R1-2002 Q1(a)

a) Determine the current I through the ammeter A in each of the four circuits in Figure 1.1. The ammeter has zero resistance. The voltmeter, in (ii), has infinite resistance and a reading 8V. The resistance R has not been specified.

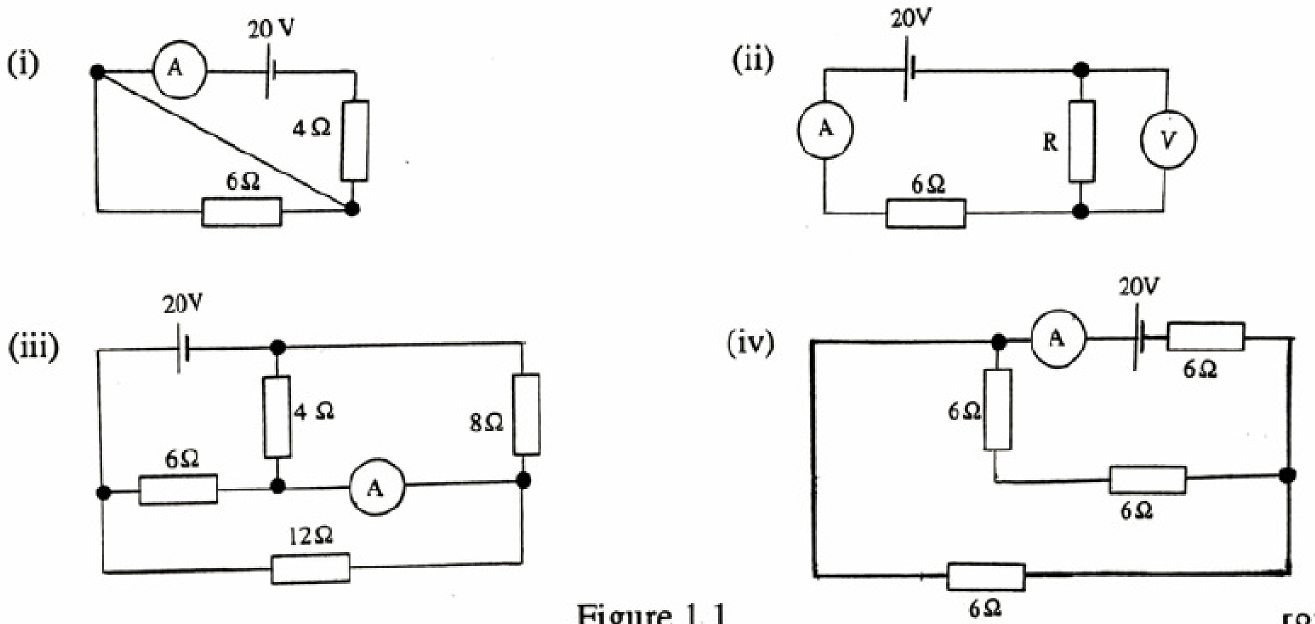


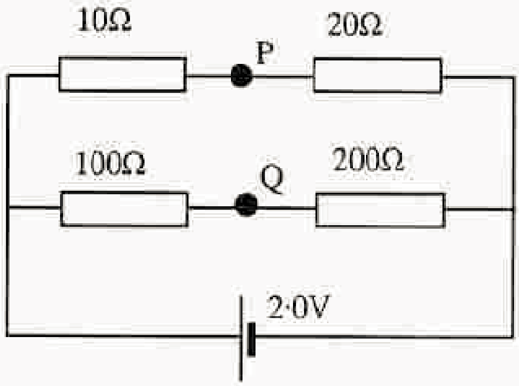
Figure 1.1

[8]

R1-2004 Q1(a)

a)

Figure 1.1



(i) Determine the p d between P and Q in Figure 1.1.

(ii) If the 10Ω resistance is replaced by an unknown resistor of XΩ, how could this circuit, with additional components, be modified to determine *X*?

[6]

R1-2005 Q1(b) and 1(c)(i)

b) The potential in volts, V, across a new material varies with the current in amperes, I, according to the relation

$$V = (6I - 3I^2 + 2I^3)/6,$$

from $I = 0$ to $I = 5$.
Determine the resistance, for (i) $I = 2$, and (ii) $I = 0$.

For a light bulb and a LED:

(iii) sketch graphs of voltage V against current I
(iv) explain the variation in each case.

[6]

c) (i) Why is there a force of net attraction between a charged particle and an uncharged isolated copper sphere some distance away ?
Why does this force increase if the sphere is earthed?

R1-2006 Q1(b)

(b) The circuit in Figure 1.b contains a battery, emf E, and resistors all with resistance r. Determine the current I through the battery.

