

Physics Higher Level Electricity and Electronics Practice Unit Assessment

Time 45 minutes

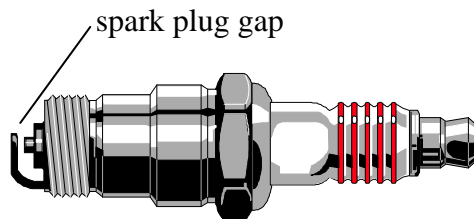
Read Carefully

- 1 All questions should be attempted.
- 2 Enter the question number clearly beside the answer to each question.
- 3 Care should be taken to give an appropriate number of significant figures in the final answers to calculations.
- 4 The following data should be used when required.

Speed of light in vacuum c	$3.00 \times 10^8 \text{ m s}^{-1}$	Planck's constant h	$6.63 \times 10^{-34} \text{ J s}$
Magnitude of the charge on electron e	$1.60 \times 10^{-19} \text{ C}$	Mass of electron m_e	$9.11 \times 10^{-31} \text{ kg}$
Acceleration due to gravity g	9.8 m s^{-2}	Mass of proton m_p	$1.67 \times 10^{-27} \text{ kg}$

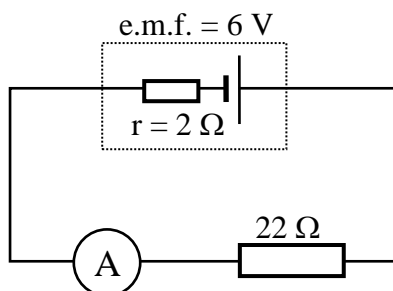
NOTE: This is a **trial paper** and contains questions **of the type** that will be encountered in the actual unit assessment. The threshold of attainment of the unit assessment (pass mark) is 18 marks.

1. A spark crosses the gap between the electrodes at the end of a spark plug. The voltage across the gap is 600 V. Calculate the electrical energy transferred by the spark if the spark transfers a charge of 1×10^{-5} C.



(2)

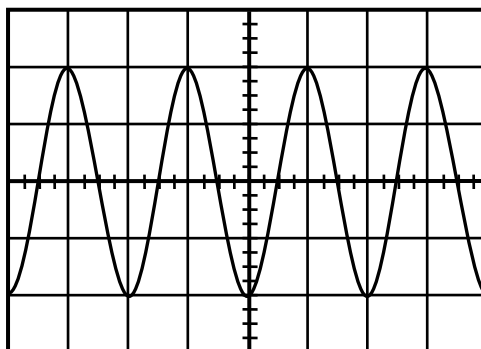
2. A 22Ω resistor is connected in series with a cell of e.m.f. 6 V and with an internal resistance of 2Ω .



- (a) (i) Find the current flowing through the ammeter. 2
- (ii) What will be the voltage across the terminals of the cell? 2
- (iii) What is the value of the lost volts in the circuit? 1
- (b) The 22Ω resistor is replaced by a resistor with only 18Ω resistance. State the effect this change will have on the value of the lost volts in the circuit. Explain your answer. 2

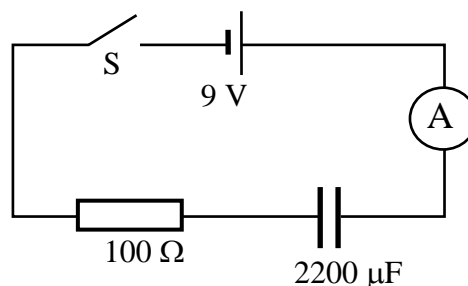
(7)

3. An oscilloscope is used to find the frequency of an a.c. power supply. The oscilloscope screen is divided into 1 cm squares and these are shown below. Each 1 cm square represents 2 ms.



- (a) Use the trace shown above to calculate the frequency of the power supply. 2
- (b) The root mean square (r.m.s.) output voltage from the power supply is 12 V. What is the peak output voltage from the power supply? 2

4. A circuit is set up which consists of a resistor and capacitor in series connected to a 9 V cell with negligible internal resistance. The capacitor has a capacitance of 2200 μF .

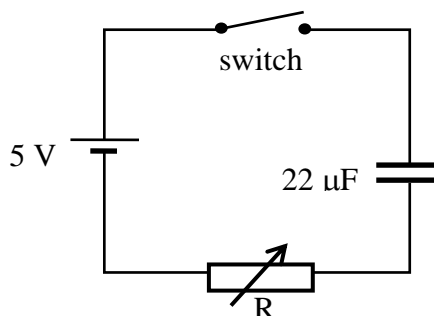


(4)

- (a) The capacitor is initially uncharged. The switch, S, is closed and the capacitor allowed to charge. What will be the initial charging current recorded on the ammeter? 2
- (b) The capacitor begins to charge. What will be the voltage across the capacitor at the instant the voltage across the resistor is 6 V? 1
- (c) (i) Calculate the charge Q , on the capacitor when fully charged? 2
 (ii) How much energy can the capacitor store when fully charged? 2

(7)

