1 - Electricity Revision

1. A 200m sprinter records the following times over the course of a season:

19.83 s, 19.23 s, 19.56 s, 19.87 s, 19.40 s, 19.38 s, 19.73 s and 19.69 s.

Calculate or find:

a) Mean time of the sprinter. **(1)**

b) Random uncertainty in the mean. **(3)**

c) Mean Time ± Random Uncertainty. **(1)**

2. The following readings were taken to measure the capacitance of a capacitor.

Charge, Q = (10.8 ± 0.01) x10^{-3}C

Voltage, V = (12.00 ± 0.05) V

Calculate or find:

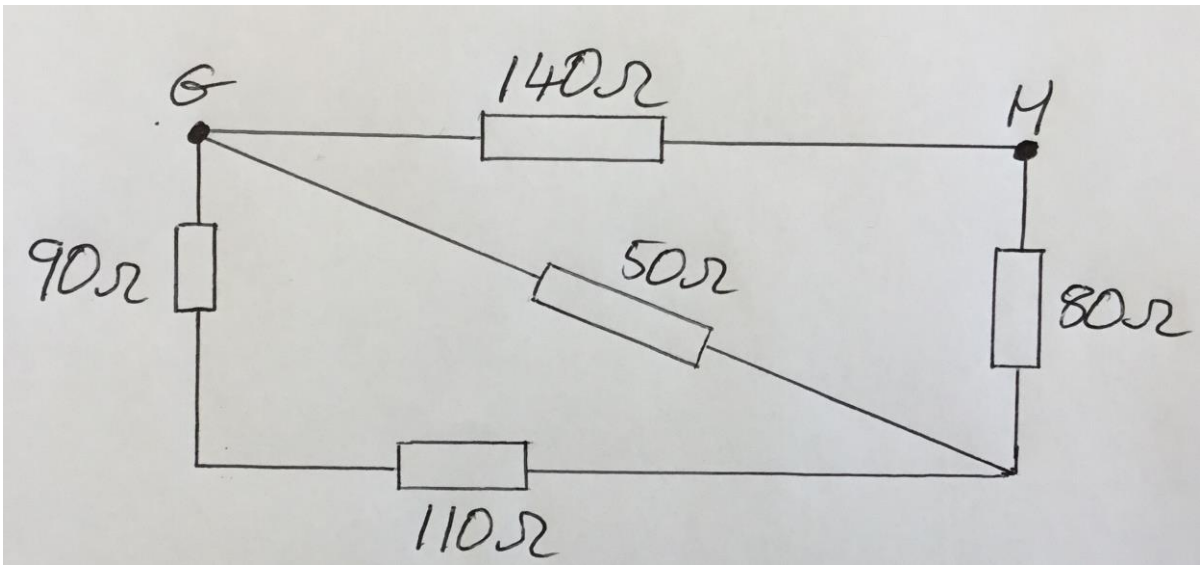
a) Capacitance of the capacitor in micro Farads**. (x10^{-6} Farads.)** **(3)**

