown in Fig. 6.1.

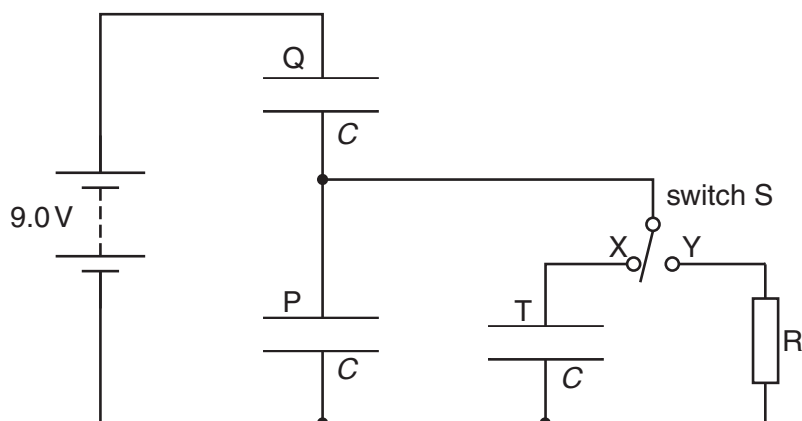


Fig. 6.1

A switch S is used to connect either a third capacitor T, also of capacitance  $C$ , or a resistor R, in parallel with capacitor P.

- (a) Switch S is in position X.

Calculate

- (i) the combined capacitance, in terms of  $C$ , of the three capacitors,

capacitance = ..... [2]

- (ii) the potential difference across capacitor Q. Explain your working.

potential difference = ..... V [2]

- (b) Switch S is now moved to position Y.  
State what happens to the potential difference across capacitor P and across capacitor Q.

capacitor P: .....  
.....  
.....

capacitor Q: .....  
.....  
.....

[4]

[Total: 8]

- 7 (a) Explain what is meant by the *capacitance* of a parallel plate capacitor.

.....

.....

.....

.....[3]

- (b) A parallel plate capacitor C is connected into the circuit shown in Fig. 7.1.

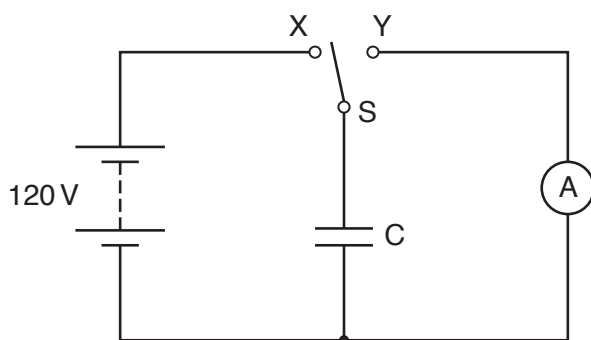


Fig. 7.1

When switch S is at position X, the battery of electromotive force 120 V and negligible internal resistance is connected to capacitor C.

When switch S is at position Y, the capacitor C is discharged through the sensitive ammeter.

The switch vibrates so that it is first in position X, then moves to position Y and then back to position X fifty times each second.

The current recorded on the ammeter is  $4.5\mu\text{A}$ .

Determine

- (i) the charge, in coulomb, passing through the ammeter in 1.0 s,

charge = ..... C [1]

(ii) the charge on one plate of the capacitor, each time that it is charged,

charge = ..... C [1]

(iii) the capacitance of capacitor C.

capacitance = ..... F [2]

(c) A second capacitor, having a capacitance equal to that of capacitor C, is now placed in series with C.

Suggest and explain the effect on the current recorded on the ammeter.

.....  
.....  
.....[2]

[Total: 9]

8 (a) Negative feedback is often used in amplifiers incorporating an operational amplifier (op-amp).

State

(i) what is meant by *negative feedback*,

.....  
.....  
.....[2]

(ii) two effects of negative feedback on the gain of an amplifier.

1. ....  
.....  
2. ....  
.....[2]

(b) An ideal op-amp is incorporated into the amplifier circuit shown in Fig. 8.1.

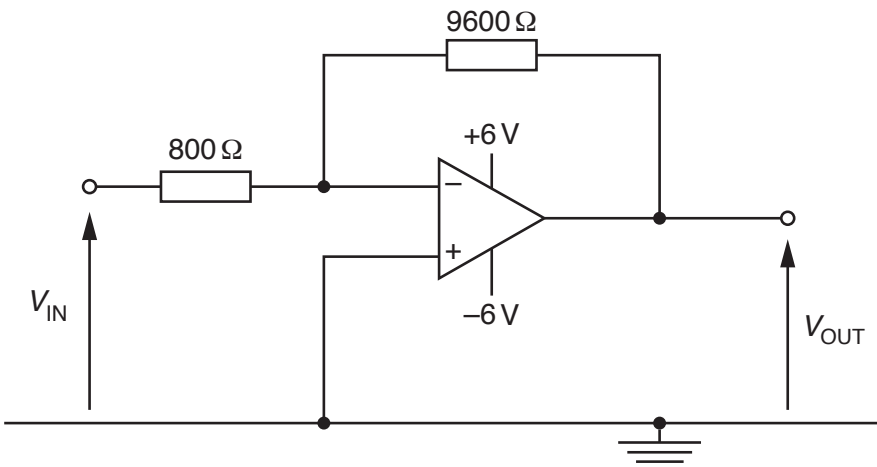


Fig. 8.1

(i) Calculate the gain  $G$  of the amplifier circuit.

$G =$  .....[2]

(ii) Determine the output potential difference  $V_{\text{OUT}}$  for input potential differences  $V_{\text{IN}}$  of

1.  $-0.10\text{ V}$ ,

$V_{\text{OUT}} = \dots\dots\dots \text{ V}$

2.  $+1.3\text{ V}$ .

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

(iii) The gain of the amplifier shown in Fig. 8.1 is constant.

State one change that can be made to the circuit of Fig. 8.1 so that the amplifier circuit monitors light intensity levels, with the magnitude of the gain decreasing as light intensity increases.

.....  
.....[1]

[Total: 9]

- 6 (a)** Explain what is meant by the *capacitance* of a parallel plate capacitor.

.....

.....

.....

.....[3]

- (b)** Three parallel plate capacitors each have a capacitance of  $6.0\ \mu\text{F}$ .

Draw circuit diagrams, one in each case, to show how the capacitors may be connected together to give a combined capacitance of

- (i)**  $9.0\ \mu\text{F}$ ,

[1]

- (ii)**  $4.0\ \mu\text{F}$ .

[1]

- (c)** Two capacitors of capacitances  $3.0\ \mu\text{F}$  and  $2.0\ \mu\text{F}$  are connected in series with a battery of electromotive force (e.m.f.)  $8.0\ \text{V}$ , as shown in Fig. 6.1.

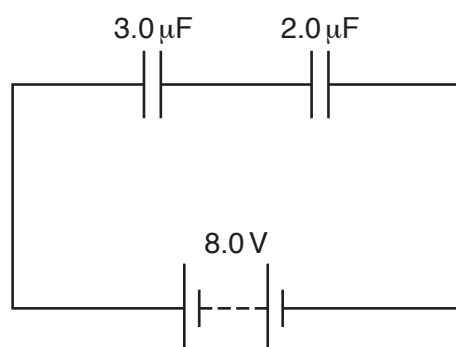


**Fig. 6.1**

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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11. Question part 2/2 | 9702 May-June 2018 P4 V2 Q6

- (i) Calculate the combined capacitance of the capacitors.

capacitance = .....  $\mu\text{F}$  [1]

- (ii) Use your answer in (i) to determine, for the capacitor of capacitance  $3.0\ \mu\text{F}$ ,

1. the charge on one plate of the capacitor,

charge = .....  $\mu\text{C}$

2. the energy stored in the capacitor.

energy = ..... J  
[4]

[Total: 10]

**7 (a)** Negative feedback is often used in amplifiers.

State

**(i)** what is meant by *negative feedback*,

.....

.....

.....[2]

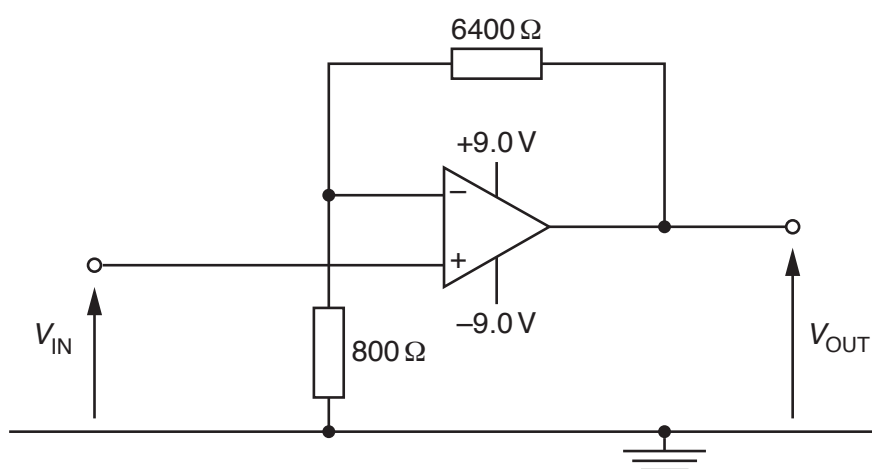
**(ii)** two effects of negative feedback on the gain of an amplifier.

1. ....

.....

2. ....

.....[2]

**(b)** An ideal operational amplifier (op-amp) is incorporated into the circuit shown in Fig. 7.1.**Fig. 7.1****(i)** Calculate the gain  $G$  of the amplifier circuit. $G = \dots\dots\dots[1]$

(ii) Determine the output potential difference  $V_{\text{OUT}}$  for an input potential difference  $V_{\text{IN}}$  of

1.  $+0.60 \text{ V}$ ,

$V_{\text{OUT}} = \dots\dots\dots \text{ V}$

2.  $-2.1 \text{ V}$ .

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

(iii) The gain of the amplifier shown in Fig. 7.1 is constant.

State one change that may be made to the circuit of Fig. 7.1 so that the amplifier circuit monitors temperature with the gain decreasing as the temperature rises.

.....  
.....[1]

[Total: 8]

- 7 (a) Explain what is meant by the *capacitance* of a parallel plate capacitor.

.....

.....

.....

.....[3]

- (b) A parallel plate capacitor C is connected into the circuit shown in Fig. 7.1.

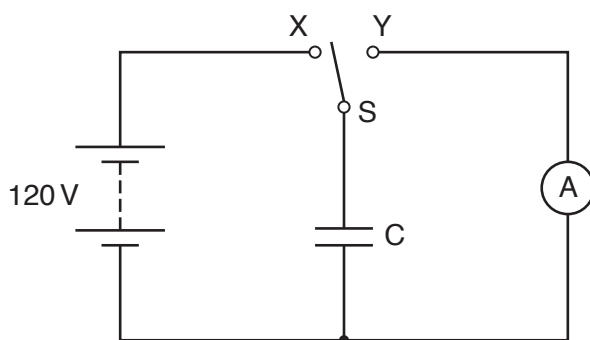


Fig. 7.1

When switch S is at position X, the battery of electromotive force 120 V and negligible internal resistance is connected to capacitor C.