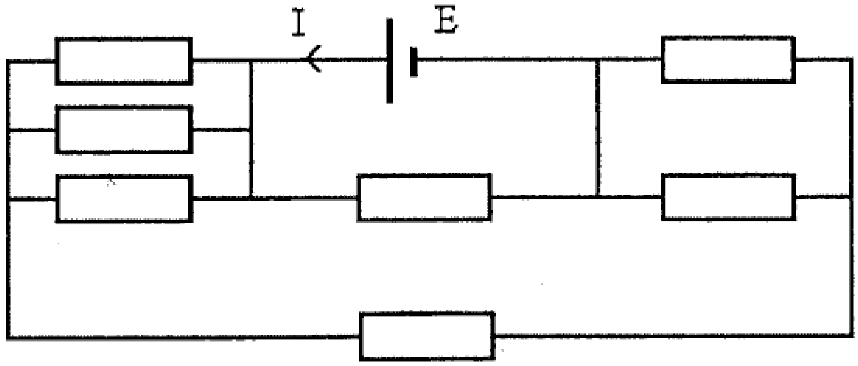


Figure 1.b

[4]

R1-2006 Q1(f)

(f) A long thin copper strip, width w, is sandwiched between two insulating sheets, each of thickness t and thermal conductivity κ, in an environment at 0°C. The electrical resistance per unit length of the strip, R, at θ°C is given by

$$R = a(1 + b\theta),$$

where a and b are constants.

(i) What is the rate of heat generation in the copper strip, per unit length, by a current I?

(ii) Show that if the current I through the strip is increased, a critical current, I_c, is reached at which the temperature increases indefinitely.

(iii) Calculate I_c using the data in Table 1.f.

Quantity	Value	Quantity	Value
w	5.00 mm	a	2.20×10^{-2} Ωm^{-1}
t	1.00 mm	b	4.30×10^{-3} K^{-1}
κ	1.30×10^{-1} Wm^{-1}K^{-1}		

Table 1.f

[5]

R1-2007 Q1(c), Q1(d), and Q1(e)

(c) In the right angle triangle ABP, Figure 1.a , there is a charge of 100 nC at A and a charge of 576nC at B . AP = 50 mm, BP = 120 mm and AB = 130 mm.

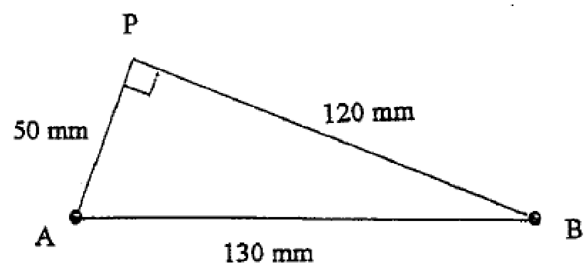


Figure 1.c

What is the magnitude and direction of the electric field , E , at P ? [5]

(d) The circuit in Figure 1.d consists of a cell of emf E and resistors, each with resistance R . Calculate the current I through the battery .

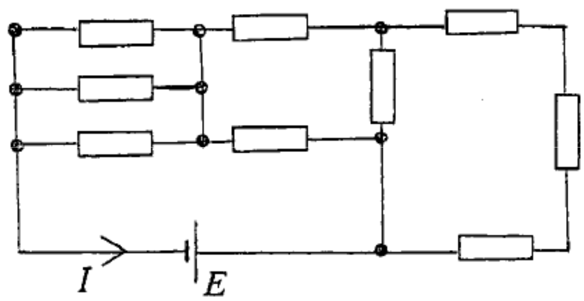


Figure 1.d [5]

(e) The potential difference between the target and the cathode of an X-ray tube is 50.0 kV. The current in the tube is 20.0 mA. Only 1.00% of the total energy is emitted as X-rays.

(i) What is the maximum frequency of the emitted radiation ?
(ii) At what rate must the heat be removed from the target in order to keep it at a constant temperature?

[3]

R1-2008 Q1(j)

(j) In the circuit in Figure 1.j all the resistors have resistance r and the cells have emfs E. Calculate the current, I, flowing through each cell.

[5]

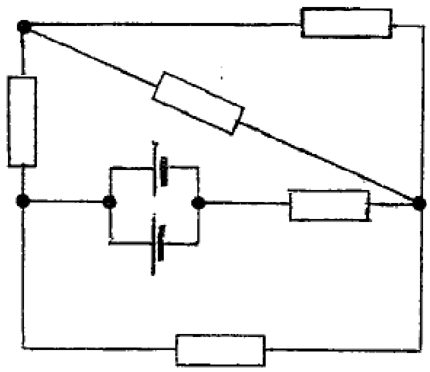


Figure 1.j

R1-2009 Q1(f)

(f) An oil drop is observed between the plates of a capacitor.

(i) In an electric field of 0.30 MVm^{-1} a stationary drop, with one excess electron, is observed. What is the weight of the drop ?

(ii) This drop is later observed to fall with a terminal speed of 0.20 mms^{-1}, which is independent of the pd between the plates. Explain this observation. [4]

R1-2009 Q1(m)

(m) 20 identical electric lamps , each of 12 V, are connected in series to a 240 V mains supply. The total power consumed is 24 W.

(i) What is the resistance of each lamp ?

(ii) If one lamp is short circuited, what is the power consumed ?

(iii) When one of the lamps is tested by applying a pd of 0.10 V, a 10mA current is measured. Explain.

[6]

R1-2010 Q1(e)

(e) A tungsten filament rated at 250 W, 230 V, has a resistance of 20 Ω at 273 K. Its mean temperature coefficient of resistance is $5.0 \times 10^{-3}\ K^{-1}$.
What is its working temperature?