b) Percentage uncertainty in the capacitance. **(2)**

c) Absolute uncertainty in the capacitance. **(1)**

d) Capacitance ± Absolute Uncertainty. **(1)**

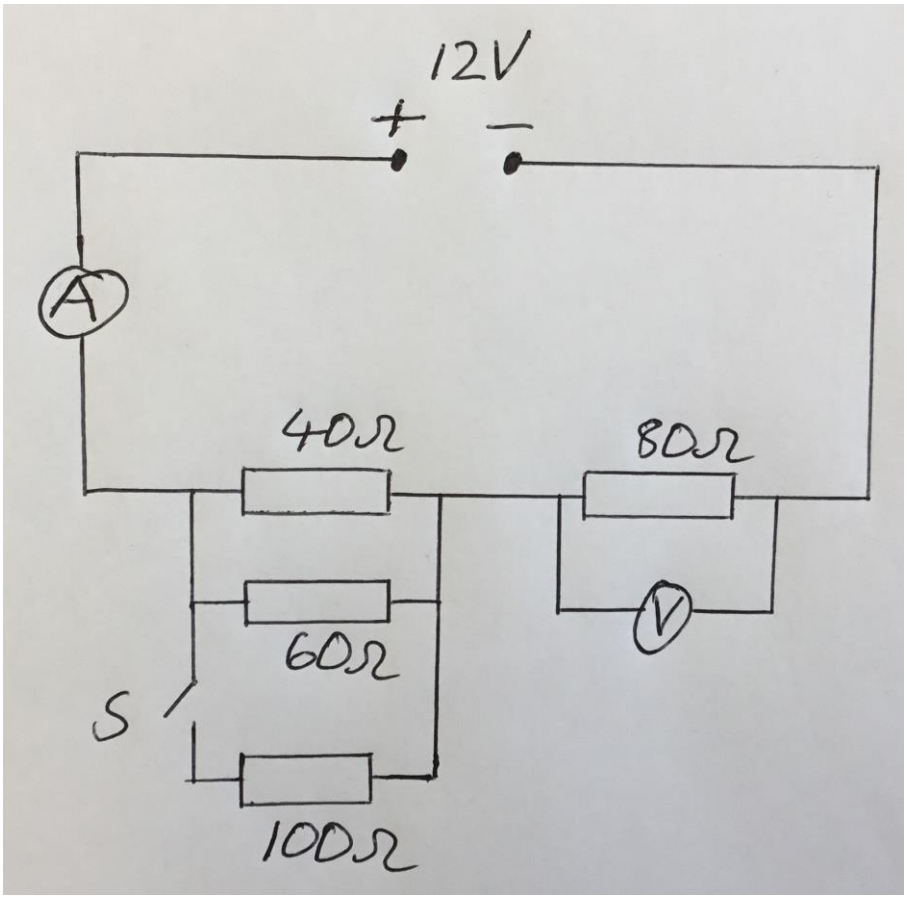
3. Calculate the resistance between points **G and H** in the circuit network below. **(3)**



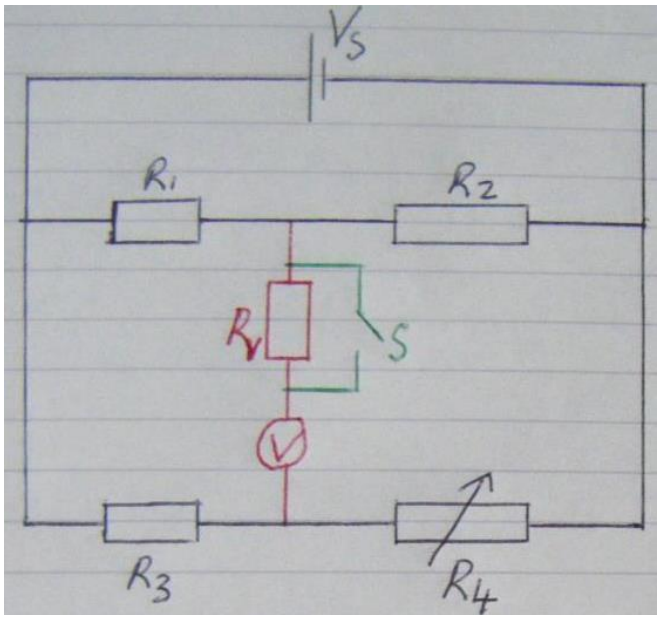
4. Calculate the readings on the **ammeter** and the **voltmeter** in the circuit below when:

a) The switch S is open. **(4)**

b) The switch S is closed. **(4)**



5. The circuit diagram below shows a Wheatstone Bridge Circuit.



R_1 = 2.6 kΩ

R_2 = 4.2 kΩ

R_3 = 3.9 kΩ

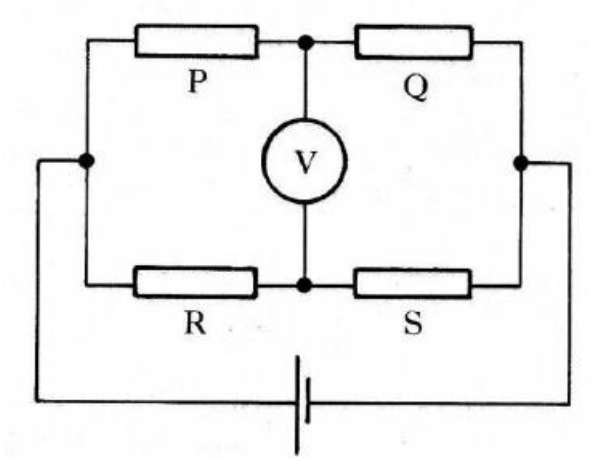
R_4 = ?

a) Calculate the resistance of variable resistor **R_4** which will balance the Wheatstone Bridge. **(3)**

b) What affect would an increase in the voltage supply from 8V to 12V have on the reading on the voltmeter when the bridge is balanced **or** when it is unbalanced? **(2)**

c) What is the purpose of the switch S in this circuit? **(1)**

6. Calculate the reading on the voltmeter in the unbalanced Wheatstone Bridge circuit below. **(3)**



P = 6.5 kΩ

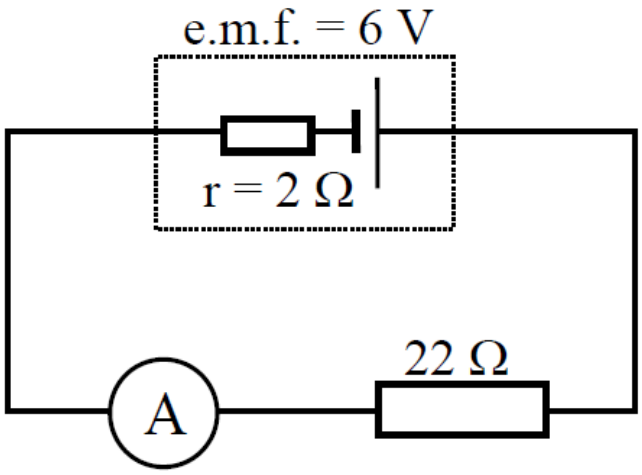
Q = 3.5 kΩ

R = 2.1 kΩ

S = 8.2 kΩ

Vs = 10V

7. Calculate or find the following from the circuit diagram below:



a) i) The current reading on the ammeter. **(3)**

ii) The terminal potential difference. **(3)**

iii) The lost volts. **(1)**

b) A voltmeter is placed across the cell and then a 66 Ω resistor is placed **in parallel** across the 22 Ω external load resistor.

Explain the changes observed on the readings found on the **ammeter** and the **voltmeter** when the 66 Ω resistor is added in parallel. **(3)**

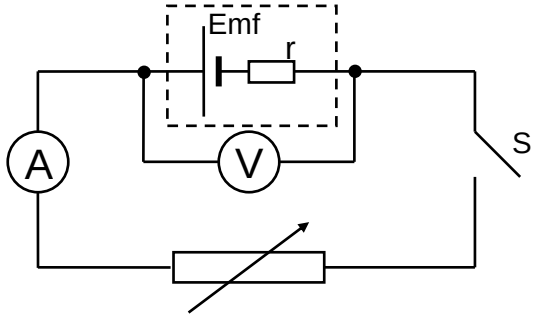
8. A lamp is connected to an ac supply with the following readings being taken:

Peak Voltage = 325.3V

Peak Current = 369mA

Calculate the **power of the lamp**. **(4)**

9. A battery is connected in a circuit to look at how the voltage from a battery varies with the current drawn from it.



For each setting of the variable resistor the switch is closed for a short period of time, and the ammeter and voltmeter readings are recorded. A table of the results recorded is shown below.