When switch S is at position Y, the capacitor C is discharged through the sensitive ammeter.

The switch vibrates so that it is first in position X, then moves to position Y and then back to position X fifty times each second.

The current recorded on the ammeter is  $4.5\ \mu\text{A}$ .

Determine

- (i) the charge, in coulomb, passing through the ammeter in 1.0 s,

charge = ..... C [1]

(ii) the charge on one plate of the capacitor, each time that it is charged,

charge = ..... C [1]

(iii) the capacitance of capacitor C.

capacitance = ..... F [2]

(c) A second capacitor, having a capacitance equal to that of capacitor C, is now placed in series with C.

Suggest and explain the effect on the current recorded on the ammeter.

.....  
.....  
.....[2]

[Total: 9]

14. Question part 1/2 | 9702 Feb-March 2019 P4 V2 Q6

6 (a) Define the *capacitance* of a parallel-plate capacitor.

.....

.....

..... [2]

(b) A student has three capacitors. Two of the capacitors have a capacitance of  $4.0\,\mu\text{F}$  and one has a capacitance of  $8.0\,\mu\text{F}$ .

Draw labelled circuit diagrams, one in each case, to show how the three capacitors may be connected to give a total capacitance of:

(i)  $1.6\,\mu\text{F}$

[1]

(ii)  $10\,\mu\text{F}$ .

[1]

- (c) A capacitor  $C$  of capacitance  $47\mu\text{F}$  is connected across the output terminals of a bridge rectifier, as shown in Fig. 6.1.

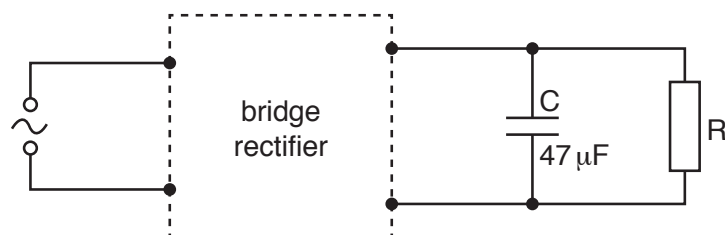


Fig. 6.1

The variation with time  $t$  of the potential difference  $V$  across the resistor  $R$  is shown in Fig. 6.2.

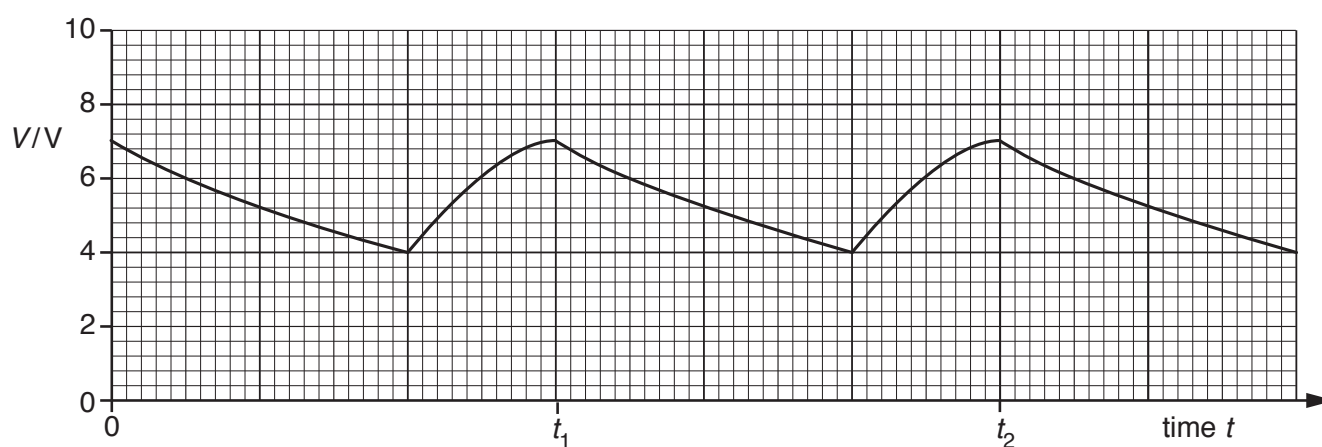


Fig. 6.2

Use data from Fig. 6.2 to determine the energy transfer from the capacitor  $C$  to the resistor  $R$  between time  $t_1$  and time  $t_2$ .

energy = ..... J [3]

[Total: 7]

6 (a) State **two** different functions of capacitors in electrical circuits.

1. ....

.....

2. ....

.....

[2]

(b) Three uncharged capacitors of capacitances  $C_1$ ,  $C_2$  and  $C_3$  are connected in series with a battery of electromotive force (e.m.f.)  $E$  and a switch, as shown in Fig. 6.1.

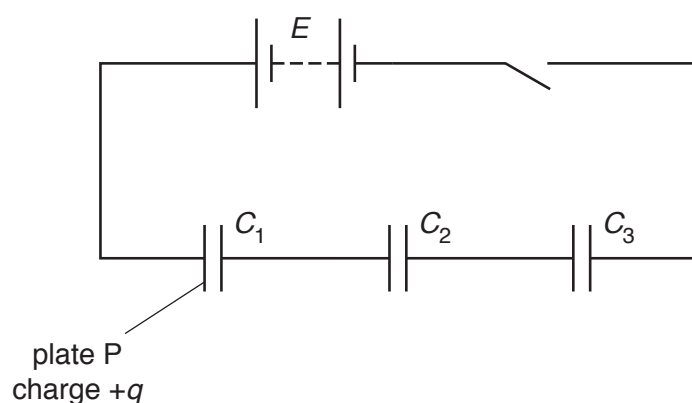


Fig. 6.1

When the switch is closed, there is a charge  $+q$  on plate P of the capacitor of capacitance  $C_1$ .

Show that the combined capacitance  $C$  of the three capacitors is given by the expression

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}.$$

[3]

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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15. Question part 2/2 | 9702 May-June 2019 P4 V1 Q6

**(c)** A student has available four capacitors, each of capacitance  $20\mu\text{F}$ .

Draw circuit diagrams, one in each case, to show how the student may connect some or all of the capacitors to produce a combined capacitance of:

**(i)**  $60\mu\text{F}$

[1]

**(ii)**  $15\mu\text{F}$ .

[1]

[Total: 7]

6 (a) State **two** different functions of capacitors in electrical circuits.

1. ....

.....

2. ....

.....

[2]

(b) Three uncharged capacitors of capacitances  $C_1$ ,  $C_2$  and  $C_3$  are connected in series with a battery of electromotive force (e.m.f.)  $E$  and a switch, as shown in Fig. 6.1.

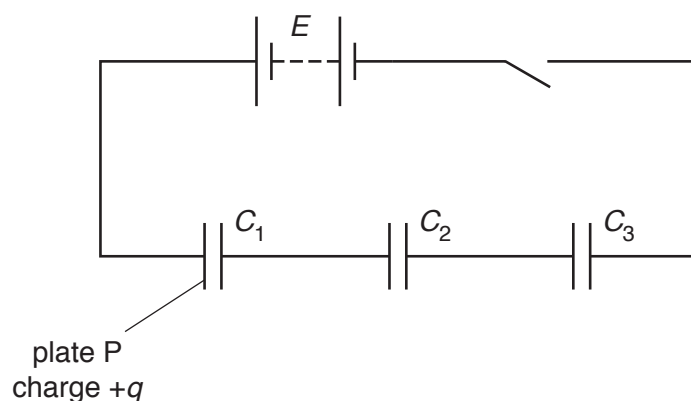


Fig. 6.1

When the switch is closed, there is a charge  $+q$  on plate P of the capacitor of capacitance  $C_1$ .

Show that the combined capacitance  $C$  of the three capacitors is given by the expression

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}.$$

[3]

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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16. Question part 2/2 | 9702 May-June 2019 P4 V3 Q6

**(c)** A student has available four capacitors, each of capacitance  $20\mu\text{F}$ .

Draw circuit diagrams, one in each case, to show how the student may connect some or all of the capacitors to produce a combined capacitance of:

**(i)**  $60\mu\text{F}$

[1]

**(ii)**  $15\mu\text{F}$ .

[1]

[Total: 7]

6 (a) (i) Define the *capacitance* of a parallel plate capacitor.

.....

.....

..... [2]

(ii) State **three** functions of capacitors in electrical circuits.

1. ....

2. ....

3. .... [3]

(b) A student has available four capacitors, each of capacitance  $24\,\mu\text{F}$ .

The capacitors are connected as shown in Fig. 6.1.

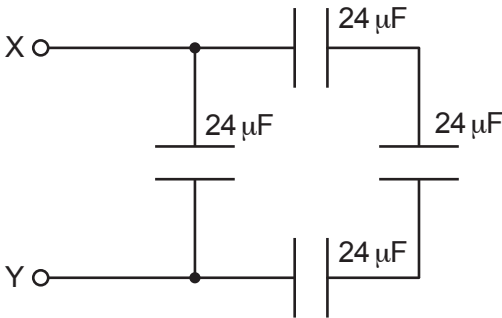


Fig. 6.1

Calculate the combined capacitance between the terminals X and Y.

capacitance = .....  $\mu\text{F}$  [2]

[Total: 7]

6 (a) (i) Define the *capacitance* of a parallel plate capacitor.

.....  
.....  
..... [2]

(ii) State **three** functions of capacitors in electrical circuits.

1. ....  
2. ....  
3. ..... [3]

(b) A student has available **three** capacitors, each of capacitance  $12\,\mu\text{F}$ .

Draw diagrams, one in each case, to show how the student connects the capacitors to give a combined capacitance between the terminals of:

(i)  $18\,\mu\text{F}$



[1]

(ii)  $8\,\mu\text{F}$ .



[1]

[Total: 7]

6 (a) (i) Define the *capacitance* of a parallel plate capacitor.

.....

.....

..... [2]

(ii) State **three** functions of capacitors in electrical circuits.

1. ....

2. ....

3. .... [3]

(b) A student has available four capacitors, each of capacitance  $24\,\mu\text{F}$ .

The capacitors are connected as shown in Fig. 6.1.

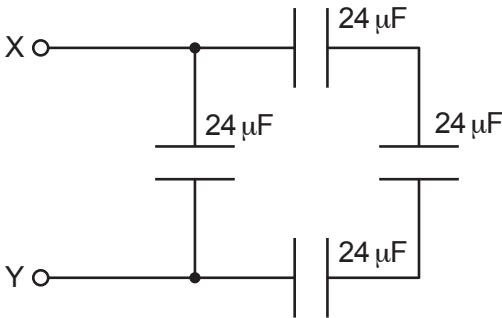


Fig. 6.1

Calculate the combined capacitance between the terminals X and Y.

capacitance = .....  $\mu\text{F}$  [2]

[Total: 7]

- 7 (a) State what is meant by the *capacitance* of a parallel plate capacitor.

.....  
.....  
..... [2]

- (b) A capacitor of capacitance  $C$  is connected into the circuit shown in Fig. 7.1.