5. A capacitor is connected in series with a resistor as shown below.

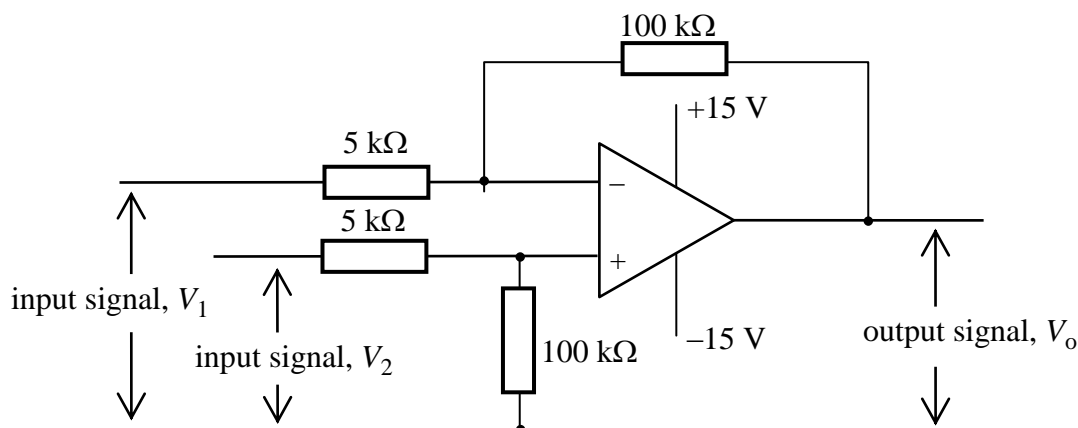


The switch is closed so that the capacitor charges through resistor R.

- (a) Sketch a graph of voltage against time for the charging capacitor. 1
- (b) The value of the variable resistor is now decreased. State the effect this will have on the time it takes for the capacitor to charge. 1

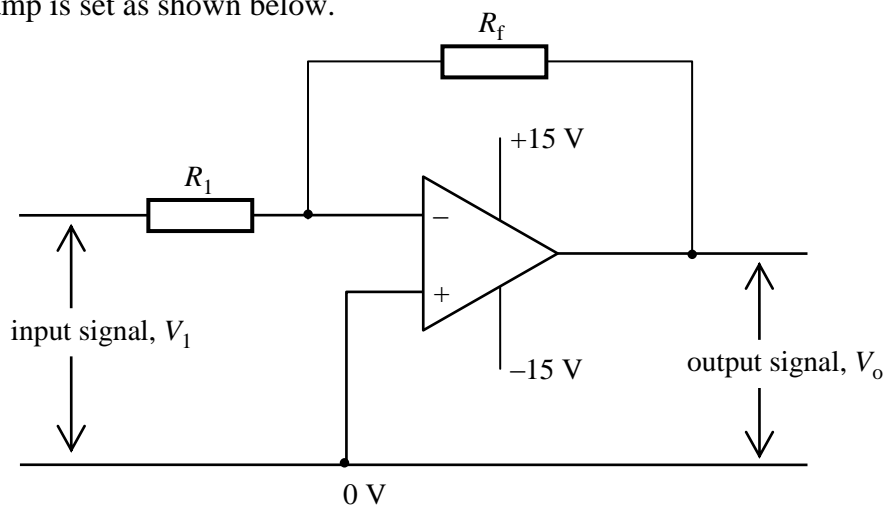
(2)

6. An op-amp is set up as shown in the circuit diagram below.



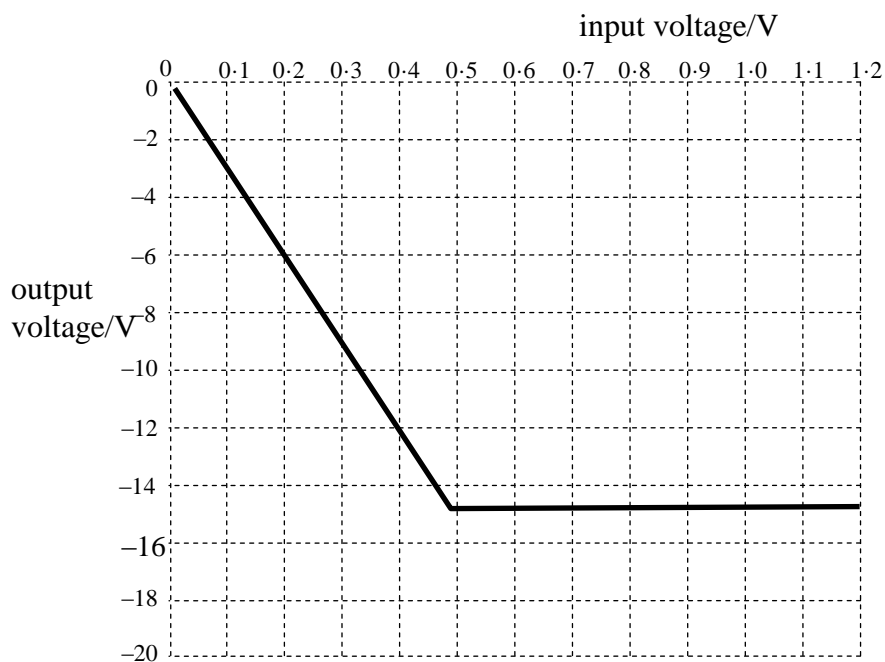
The op-amp has two inputs, V_1 and V_2 . The voltage applied to V_1 is 0.4 V and the voltage applied to V_2 is 0.5 V. Calculate the output from this op-amp. (2)

7. An op-amp is set as shown below.



(a) In what mode is this op-amp operating? 1

(b) The output voltage from the op-amp is plotted against the input voltage to produce the graph shown below.



(i) Use the graph to find the gain of the op-amp. 2

(ii) If the input resistor has a value of 10 kΩ, find the value of the feedback resistor to provide the gain calculated in (b) (i). 2

(iii) Explain why the output voltage does not exceed 15 V. 1

(6)