Voltmeter reading (V)	5.5	4.5	3.5	2.5	1.5
Ammeter Reading (A)	5	15	25	35	45

a) Draw a graph of the **voltmeter** reading **against** the **ammeter** reading using all the data from the table. **(3)**

b) From the information in the graph find:

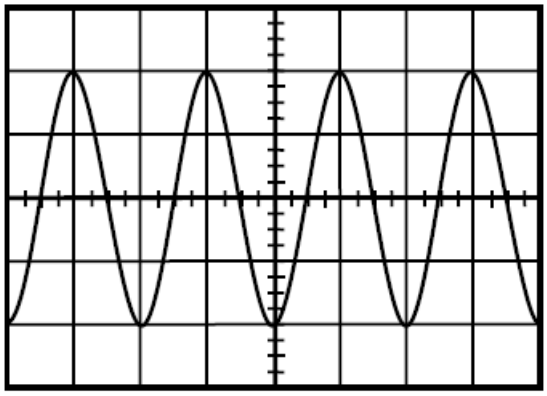
i) **e.m.f.** of the battery. **(1)**

ii) the **internal resistance** of the battery. **(3)**

iii) the **current** drawn from the battery if it is short circuited. **(1)**

c) State the definition of e.m.f **using the figure found** in b) i). **(1)**

10. A signal generator is connected to an oscilloscope and the trace below is observed on the oscilloscope screen.



Oscilloscope Settings
Y- Gain Setting = 10V div $^{-1}$

Time - Base Setting = 40ms div $^{-1}$

Calculate or find:

a) Peak Voltage, Vp. **(2)**

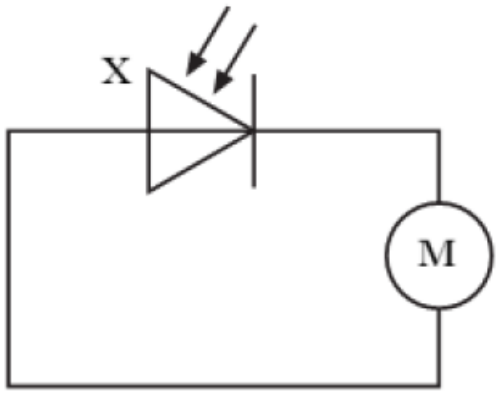
b) Root mean Square Voltage, Vrms. **(2)**

c) Frequency, f. **(4)**

The time base setting is then reduced to 20ms div^{-1}.

d) **Describe** the wave trace now observed on the screen. **(2)**

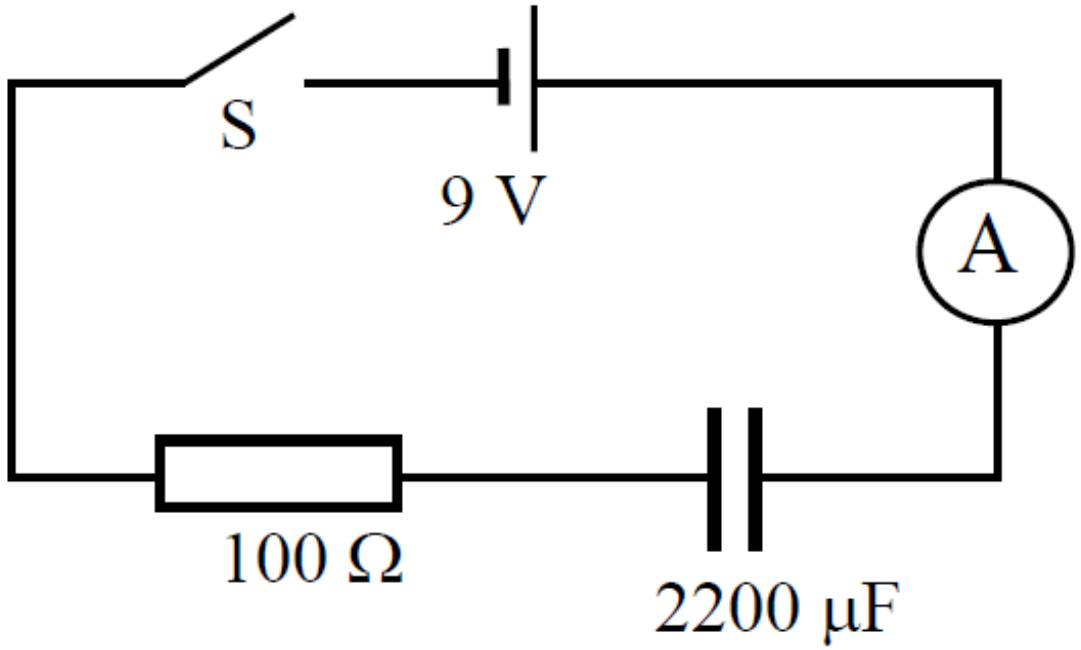
11. In the diagram below the photodiode is used to turn the electric motor.