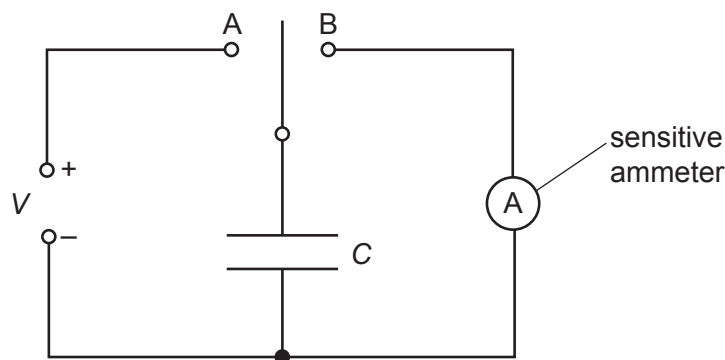


Fig. 7.1

When the two-way switch is in position A, the capacitor is charged so that the potential difference across it is  $V$ .

The switch moves to position B and the capacitor fully discharges through the sensitive ammeter.

The switch moves repeatedly between A and B so that the capacitor charges and then discharges with frequency  $f$ .

- (i) Show that the average current  $I$  in the ammeter is given by the expression

$$I = fCV.$$

[2]

- (ii) For a potential difference  $V$  of 150 V and a frequency  $f$  of 60 Hz, the average current in the ammeter is  $4.8\,\mu\text{A}$ .

Calculate the capacitance, in pF, of the capacitor.

capacitance = ..... pF [2]

- (c) A second capacitor, having the same capacitance as the capacitor in (b), is connected into the circuit of Fig. 7.1. The two capacitors are connected in series.

State and explain the new reading on the ammeter.

new reading = .....  $\mu\text{A}$

.....  
.....  
..... [3]

[Total: 9]

- 6 (a) Two flat metal plates are held a small distance apart by means of insulating pads, as shown in Fig. 6.1.

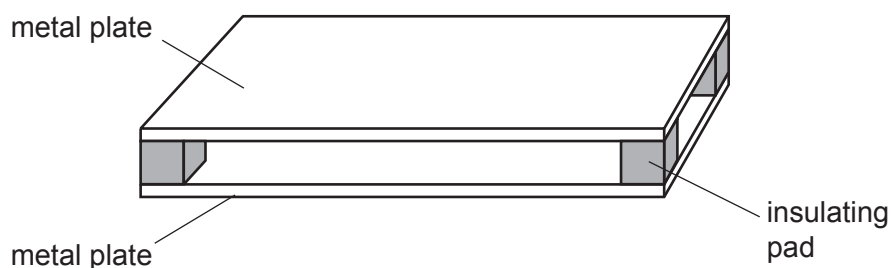


Fig. 6.1

Explain how the plates could act as a capacitor.

.....

.....

..... [2]

- (b) The arrangement in Fig. 6.1 has capacitance  $C$ .  
The arrangement is connected into the circuit of Fig. 6.2.

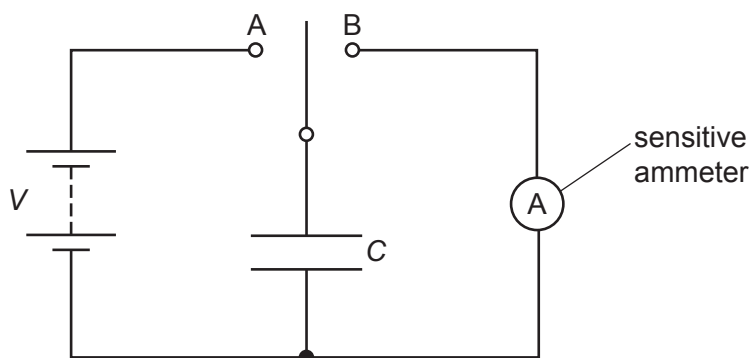


Fig. 6.2

When the two-way switch is moved to position A, the capacitor is charged so that the potential difference across it is  $V$ . When the switch moves to position B, the capacitor fully discharges through the sensitive ammeter.

The switch moves repeatedly between A and B so that the capacitor charges and then discharges with frequency  $f$ .

(i) Show that the average current  $I$  in the ammeter is given by

$$I = CVf.$$

[2]

(ii) For a potential difference  $V$  of 180 V and a frequency  $f$  of switching of 50 Hz, the average current  $I$  in the ammeter is  $2.5\,\mu\text{A}$ .

Calculate the capacitance, in pF, of the parallel plates.

capacitance = ..... pF [2]

(c) A second capacitor is connected into the circuit of Fig. 6.2.  
The two capacitors are connected in parallel.

State and explain the change, if any, in the average current in the ammeter.

.....  
.....  
..... [2]

[Total: 8]

- 7 (a) State what is meant by the *capacitance* of a parallel plate capacitor.

.....  
 .....  
 ..... [2]

- (b) A capacitor of capacitance  $C$  is connected into the circuit shown in Fig. 7.1.

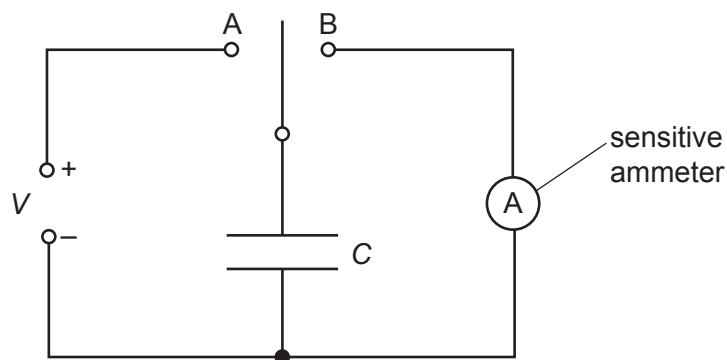


Fig. 7.1

When the two-way switch is in position A, the capacitor is charged so that the potential difference across it is  $V$ .

The switch moves to position B and the capacitor fully discharges through the sensitive ammeter.

The switch moves repeatedly between A and B so that the capacitor charges and then discharges with frequency  $f$ .

- (i) Show that the average current  $I$  in the ammeter is given by the expression

$$I = fCV.$$

[2]

- (ii) For a potential difference  $V$  of 150 V and a frequency  $f$  of 60 Hz, the average current in the ammeter is  $4.8\,\mu\text{A}$ .

Calculate the capacitance, in pF, of the capacitor.

capacitance = ..... pF [2]

- (c) A second capacitor, having the same capacitance as the capacitor in (b), is connected into the circuit of Fig. 7.1. The two capacitors are connected in series.

State and explain the new reading on the ammeter.

new reading = .....  $\mu\text{A}$

.....  
.....  
..... [3]

[Total: 9]

- 6 (a)** A capacitor consists of two parallel metal plates, separated by air, at a variable distance  $x$  apart, as shown in Fig. 6.1. The capacitance  $C$  is inversely proportional to  $x$ .

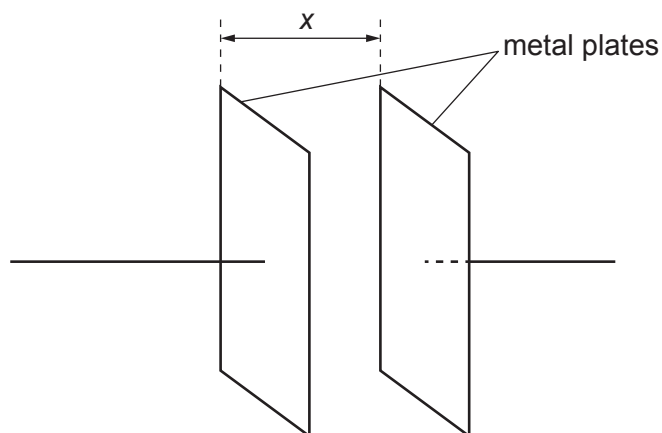


Fig. 6.1

The capacitor is charged by a supply so that there is a potential difference (p.d.)  $V$  between the plates.

State expressions, in terms of  $C$  and  $V$ , for the charge  $Q$  on one of the plates and for the energy  $E$  stored in the capacitor.

$Q = \dots\dots\dots$   $E = \dots\dots\dots$  [1]

- (b)** The charged capacitor in **(a)** is now disconnected from the supply. The plates of the capacitor are initially separated by distance  $L$ . They are then moved closer together by a distance  $D$ , as shown in Fig. 6.2.

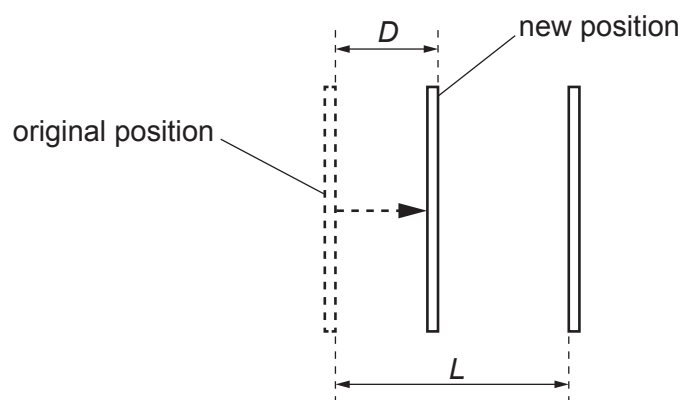


Fig. 6.2

State expressions, in terms of  $C$ ,  $V$ ,  $L$  and  $D$ , for:

- (i)** the new capacitance  $C_N$

$C_N = \dots\dots\dots$  [1]

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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23. Question part 2/2 | 9702 Oct-Nov 2021 P4 V1 Q6

(ii) the new charge  $Q_N$  on one of the plates

$Q_N = \dots\dots\dots$  [1]

(iii) the new p.d.  $V_N$  between the plates.

$V_N = \dots\dots\dots$  [1]

(c) Explain whether reducing the separation of the plates in (b) results in an increase or decrease in the energy stored in the capacitor.

.....  
.....  
..... [1]

[Total: 5]

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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24. Question | 9702 Oct-Nov 2021 P4 V2 Q6

- 6 (a)** Define *electric potential*.

.....  
.....  
..... [2]

- (b)** An isolated conducting sphere in a vacuum has radius  $r$  and is initially uncharged. It is then charged by friction so that it carries a final charge  $Q$ . This charge can be considered to be acting at the centre of the sphere.

By considering the electric potential at its surface, show that the capacitance  $C$  of the sphere is given by

$$C = 4\pi\epsilon_0 r$$

where  $\epsilon_0$  is the permittivity of free space.

[2]

- (c)** The dome of an electrostatic generator is a spherical conductor of radius 13 cm. It is initially charged so that the electric potential at the surface is 4.5 kV.

A smaller isolated sphere of radius 5.2 cm, initially uncharged, is brought near to the dome. Sparking causes a current between the two spheres until they reach the same potential. Assume that any charge on a sphere may be considered to act as a point charge at its centre.

Calculate the charge that is transferred between the two spheres.

charge = ..... C [3]

[Total: 7]

- 6 (a)** A capacitor consists of two parallel metal plates, separated by air, at a variable distance  $x$  apart, as shown in Fig. 6.1. The capacitance  $C$  is inversely proportional to  $x$ .