[4]

R1-2010 Q1(i)

(i) A battery, internal resistance r and emf E, drives a current of 3.0 A round a circuit consisting of two 2.0 Ω resistors connected in parallel. When these resistors are connected in series the current is 1.2 A. Calculate:

- (i) the emf of the battery E
- (ii) the internal resistance of the battery r
- (iii) the power dissipated in a resistor in each case, P_p and P_s respectively [4]

R1-2010 Q1(n)

(n) Two identical parallel insulating plates, each of area A and having a charge $+Q$, are separated by a distance x. Sketch the field lines between the plates:

- (i) for the system
- (ii) for a capacitor with identical dimensions having charges Q and -Q
- (iii) Deduce, giving an appropriate explanation, the ratio of the forces between the plates in (i) and (ii).
- (iv) Obtain an expression for the energy, E, of the capacitor using an appropriate expression for its capacitance as a function of x.
- (v) Determine the force between the plates of the capacitor either directly or by comparison with the energy of a physical system with the same dependence on the parameter 'x'.

[7]

R1-2013 Q1(h)

(h) A thundercloud has a horizontal lower surface, area 25.0 km^2, 750 m above the surface of the Earth. Using a capacitor as a model, calculate the electrical energy, E_1, stored when its potential is 1.00 x 10^5 V above the earth potential.

If the cloud rises to 1250 m:

(i) explain why the energy, E_2, has increased or decreased

(ii) What is the change in electrical energy, ΔE?

[10]

R1-2012 Q1(a)

In a circuit the following resistor combination is found.

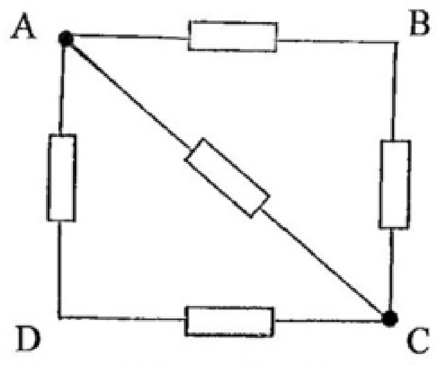


Figure 1.a

All the resistors in Figure 1.a have resistance R ohms.
What is the total resistance across (i) AC and (ii) AB?

[4]

R1-2011 Q1(b) and Q1(c)

b) In *Figure 1.b*, what is the value of the resistor R_3, in terms of the resistances R_1 and R_2, expressed in its simplest form, if the total resistance across AB is equal to R_1 ?

[2]

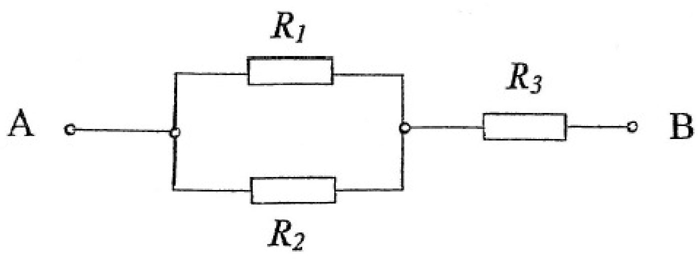


Figure 1.b

c) What is an electric field line? Sketch the field lines due to two charges 3Q and (-Q).

[5]

R1-2011 Q1(j)

j) Two identical plastic balls of mass 5.00 g are charged to +1.00 μC and suspended from a fixed point by massless non-conducting threads, each of length 1.00 m. Verify that the angle between the threads is 41.0^0 .

[7]

R1-2011 Q1(l)

l) A battery consisting of two cells, in series, each of emf E, is used to charge a capacitor, capacitance C.

(i) What is the energy of the charged capacitor?
(ii) How much energy has been lost?
(iii) If the capacitor is charged in two stages, first with one cell and then with two cells, determine the energy lost. Comment on the result.

[8]

R1-2002 Q6

(a) Faraday's law of electromagnetic induction can be expressed as

$$E = \text{ - RATE OF INCREASE OF } (\Phi).$$

Explain the symbols and the significance of the negative sign. [3]

(b) The wing span of a jumbo jet is 80m, its length is 60m and its depth is 8.0m. Estimate the magnitude of the electric potential differences that exist over the surface of the jet when it flies horizontally at 720 kmh^{-1}:

(i) over the North Pole
(ii) northwards over the equator
(iii) eastwards along the equator
(iv) northwards over London

The Earth's magnetic field density is 3×10^{-5} T at the equator, 5×10^{-5} T over London and 6×10^{-5} T at the North Pole. The angle between the horizontal and the Earth's magnetic field at London, the angle of dip, is 66°.

[11]

(c) A copper rod of length L is pivoted at its mid point and rotates about a horizontal axis perpendicular to its length, in a vertical plane, with a constant angular frequency ω . A uniform magnetic field flux density B exists parallel to the axis.

What is the magnitude of the emf developed between:

(i) the centre and one end of the rod ?
(ii) the ends of the rod ?
(iii) the ends of the rod when the pivot is moved to a point a distance x from one end ?