a) In which mode is the photodiode operating? **(1)**

b) Describe how the photodiode operates in this mode using the terms **junction, holes, electrons, photons and free charge carriers**. **(3)**

12. In the circuit below a potential divider is set up with a resistor, capacitor and a 9V battery.



The capacitor is initially uncharged.

a) State the definition of a **2200μF** capacitance. **(1)**

b) Calculate the reading on the ammeter at the instant that the switch S is closed. **(3)**

c) State a suitable **range** for the ammeter. **(1)**

d) Calculate the reading on the ammeter during the charging process when the voltage across the capacitor is 6V. **(3)**

e) Calculate the charge stored in the capacitor when it is fully charged. **(3)**

f) Calculate the energy stored in the capacitor when it is fully charged. **(3)**

g) i) Sketch a graph of **current against time** during the charging of the capacitor. (Label the maximum current.) **(2)**

ii) Sketch a graph of **voltage across the capacitor** against time during the charging of the capacitor. (Label the maximum voltage.) **(2)**

13. a) Name the process which will convert a pure semiconductor material into a n-type semiconductor material. **(1)**

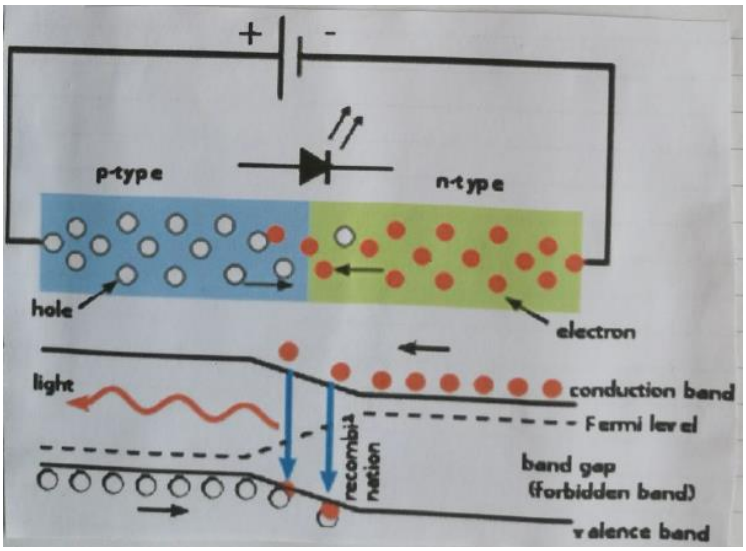
b) Describe how this process will reduce the resistance of the semiconductor material. **(2)**

c) State the name of the majority charge carriers in a n-type semiconductor material. **(1)**

14. a**) Draw band diagrams side by side** for insulators, semiconductors and conductors. **(3)**

b) Describe the relative abundance of electrons contained in the bands for insulators, semiconductors and conductors. **(3)**

c) Use the diagram shown below to describe how LED's work. **(3)**



Total Marks = 100