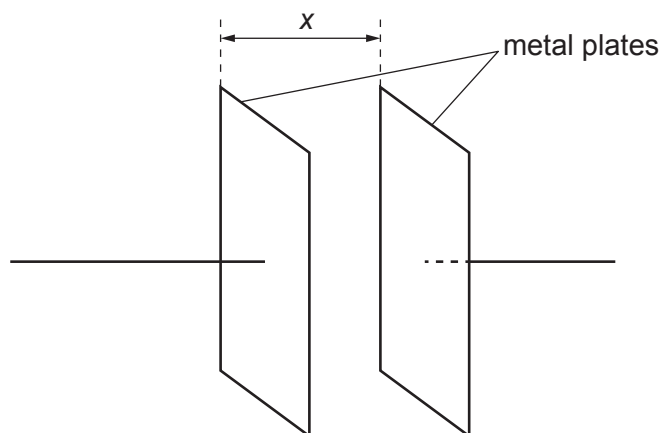


Fig. 6.1

The capacitor is charged by a supply so that there is a potential difference (p.d.)  $V$  between the plates.

State expressions, in terms of  $C$  and  $V$ , for the charge  $Q$  on one of the plates and for the energy  $E$  stored in the capacitor.

$Q = \dots\dots\dots$   $E = \dots\dots\dots$  [1]

- (b)** The charged capacitor in **(a)** is now disconnected from the supply. The plates of the capacitor are initially separated by distance  $L$ . They are then moved closer together by a distance  $D$ , as shown in Fig. 6.2.

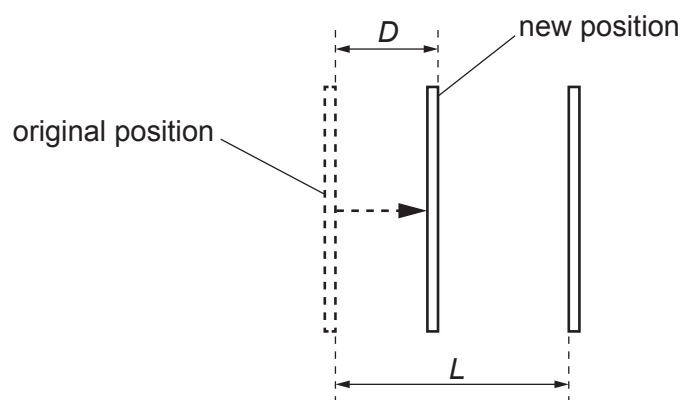


Fig. 6.2

State expressions, in terms of  $C$ ,  $V$ ,  $L$  and  $D$ , for:

- (i)** the new capacitance  $C_N$

$C_N = \dots\dots\dots$  [1]

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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25. Question part 2/2 | 9702 Oct-Nov 2021 P4 V3 Q6

(ii) the new charge  $Q_N$  on one of the plates

$Q_N = \dots\dots\dots$  [1]

(iii) the new p.d.  $V_N$  between the plates.

$V_N = \dots\dots\dots$  [1]

(c) Explain whether reducing the separation of the plates in (b) results in an increase or decrease in the energy stored in the capacitor.

.....

.....

..... [1]

[Total: 5]

- 5 The variation with potential difference  $V$  of the charge  $Q$  on one of the plates of a capacitor is shown in Fig. 5.1.

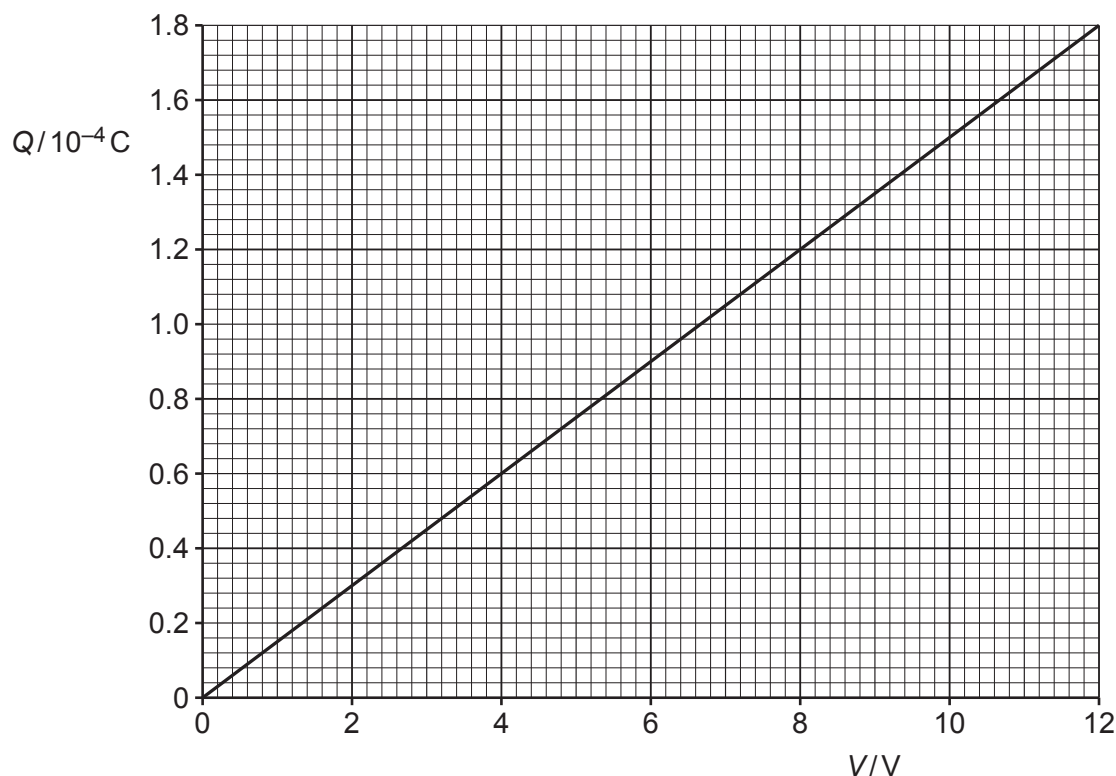


Fig. 5.1

The capacitor is connected to an 8.0V power supply and two resistors R and S as shown in Fig. 5.2.

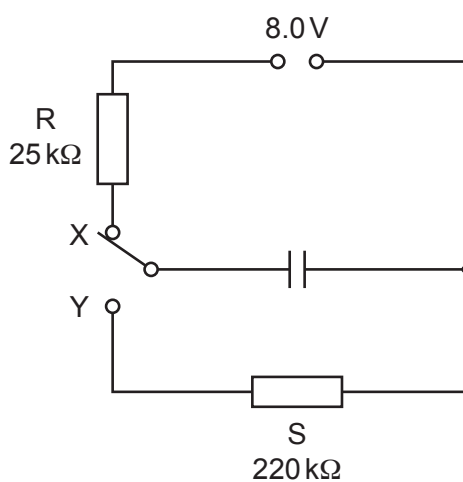


Fig. 5.2

The resistance of R is  $25 \text{ k}\Omega$  and the resistance of S is  $220 \text{ k}\Omega$ .

The switch can be in either position X or position Y.

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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26. Question part 2/3 | 9702 Feb-March 2022 P4 V2 Q5

- (a)** The switch is in position X so that the capacitor is fully charged.

Calculate the energy  $E$  stored in the capacitor.

$E = \dots\dots\dots$  J [2]

- (b)** The switch is now moved to position Y.

- (i)** Show that the time constant of the discharge circuit is 3.3 s.

[2]

- (ii)** The fully charged capacitor in **(a)** stores energy  $E$ .

Determine the time  $t$  taken for the stored energy to decrease from  $E$  to  $E/9$ .

$t = \dots\dots\dots$  s [4]

(c) A second identical capacitor is connected in parallel with the first capacitor.

State and explain the change, if any, to the time constant of the discharge circuit.

.....

.....

..... [2]

[Total: 10]

- 5 (a) Define the capacitance of a parallel plate capacitor.

.....  
.....  
..... [2]

- (b) Two capacitors, of capacitances  $C_1$  and  $C_2$ , are connected in parallel to a power supply of electromotive force (e.m.f.)  $E$ , as shown in Fig. 5.1.

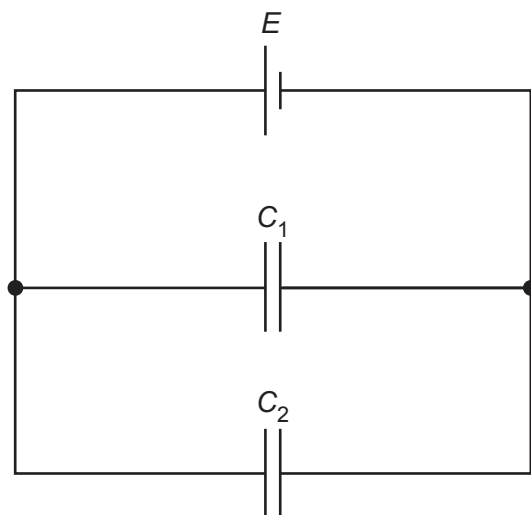


Fig. 5.1

Show that the combined capacitance  $C_T$  of the two capacitors is given by

$$C_T = C_1 + C_2.$$

Explain your reasoning. You may draw on Fig. 5.1 if you wish.

[3]

- (c) Two capacitors of capacitances  $22\mu\text{F}$  and  $47\mu\text{F}$ , and a resistor of resistance  $2.7\text{M}\Omega$ , are connected into the circuit of Fig. 5.2.

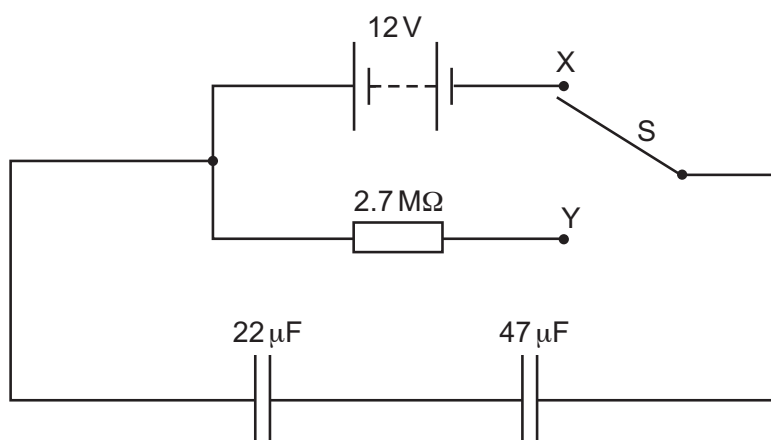


**Fig. 5.2**

The battery has an e.m.f. of 12V.

- (i) Show that the combined capacitance of the two capacitors is  $15\mu\text{F}$ .

[1]

- (ii) The two-way switch S is initially at position X, so that the capacitors are fully charged.

Use the information in (c)(i) to calculate the total energy stored in the two capacitors.

total energy = ..... J [2]

- (iii) The two-way switch is now moved to position Y.

Determine the time taken for the potential difference (p.d.) across the  $22\mu\text{F}$  capacitor to become 6.0V.

time = ..... s [3]

[Total: 11]

- 5 A capacitor of capacitance  $470\ \mu\text{F}$  is connected to a battery of electromotive force (e.m.f.)  $24\ \text{V}$  in the circuit of Fig. 5.1.