[6]

R1-2004 Q4

a) Figure 4.1

Figure 4.1 shows the solar car that won the 2001 World Solar Challenge race. The maximum speed, using solar power only, was 108 $\mathrm{kmhr^{-1}}$. The electrical power produced by the solar panels, efficiency 25%, was 1.35 kW. The efficiency of the motor was 97%. There was no wind.

(i) Calculate the total resistive force, R, of the car at maximum speed.
(ii) Why was the tyre pressure much greater than that in conventional vehicles?
(iii) Calculate the incident radiant power, P, of the Sun on the panels.
(iv) The car has three wheels. What advantage does this give?

[8]

b) A series circuit consits of an electrical cell, of p d V and negligable resistance, and a simple small d c motor consisting of a rotating coil, resistance r, and permanent magnets. The motor rotates at angular frequency ω when the average current is I.

(i) Explain why I decreases as the motor speeds up.
(ii) Derive the equation relating I and ω, introducing any appropriate constant.

[4]

c)

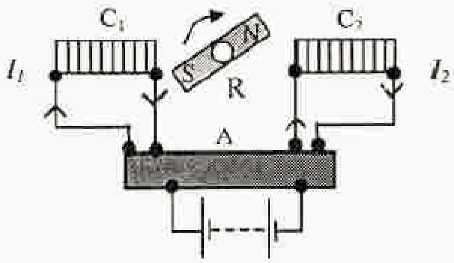


Figure 4.2

Figure 4.2 is a diagram of a brushless d c motor used to propel the solar car. The electrical cells are connected to a "black box" A, which supplies currents I_1 and I_2 to the coils. The rotor R is a magnet connected to the wheels.

(i) What is the purpose of A?
(ii) Sketch, on the same graph, the currents in the coils C_1 and C_2 as a function of time t.

[4]

(d) Why do solar cells overheat if the car is stationary and the batteries are not charging?

[4]

R1-2004 Q6

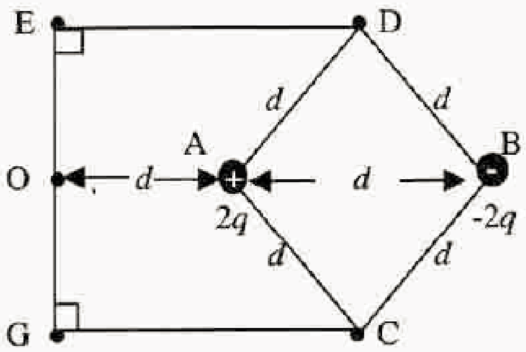


Figure 6.1

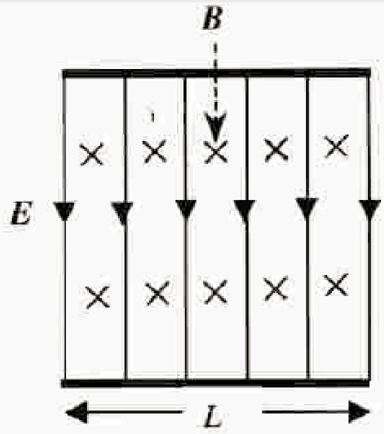


Figure 6.2

a) The charges $2q$ and $-2q$ are separated by a distance d and located at points A and B, Figure 6.1. d = AB = AD = DB = AO = AC = CB, where O is the mid-point of GE.

Determine:

(i) the vector forces $\boldsymbol{F}_c$ at C and $\boldsymbol{F}_o$ at O on a unit positive charge
(ii) the potential V_c at C and V_o at O
(iii) the work done in taking the charge $2q$ along the path ACGOED to D.

[10]

b) Figure 6.2 shows the plates, length L, of a CRO with a constant electric field $\boldsymbol{E}$ and a constant magnetic field of flux density $\boldsymbol{B}$ parallel to the plates and perpendicular to $\boldsymbol{E}$. A charge q, mass m, travelling horizontally with velocity v enters the region between the plates.

(i) If **B** = 0, show that on emerging it will be deflected vertically by a distance y_1 given by

$$y_1 = \frac{qEL^2}{2mv^2} .$$

(ii) If $\boldsymbol{E}$ = 0 and $\boldsymbol{B}$ is finite, show that the charge will emerge with a vertical deflection, y_2, in the opposite direction to y_1, given by

$$y_2 = R - \sqrt{R^2 - L^2}, \qquad \text{where } R = \frac{mv}{Bq} .$$

(iii) Show that if, during the motion through the plates, the fields are adjusted so that the forces on q balance,

$$\frac{q}{m} = \frac{2y_1 E}{B^2 L^2} .$$

[10]

R1-2005 Q5

a) Two identical insulating spheres, A and B radius a, have uniform charge density, each with a total negative charge $-Q$. Their centres are $6a$ apart. The origin of coordinates, O, is midway between the centres. The x – axis is along the line of centres.

(i) What is the electrostatic potential, V, at O?

(ii) At what points along the x – axis is the potential equal to that at O?

(iii) Sketch the electrostatic equipotential curve of magnitude V in the $x-y$ plane and show the spheres on your diagram. [7]

b) (i) Indicate, in a diagram, the point/s on the surface of B with the highest potential, V_H, and calculate its value.