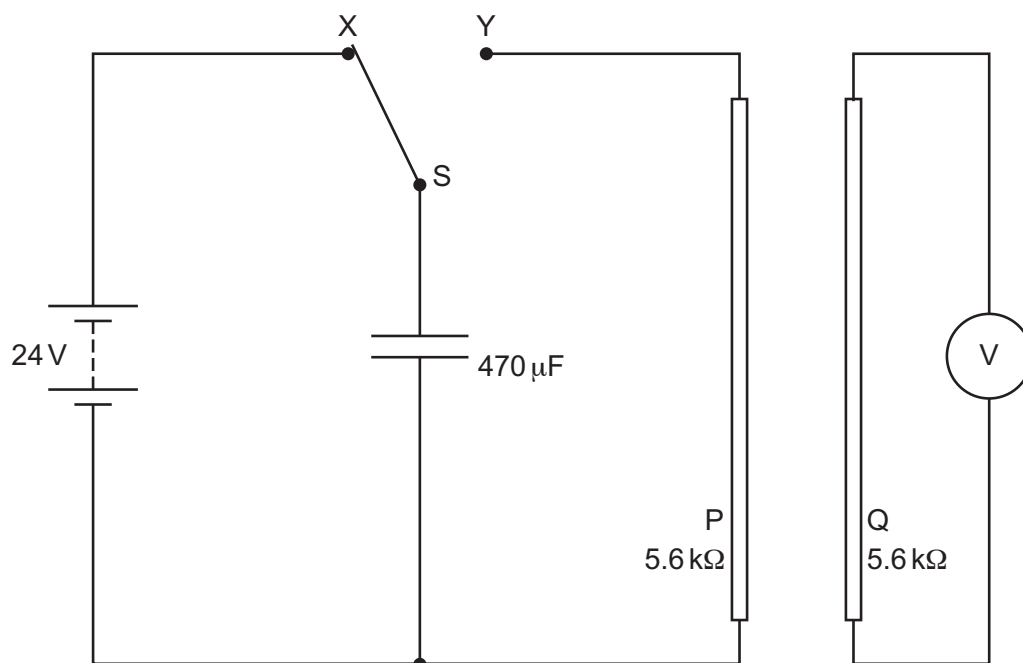


Fig. 5.1

The two-way switch S is initially at position X.

P and Q are identical long straight wires, each with a resistance of  $5.6\ \text{k}\Omega$ . These wires are placed near to, and parallel to, each other. Wire Q is connected to a voltmeter.

At time  $t = 0$ , switch S is moved to position Y so that the capacitor discharges through wire P.

- (a) (i) Calculate the charge  $Q_0$  on the capacitor at time  $t = 0$ .

$$Q_0 = \dots\dots\dots \text{ C [2]}$$

- (ii) Calculate the current  $I_0$  in wire P at time  $t = 0$ .

$$I_0 = \dots\dots\dots \text{ A [1]}$$

(iii) Calculate the time constant  $\tau$  of the discharge circuit.

$\tau = \dots\dots\dots$  s [2]

(iv) On Fig. 5.2, sketch a line to show the variation with  $t$  of the current  $I$  in wire P as the capacitor discharges.



Fig. 5.2

[2]

(b) (i) Explain why there is an induced e.m.f. across wire Q during the discharge of the capacitor.

.....  
.....  
.....  
..... [3]

(ii) On Fig. 5.3, sketch a line to suggest the variation with  $t$  of the voltmeter reading  $V$ .



Fig. 5.3

[1]

[Total: 11]

- 6 A capacitor of capacitance  $C$  and a resistor of resistance  $R$  are connected as shown in Fig. 6.1.

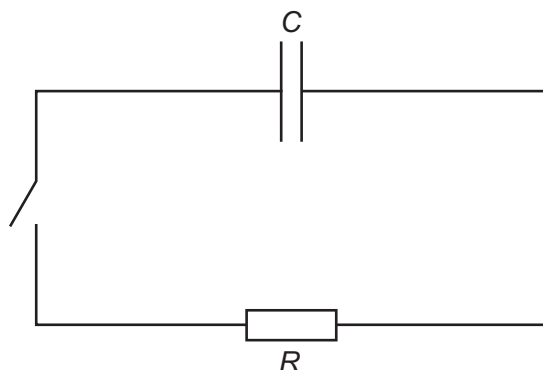


Fig. 6.1

Initially, the capacitor is charged and the switch is open.

The switch is closed at time  $t = 0$ .

Fig. 6.2 and Fig. 6.3 show, respectively, the variations with  $t$  of the charge  $Q$  on the capacitor and the potential difference (p.d.)  $V$  across the resistor.

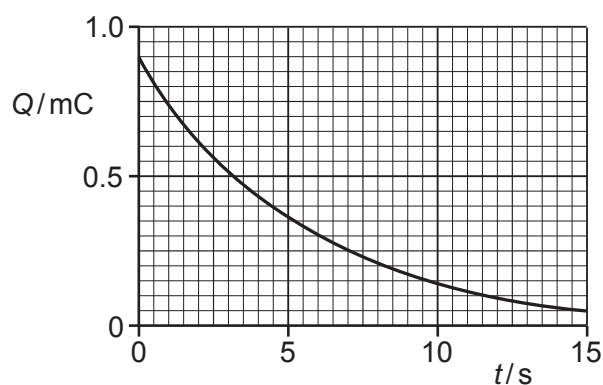


Fig. 6.2

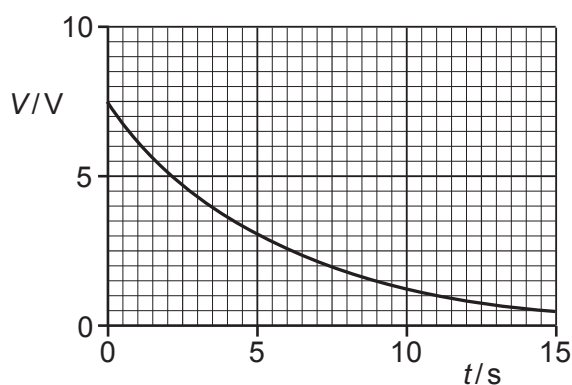


Fig. 6.3

- (a) Explain the shape of the line in Fig. 6.3 representing the variation of  $V$  with  $t$ .

.....

.....

.....

.....

..... [3]

**(b)** Use Fig. 6.2 to show that the time constant of the circuit in Fig. 6.1 is 5.5 s.

[3]

**(c)** Use Fig. 6.2, Fig. 6.3 and the information in **(b)** to determine:

**(i)** capacitance  $C$ , in  $\mu\text{F}$

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

**(ii)** resistance  $R$ , in  $\text{k}\Omega$ .

$R = \dots\dots\dots \text{k}\Omega$  [2]

[Total: 10]

- 5 A capacitor of capacitance  $470\ \mu\text{F}$  is connected to a battery of electromotive force (e.m.f.)  $24\ \text{V}$  in the circuit of Fig. 5.1.

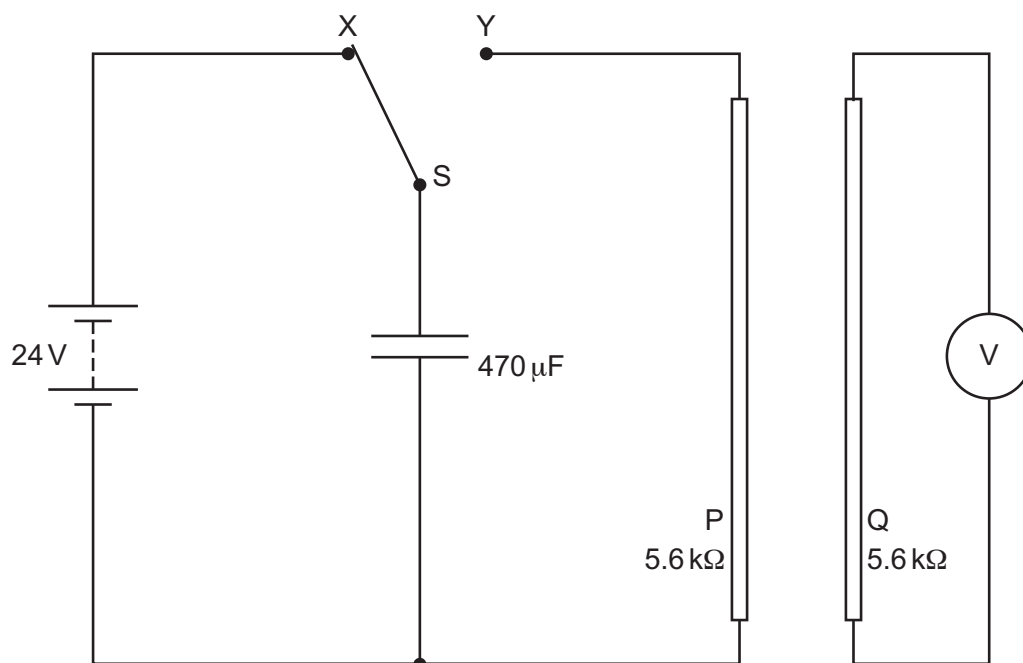


Fig. 5.1

The two-way switch S is initially at position X.

P and Q are identical long straight wires, each with a resistance of  $5.6\ \text{k}\Omega$ . These wires are placed near to, and parallel to, each other. Wire Q is connected to a voltmeter.

At time  $t = 0$ , switch S is moved to position Y so that the capacitor discharges through wire P.

- (a) (i) Calculate the charge  $Q_0$  on the capacitor at time  $t = 0$ .

$$Q_0 = \dots\dots\dots \text{ C [2]}$$

- (ii) Calculate the current  $I_0$  in wire P at time  $t = 0$ .

$$I_0 = \dots\dots\dots \text{ A [1]}$$

(iii) Calculate the time constant  $\tau$  of the discharge circuit.

$\tau = \dots\dots\dots$  s [2]

(iv) On Fig. 5.2, sketch a line to show the variation with  $t$  of the current  $I$  in wire P as the capacitor discharges.



Fig. 5.2

[2]

(b) (i) Explain why there is an induced e.m.f. across wire Q during the discharge of the capacitor.

.....  
.....  
.....  
..... [3]

(ii) On Fig. 5.3, sketch a line to suggest the variation with  $t$  of the voltmeter reading  $V$ .



Fig. 5.3

[1]

[Total: 11]

31. Question part 1/2 | 9702 Feb-March 2023 P4 V2 Q5

- 5 A capacitor, a battery of electromotive force (e.m.f.) 12V, a resistor R and a two-way switch are connected in the circuit shown in Fig. 5.1.

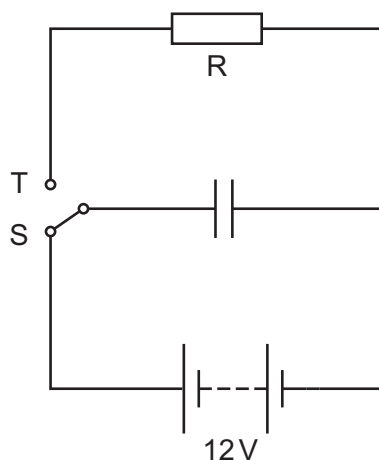


Fig. 5.1

The switch is initially in position S. When the capacitor is fully charged, the switch is moved to position T so that the capacitor discharges. At time  $t$  after the switch is moved the charge on the capacitor is  $Q$ .

The variation with  $t$  of  $\ln(Q/\mu\text{C})$  is shown in Fig. 5.2.

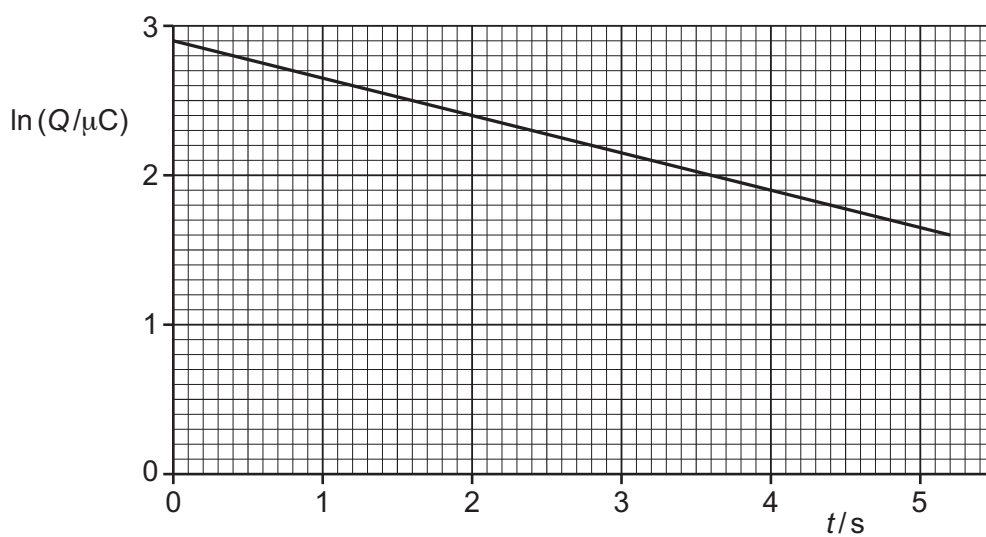


Fig. 5.2

- (a) Show that the capacitance of the capacitor is  $1.5\mu\text{F}$ .

31. Question part 2/2 | 9702 Feb-March 2023 P4 V2 Q5

**(b)** Determine the resistance of R.

resistance = .....  $\Omega$  [3]

**(c)** Calculate the energy stored in the capacitor at time  $t = 0$ .

energy = ..... J [2]

**(d)** A second identical resistor is now connected in parallel with R.

The switch is initially in position S. When the capacitor is fully charged, the switch is moved to position T so that the capacitor discharges. At time  $t$  after the switch is moved the charge on the capacitor is  $Q$ .

On Fig. 5.2, sketch a line to show the variation of  $\ln(Q/\mu\text{C})$  with  $t$  between time  $t = 0$  and time  $t = 5.0$  s. [2]

[Total: 10]

- 5 Two capacitors A and B are connected into the circuit shown in Fig. 5.1.

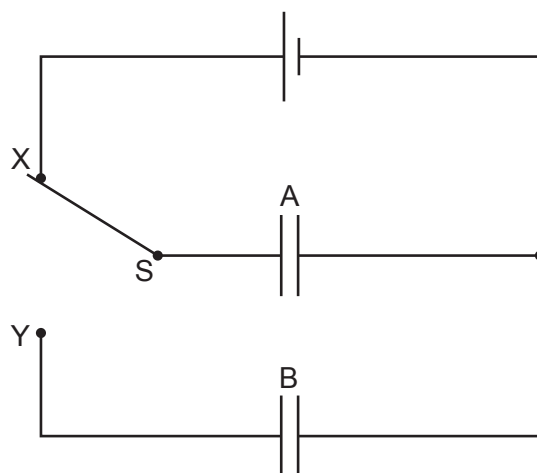


Fig. 5.1

Capacitor A has capacitance  $C$  and capacitor B has capacitance  $3C$ .

The electromotive force (e.m.f.) of the cell is  $V$ .

The two-way switch S is initially at position X, and capacitor B is initially uncharged.

- (a) State, in terms of  $V$  and  $C$ , expressions for:

- (i) the initial charge  $Q_A$  on the plates of capacitor A

$$Q_A = \dots\dots\dots [1]$$

- (ii) the initial energy  $E_A$  stored in capacitor A.

$$E_A = \dots\dots\dots [1]$$

- (b) The two-way switch S is now moved to position Y.

- (i) State and explain what happens to the charge that was initially on the plates of capacitor A.

.....  
 .....  
 ..... [2]

- (ii) Show that the final potential difference (p.d.)  $V_B$  across capacitor B is given by

$$V_B = \frac{V}{4}.$$

Explain your reasoning.

[3]

- (iii) Determine an expression, in terms of  $V$  and  $C$ , for the decrease  $\Delta E$  in the total energy that is stored in the capacitors as a result of the change of the position of the switch.

$$\Delta E = \dots\dots\dots [2]$$

[Total: 9]

33. Question part 1/2 | 9702 Oct-Nov 2023 P4 V2 Q6

- 6 A capacitor C is charged so that the potential difference (p.d.)  $V$  across its terminals is 8.0 V. The capacitor is connected into the circuit of Fig. 6.1.

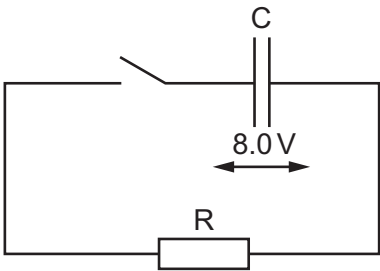


Fig. 6.1

The switch is initially open. The switch is closed at time  $t = 0$ .

- (a) Fig. 6.2 shows the variation of  $V$  with the charge  $Q$  on the plates of capacitor C as the capacitor discharges.

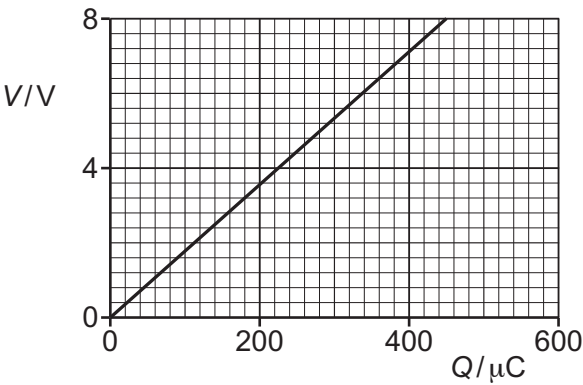


Fig. 6.2

- (i) Show that the energy stored in capacitor C at time  $t = 0$  is 1.8 mJ.

[2]

- (ii) Determine the capacitance of capacitor C. Give a unit with your answer.

capacitance = ..... unit ..... [2]

- (b) Fig. 6.3 shows the variation with  $t$  of  $-\ln\left(\frac{V}{8.0\text{V}}\right)$ .

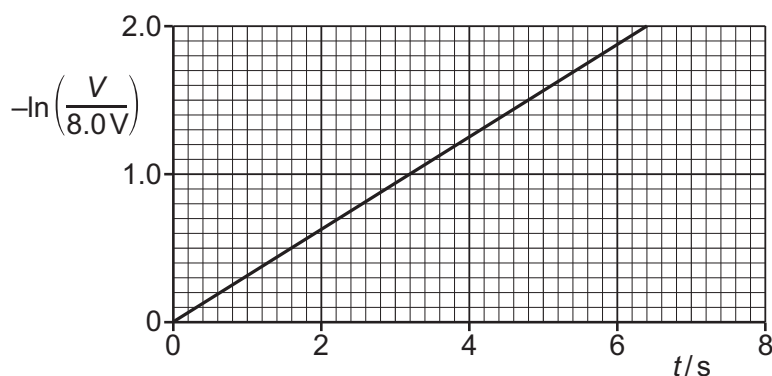


**Fig. 6.3**

- (i) Show that, when  $t$  is equal to one time constant, the value of  $-\ln\left(\frac{V}{8.0\text{V}}\right)$  is equal to 1.0.

[2]

- (ii) Determine the time constant  $\tau$  of the circuit in Fig. 6.1.

$\tau = \dots\dots\dots$  s [1]

- (iii) Calculate the resistance of resistor R.

resistance =  $\dots\dots\dots$   $\Omega$  [2]

[Total: 9]

34. Question part 1/2 | 9702 Feb-March 2024 P4 V2 Q4

- 4 (a) Three capacitors are connected as shown in Fig. 4.1.

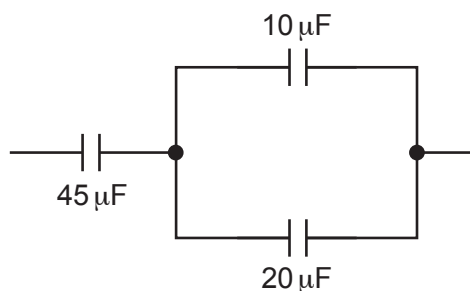


Fig. 4.1

Determine the total capacitance, in  $\mu\text{F}$ , of the network of three capacitors.

capacitance = .....  $\mu\text{F}$  [2]

- (b) A capacitor of capacitance  $45\ \mu\text{F}$  is connected to a variable power supply initially set at  $8.0\text{ V}$ . The output of the power supply increases so that the potential difference (p.d.) across the capacitor increases to  $9.6\text{ V}$ .

Calculate the increase in energy  $\Delta E$  stored in the capacitor.

$\Delta E = \dots\dots\dots\text{ J}$  [2]

- (c) A sinusoidal a.c. power supply is connected to the input of a bridge rectifier. The output of the rectifier is connected to a load resistor.

- (i) Complete the circuit in Fig. 4.2 by adding a capacitor to smooth the p.d. across the load resistor.

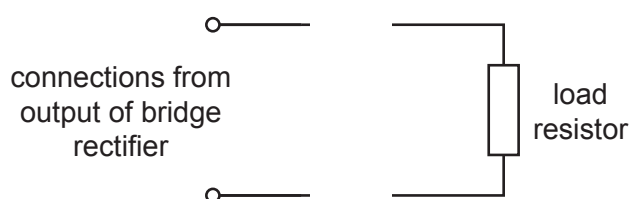


Fig. 4.2

(ii) The variation with time  $t$  of the p.d.  $V$  of the smoothed output is shown in Fig. 4.3.