(ii) What is the lowest potential "barrier", V_L, that has to be surmounted by a positively charged particle launched from B in order to reach A ?

(iii) What is the minimum speed with which a positive gas ion, mass m, and positive charge q, emitted from the surface of B, can be captured by A?

[8]

c) Calculate the force acting on a particle with charge q, mass m, on the y – axis.

[5]

R1-2005 Q9

a)

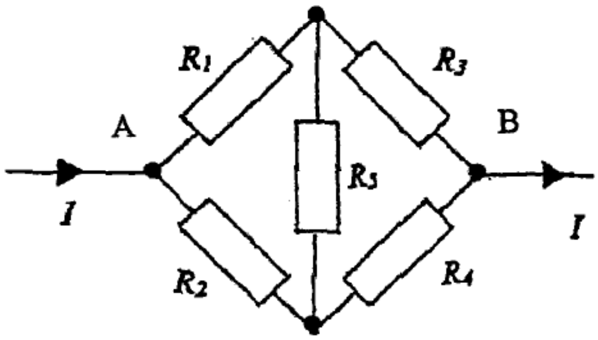


Figure 9.1

The circuit in Figure 9.1 consists of five resistors, with resistances R_1, R_2, R_3, R_4 and R_5. The current I enters at A. By choosing appropriate values of R_2 and R_3, in the range zero to infinity, reduce the circuit to the following, indicating the values of R_2 and R_3 and giving a circuit diagram:

(i) three resistors in series

(ii) three resistors in parallel with each other

(iii) two equal resistors in parallel [8]

b) For each network in (a) calculate:

(1) The total resistance across AB

(2) The power dissipated in R_5 [6]

c)

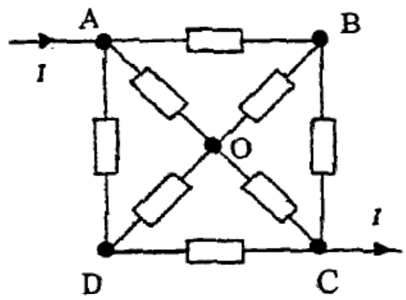


Figure 9.2

The network in Figure 9.2 consists of eight resistors each with resistance r.

(i) Explain why B and D are at the same potential.
(ii) Determine the total resistance between A and C. [6]

R1-2006 Q3

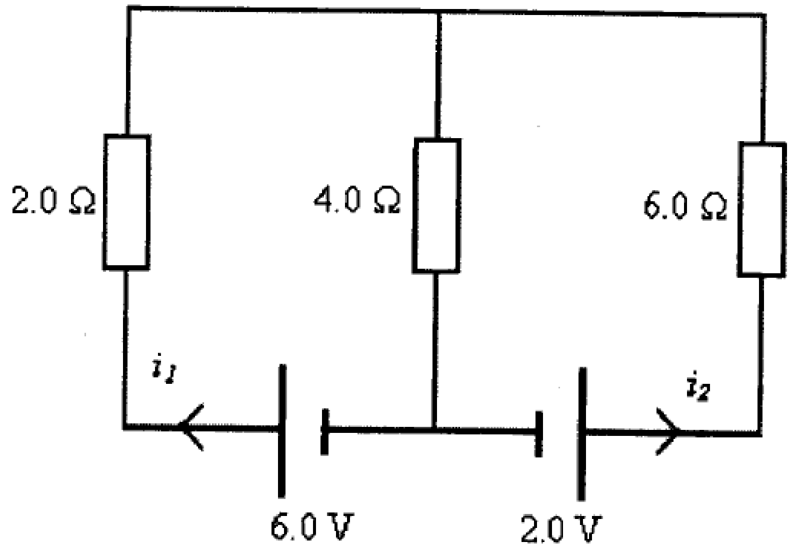


Figure 3.1

(a) In the circuit, Figure 3.1, calculate the currents when a conductor replaces:

(i) the 6.0 V source; i_{16} and i_{26} replacing i_1 and i_2
(ii) the 2.0 V source; i_{12} and i_{22} replacing i_1 and i_2

[4]

(b) It can be shown that the currents in Figure 3.1 are given by $i_1 = i_{16} + i_{12}$ *and* $i_2 = i_{26} + i_{22}$.

(i) Determine, using this result, i_1 and i_2.
(ii) Deduce the current through the 4.0 Ω resistor.
(iii) Verify that i_1 and i_2 satisfy Kirchoff's equations for the circuit.

[7]

(c)

(i) Calculate the power dissipated in the 4.0 Ω resistor.
(ii) Determine the rate of energy conversion for the 6.0 V cell.

[3]

(d)

(i) What modifications, if any, are required to the solutions to (b)(i), if the batteries are replaced by a.c. sources with, respectively, amplitudes of 6.0 V and 2.0 V and a common phase and angular frequency ω?
(ii) Comment on the case in which the a.c. sources of voltage in (i) differ in phase by π.

[6]

R1-2007 Q2

Q2 The circuit in Figure 2.1 has currents i_1 to i_{12} in the arms indicated due to a potential difference V across AB. Each arm has a resistor of resistance R.