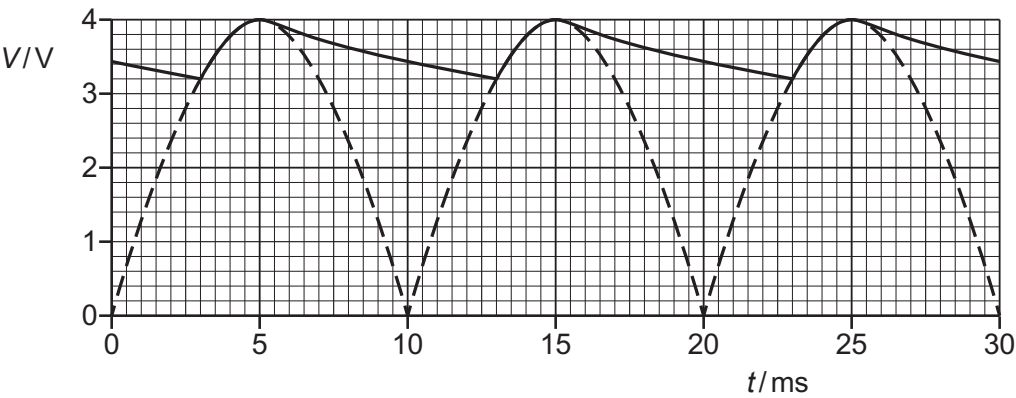


Fig. 4.3

Determine the time constant, in ms, of the smoothing circuit.

time constant = ..... ms [3]

(d) A sinusoidal a.c. power supply has a maximum power of 16 W.

State the value of the mean power when the output of the power supply is:

(i) full-wave rectified

mean power = ..... W [1]

(ii) half-wave rectified.

mean power = ..... W [1]

[Total: 10]

- 6 Fig. 6.1 shows a capacitor of capacitance  $C$  connected in series with a resistor of resistance  $R$ .

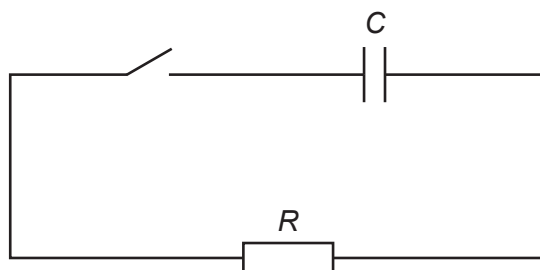


Fig. 6.1

Initially the switch is open and there is a p.d. of 12 V across the capacitor.

At time  $t = 0$ , the switch is closed so that there is a current  $I$  in the resistor.

Fig. 6.2 shows the variation of  $I$  with  $t$ .

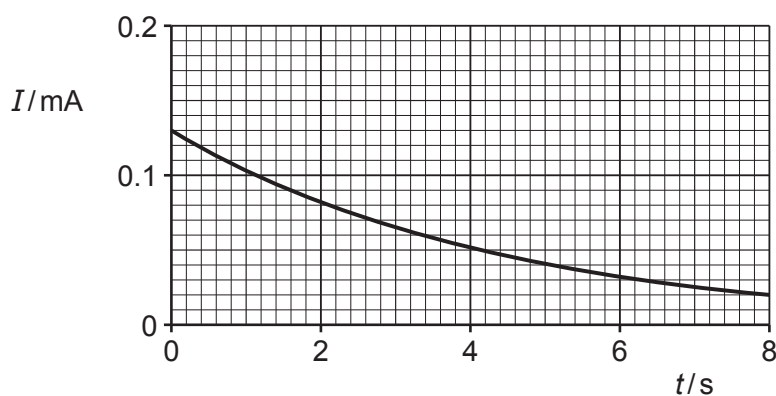


Fig. 6.2

- (a) Explain the shape of the line in Fig. 6.2.

.....

.....

.....

.....

..... [3]

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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35. Question part 2/2 | 9702 May-June 2024 P4 V1 Q6

**(b)** Use Fig. 6.2 to determine:

**(i)** resistance  $R$

$R = \dots\dots\dots \Omega$  [2]

**(ii)** the time constant  $\tau$  of the circuit in Fig. 6.1.

$\tau = \dots\dots\dots \text{ s}$  [3]

**(c)** Use your answers in **(b)** to determine capacitance  $C$ .

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

[Total: 10]

- 6 (a)** Two capacitors X and Y are connected in series to a power supply of voltage  $V$ , as shown in Fig. 6.1.

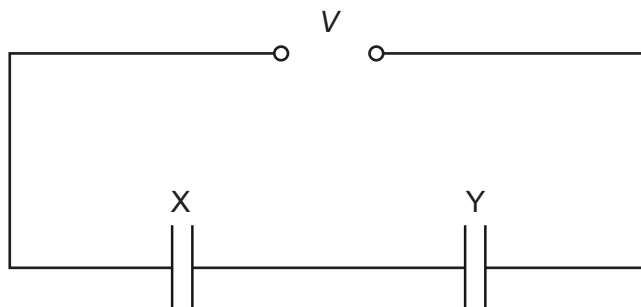


**Fig. 6.1**

The capacitance of X is  $C_X$  and the capacitance of Y is  $C_Y$ .

Derive an expression, in terms of  $C_X$  and  $C_Y$ , for the combined capacitance  $C_T$  of the capacitors in this circuit.

Explain your reasoning.

[3]

- (b)** Two capacitors P and Q are connected in parallel to a power supply of voltage  $V$ . The capacitance of P is  $200\ \mu\text{F}$ . The capacitance  $C_Q$  of Q can be varied between 0 and  $400\ \mu\text{F}$ . When  $C_Q = 0$ , the total energy stored in the capacitors is  $2.5\ \text{mJ}$ .

- (i)** Show that the supply voltage  $V$  is  $5.0\ \text{V}$ .

[2]



(ii) Calculate the total energy, in mJ, stored in the capacitors when  $C_Q$  has its maximum value.

total energy = ..... mJ [3]

(iii) On Fig. 6.2, sketch the variation of the total energy  $E$  stored in the capacitors with  $C_Q$ , as  $C_Q$  varies from 0 to 400  $\mu\text{F}$ .

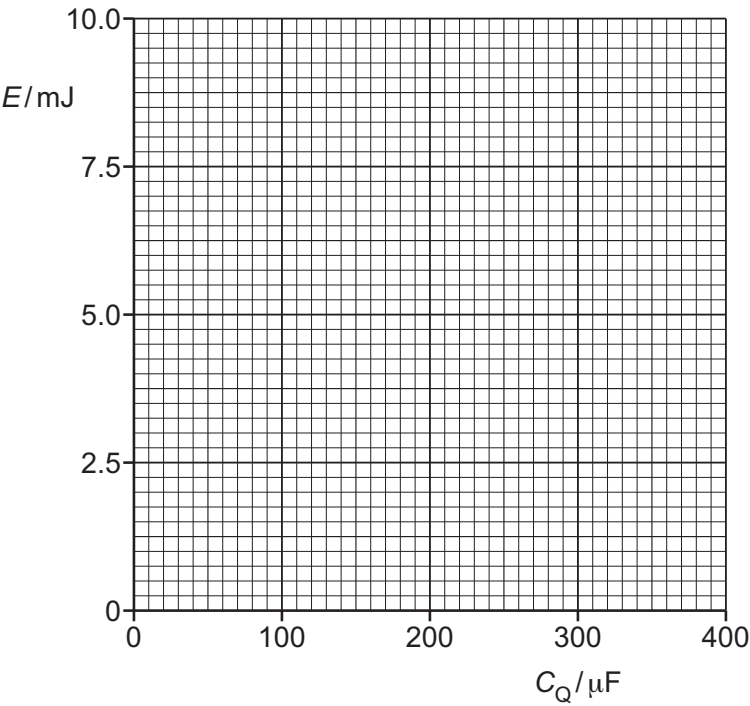


Fig. 6.2

[2]

[Total: 10]

- 6 Fig. 6.1 shows a capacitor of capacitance  $C$  connected in series with a resistor of resistance  $R$ .

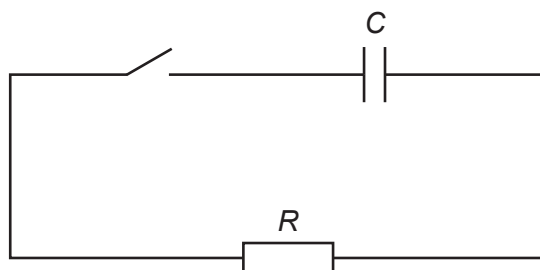


Fig. 6.1

Initially the switch is open and there is a p.d. of 12 V across the capacitor.

At time  $t = 0$ , the switch is closed so that there is a current  $I$  in the resistor.

Fig. 6.2 shows the variation of  $I$  with  $t$ .

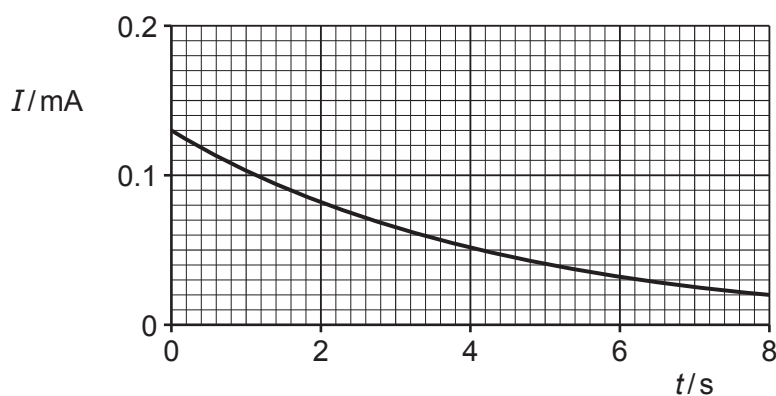


Fig. 6.2

- (a) Explain the shape of the line in Fig. 6.2.

.....

.....

.....

.....

..... [3]

## 9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

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37. Question part 2/2 | 9702 May-June 2024 P4 V3 Q6

**(b)** Use Fig. 6.2 to determine:

**(i)** resistance  $R$

$R = \dots\dots\dots \Omega$  [2]

**(ii)** the time constant  $\tau$  of the circuit in Fig. 6.1.

$\tau = \dots\dots\dots \text{ s}$  [3]

**(c)** Use your answers in **(b)** to determine capacitance  $C$ .

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

[Total: 10]

7 (a) Define the capacitance of a parallel-plate capacitor.

.....

.....

..... [2]

- (b) An initially uncharged capacitor X, of capacitance  $C$ , is gradually charged so that the final potential difference (p.d.) between its plates is  $V$  and the final charge is  $Q$ .
- (i) On Fig. 7.1, sketch the variation of charge with p.d. for capacitor X as the p.d. increases from 0 to  $V$ .

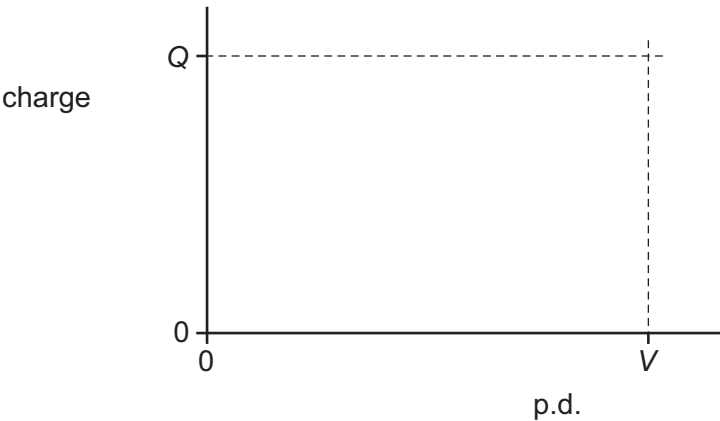


Fig. 7.1 [2]

- (ii) Determine an expression, in terms of  $Q$  and  $V$ , for the work  $W$  done on capacitor X during the charging process. Explain your reasoning.