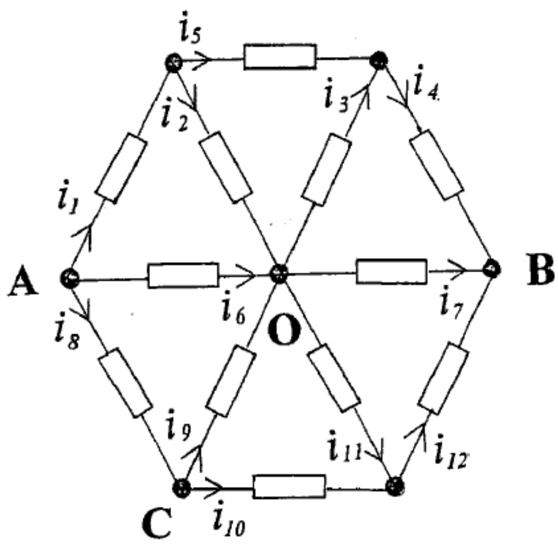


Figure 2.1

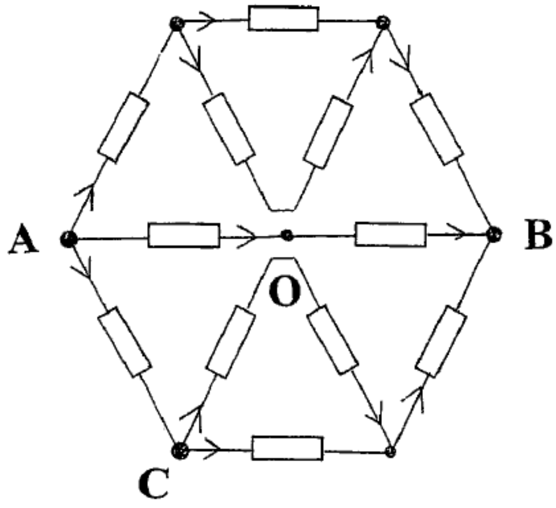


Figure 2.2

(a) (i) From the symmetry of the circuit, deduce the relationships between the currents in the lower arms and those in the upper arms.

(ii) If V is reversed, what can be deduced , using symmetry, about :

(x) the directions of the currents ?
(xi) the magnitudes of the currents ?

(iii) How do the currents in the arms change if the connections at O are altered in the way indicated in Figure 2.2 ?

(iv) Deduce the resistance, R_{AB} , across AB.

[10]

(b) Using the methods applied in (a)(ii) and (a)(iii), determine the resistance across AC when V is applied across AC.

[10]

R1-2007 Q5

(a) Two uncharged capacitors, C_1 and C_2, with capacitances C_1 and C_2, are connected in series with a battery and a switch S. When the switch is closed there is a charge Q_1 on C_1 and Q_2 on C_2.

(i) What is the relation between Q_1 and Q_2?
(ii) Give an expression for the potential difference across each capacitor.
(iii) Derive an expression for the capacitance, C, of a single capacitor equivalent to C_1 in series with C_2.
(iv) Calculate the total energy stored in the capacitors.

[7]

(b) An a.c. source of voltage V and frequency f is in series with a diode and a resistor, resistance R.

(i) Sketch a graph of the p.d., V_R, across the resistor as a function of time t.

(ii) Capacitors can be used to 'smooth' rectified a.c. voltages. A capacitor, capacitance C, is connected in parallel with the resistor, Figure 5.1. Explain, with a graph, how the modified p.d., V_R, varies with t.

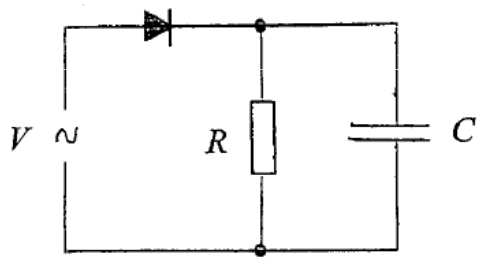


Figure 5.1

(iii) If the input voltage has a peak value of 10.000 V, f = 100.000 Hz, C = 400.000 μF and R = 100.000 Ω, calculate the time t_S for the p.d. across R to fall to its smallest value of 7.99049 V.

(iv) Verify that, to four significant figures, the input voltage also has this value at this time.

(v) The voltage across R can be approximated by the sum of a d.c. component, V_d, and an a.c. component with amplitude V_a and frequency f_a. Estimate the values of V_d, V_a, and f_a.

[13]

R1-2008 Q2

Six resistors with resistances, in ohms, of r_1, r_2, r_3, r_4, r_5, and r_6 are connected as indicated in Figure 2.1.

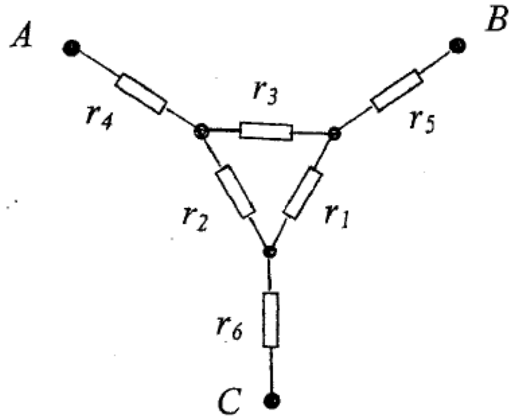


Figure 2.1

(a) If all the resistances have the value r determine the resistance:

(i) R_1 across AB
(ii) R_2 across AB when r_2 is short circuited
(iii) R_3 across AB when AC is short circuited [5]

(b) The resistors in Figure 2.1 have resistances, of 1,2,3,4,5 and 6 ohms, with no two resistors having the same value. Initially all resistors are unspecified.

(i) Obtain an algebraic expression for the resistance, R_{AB}, across AB. Express it as a rational fraction i.e. in terms of an algebraic numerator and denominator.
(ii) If $13R_{AB} = 94$, deduce the value of $(r_1 + r_2 + r_3)$.
(iii) Show that R_{AB} can be expressed as

$$R_{AB} = n_1 + n_2 + p,$$

where $p = n_3\,(13 - n_3)\,/13$

and n_1, n_2, and n_3 are integers.

(iv) Evaluate p for all six possible values of n_3 and deduce the value of r_3. Similarly deduce the values of r_2 and r_1 if $13R_{AC} = 87$ and $13R_{BC} = 131$.
(v) Determine the possible values of n_1 and n_2, hence r_4 and r_5, for R_{AB}.
(vi) Similarly obtain the possible values of n_1 and n_2 for R_{AC} and R_{BC}. and deduce the values of r_4, r_5, and r_6. [15]

R1-2009 Q7

(a)

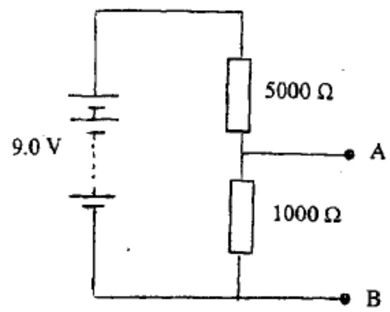


Figure 6.a

What is the final potential difference between A and B:

(i) in Figure 6.a ? What applications does this circuit have ?
(ii) if, in addition, a 500 ohm resistor is connected from A to B ?
(iii) if the 500 ohm resistor in (ii) were replaced by a 2.0 μF capacitor ?

[5]

(b)

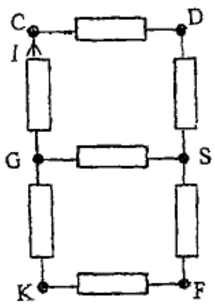


Figure7.b1

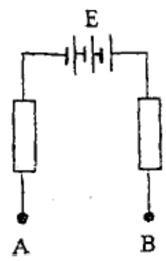


Figure 7.b2

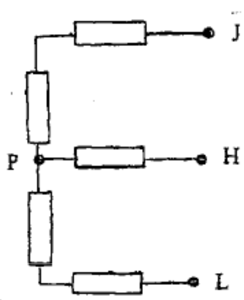


Figure 7.b3

The above electrical configurations all have resistors with resistance R. In Figure 7.b2 the batteries have total emf E. Determine the current I in Figure 7.b1 between G and C if :

(i) A, Figure 7.b2, is joined to C, Figure 7.b1, and B is joined to D
(ii) A is joined to C and B to K
(iii) in (ii) C is joined to J, Figure 7.b3, H to G and L to K
To simplify this calculation it may be helpful to consider the symmetry and compare the potentials at P and S .

[15]

R1-2010 Q5

(a) Two capacitors, of capacitance 2.0 μF and 4.0 μF, are each given a charge of 120 μC. The positive plates are now connected together, as are the negative plates. Calculate:

(i) the new potential difference between the plates of the capacitors
(ii) the change in energy. Explain this energy change. [6]

(b)

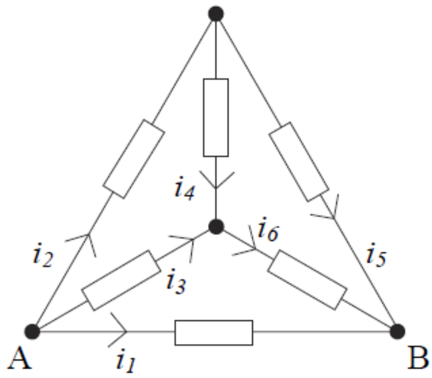


Figure 5.b

All the resistors in the circuit in Figure 5.b have resistance R. The potential difference across AB is V and the currents in the arms are $i_1, i_2, \ldots i_6$, as indicated.