$W =$  ..... [2]

38. Question part 2/2 | 9702 Oct-Nov 2024 P4 V2 Q7



(c) Another capacitor Y is initially uncharged. The fully charged capacitor X in (b) is now connected to capacitor Y, as shown in Fig. 7.2.

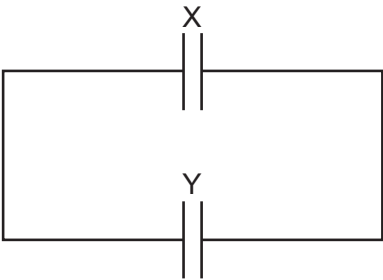


Fig. 7.2

The capacitance of capacitor Y is  $3C$ .

- (i) Complete Table 7.1 to show expressions, in terms of  $Q$  and  $V$ , for the final p.d.s across, and the final charges on, the two capacitors.  
Use the space below for any working that you need.

Table 7.1

|              | X | Y |
|--------------|---|---|
| final p.d.   |   |   |
| final charge |   |   |

[3]

- (ii) State whether the total energy stored in the two capacitors is less than, the same as, or greater than the energy initially stored in capacitor X.

..... [1]

[Total: 10]

39. Question part 1/2 | 9702 Feb-March 2025 P4 V2 Q5

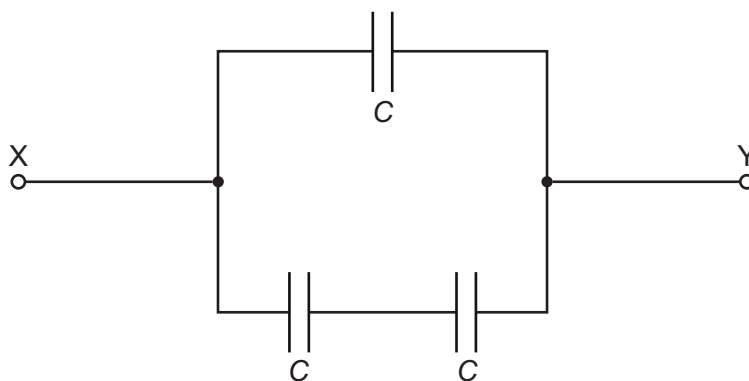
- 5 (a) A capacitor of capacitance  $C_1$  is connected in series with a second capacitor of capacitance  $C_2$ .

Show that the combined capacitance  $C$  of the two capacitors is given by

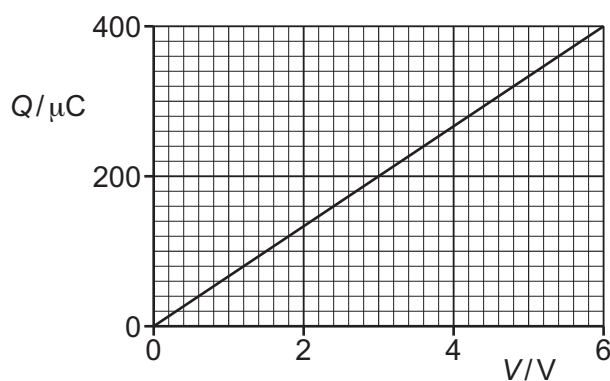
$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}.$$

[2]

- (b) Three identical capacitors, each of capacitance  $C$ , are connected in a network as shown in Fig. 5.1.

**Fig. 5.1**

The variation of the charge  $Q$  with the potential difference (p.d.)  $V$  between the terminals X and Y is shown in Fig. 5.2.

**Fig. 5.2**

39. Question part 2/2 | 9702 Feb-March 2025 P4 V2 Q5



Show that  $C$  is equal to  $44\text{ }\mu\text{F}$ .

[3]

(c) The capacitor network in Fig. 5.1 is charged and then connected to a resistor of resistance  $54\text{ k}\Omega$ . The capacitor network discharges through the resistor.

(i) Determine the time constant  $\tau$  of the circuit. Give a unit with your answer.

$\tau = \dots\dots\dots$  unit  $\dots\dots\dots$  [2]

(ii) Determine the time taken for the discharge current to reduce to 15% of the initial discharge current.

time =  $\dots\dots\dots$  s [2]

[Total: 9]

40. Question part 1/2 | 9702 May-June 2025 P4 V2 Q7

7 Fig. 7.1 shows a circuit containing a capacitor of capacitance  $C$  and a resistor of resistance  $R$ .

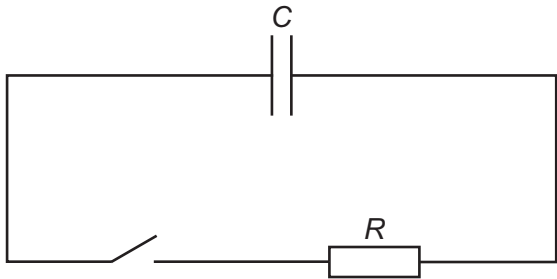


Fig. 7.1

Initially, the switch is open and the potential difference (p.d.) across the capacitor is 12 V.

The switch is closed at time  $t = 0$  and the capacitor discharges through the resistor.

Fig. 7.2 shows the variation of the charge  $Q$  on the capacitor with the p.d.  $V_C$  across the capacitor as the capacitor discharges. Fig. 7.3 shows the variation of the current  $I$  in the resistor with the p.d.  $V_R$  across the resistor as the capacitor discharges.

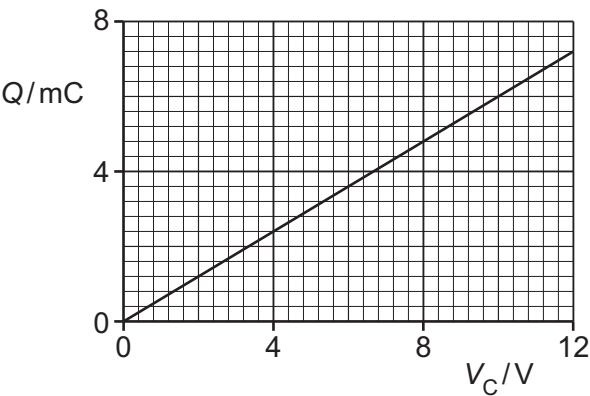


Fig. 7.2

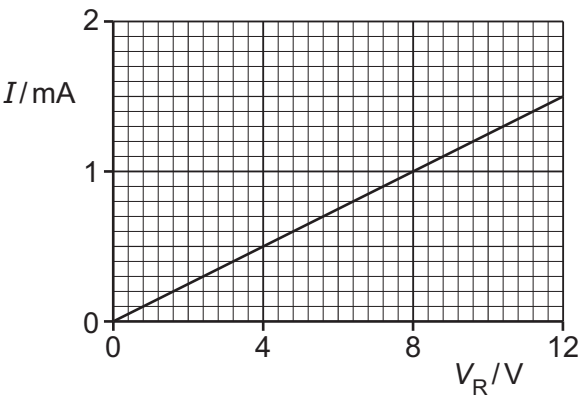


Fig. 7.3

- (a) State the relationship between  $V_C$  and  $V_R$ .
- ..... [1]
- (b) Determine:
- (i) the capacitance  $C$ , in  $\mu\text{F}$

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

40. Question part 2/2 | 9702 May-June 2025 P4 V2 Q7



(ii) the resistance  $R$ , in  $\text{k}\Omega$

$R = \dots\dots\dots \text{k}\Omega$  [2]

(iii) the time constant  $\tau$  of the circuit.

$\tau = \dots\dots\dots \text{s}$  [2]

(c) Use Fig. 7.2, Fig. 7.3 and your answer in (a) to explain why the variation of  $Q$  with  $t$  is exponential in nature.

.....

.....

.....

.....

..... [3]

[Total: 10]

41. Question part 1/2 | 9702 Oct-Nov 2025 P4 V1 Q6

- 6 (a) Two parallel plate capacitors  $C_1$  and  $C_2$  are connected to a supply that has a potential difference (p.d.)  $V_S$ . The capacitors may be connected in series or in parallel.

The supply provides charge  $Q_S$  and the plates of the two capacitors acquire charges  $Q_1$  and  $Q_2$  respectively. The p.d.s across the plates of the capacitors are  $V_1$  and  $V_2$  respectively.

Complete Table 6.1 to indicate how  $Q_S$ ,  $Q_1$  and  $Q_2$  relate to each other, and how  $V_S$ ,  $V_1$  and  $V_2$  relate to each other, for series and parallel connections of the capacitors to the supply.

Table 6.1

|          | relationship between charges | relationship between p.d.s |
|----------|------------------------------|----------------------------|
| series   |                              |                            |
| parallel |                              |                            |

[4]

- (b) An isolated capacitor of capacitance  $470\text{ }\mu\text{F}$  stores  $19\text{ mJ}$  of energy.

- (i) Calculate the p.d. across the capacitor.

p.d. = .....V [2]

- (ii) Calculate the charge on the capacitor.

charge = ..... C [2]

9702 Physics Paper 4 - Capacitance

Topical questions | 42 questions

41. Question part 2/2 | 9702 Oct-Nov 2025 P4 V1 Q6



- (iii) The capacitor is now connected in parallel with a capacitor of capacitance  $180\mu\text{F}$  that is initially uncharged.

Determine the total energy, in mJ, now stored in the two capacitors.

energy = ..... mJ [3]

[Total: 11]

42. Question part 1/2 | 9702 Oct-Nov 2025 P4 V3 Q6

- 6 (a) Two parallel plate capacitors  $C_1$  and  $C_2$  are connected to a supply that has a potential difference (p.d.)  $V_S$ . The capacitors may be connected in series or in parallel.

The supply provides charge  $Q_S$  and the plates of the two capacitors acquire charges  $Q_1$  and  $Q_2$  respectively. The p.d.s across the plates of the capacitors are  $V_1$  and  $V_2$  respectively.

Complete Table 6.1 to indicate how  $Q_S$ ,  $Q_1$  and  $Q_2$  relate to each other, and how  $V_S$ ,  $V_1$  and  $V_2$  relate to each other, for series and parallel connections of the capacitors to the supply.

Table 6.1

|          | relationship between charges | relationship between p.d.s |
|----------|------------------------------|----------------------------|
| series   |                              |                            |
| parallel |                              |                            |

[4]

- (b) An isolated capacitor of capacitance  $470\text{ }\mu\text{F}$  stores  $19\text{ mJ}$  of energy.

- (i) Calculate the p.d. across the capacitor.

p.d. = .....V [2]

- (ii) Calculate the charge on the capacitor.

charge = ..... C [2]

42. Question part 2/2 | 9702 Oct-Nov 2025 P4 V3 Q6



(iii) The capacitor is now connected in parallel with a capacitor of capacitance  $180\mu\text{F}$  that is initially uncharged.

Determine the total energy, in mJ, now stored in the two capacitors.

energy = ..... mJ [3]

[Total: 11]