(i) How are the currents altered if V is reversed? Give the relations between the currents by comparing the circuits in the two situations; V and $-V$.
(ii) Deduce the currents in terms of V and R.
(iii) Determine the resistance across AB. [7]

(c)

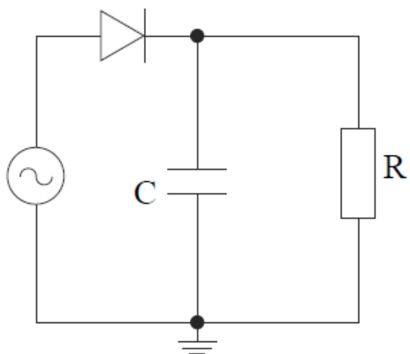


Figure 5.c

The circuit in Figure 5.c has a capacitor C, with capacitance 50 μF, a diode and a resistor R, resistance R. It is used to rectify an a.c. supply of frequency 50 Hz and peak to peak voltage of 20 V. R can have the values of 10 kΩ or 100 Ω. In each case:

(i) determine the time constant for the circuit
(ii) sketch the voltage waveforms across R

If the a.c. supply is replaced by a square wave supply of the same frequency and amplitude, determine the greatest fractional change in the voltage across R for the circuit with the 10 kΩ resistor.

[7]

R1-2011 Q2

a) In the circuit below, determine the potential difference V_{AB} between A and B in *Figure 2.a.*

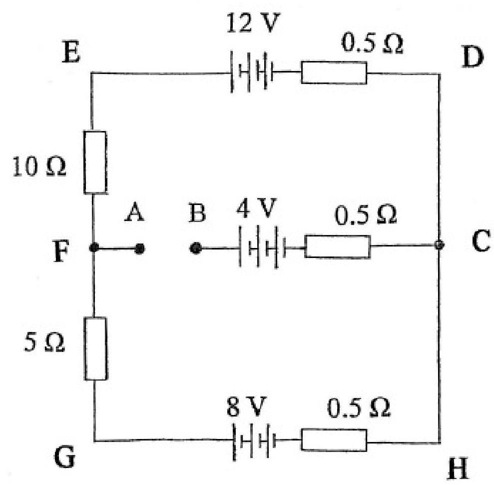


Figure 2.a

[6]

b) The network in *Figure 2.b* consists of eight 3.00 Ω resistors. The currents , $i_1, \ldots i_8$, in the arms of the circuit are indicated. A and B are connected to a voltage source.

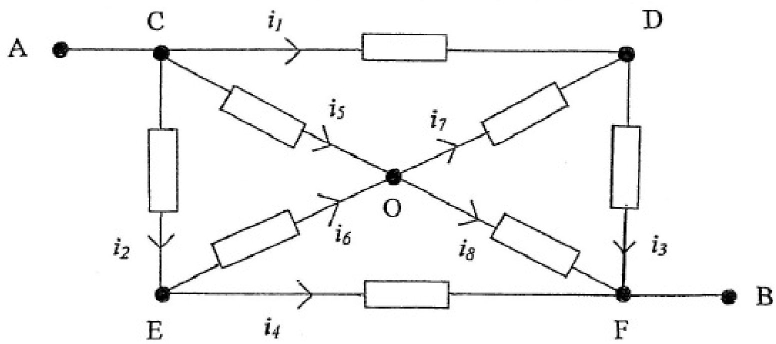


Figure 2.b

Determine:

(i) Using symmetry, the relations between currents.
(ii) By reversing the pd across AB, further relations between the currents.
(iii)Which points in the circuit are at the same potential.
(iv)The resistance, R_{AB}, between AB.
(v) What can be deduced about the potential at O?

[14]

R1-2012 Q2

(a) In Figure 2.a a battery of emf 12.6 V and internal resistance 0.10 ohms is being charged from a solar panel of emf 24.0 V and internal resistance 1.00 ohms. V_1 and V_2 are voltmeters, that give the value and sign of the voltage, and R is a fixed resistor.

(i) If the charging current is 5.00 A, determine the value of R.
(ii) If R is changed to 0.90 ohms, what would be the readings on the voltmeters?

[5]

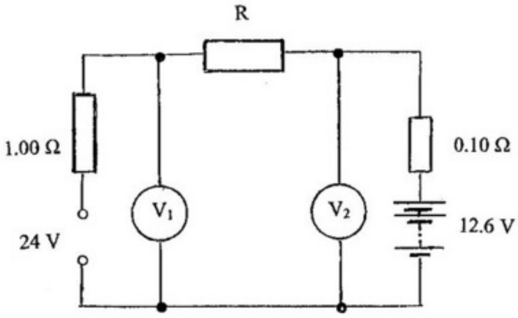


Figure 2.a

(b) In the circuit in Figure 2.b, determine the resistance R_1 if there is no current flowing through E_2.

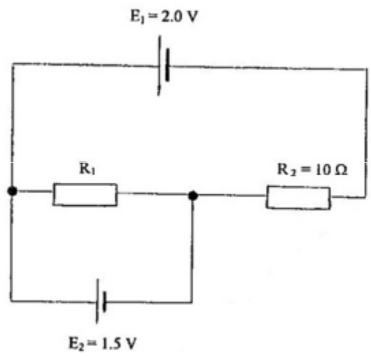


Figure 2.b

(c) In Figure 2.c all resistors have resistance R. If a pd V is applied across AB:

(i) Explain why the potentials at C and D are equal.
(ii) What is the outcome of joining C and D by a conducting wire?
(iii) Keeping C and D connected, draw a simplified circuit by combining those resistors which are in parallel.
(iv) What is the pd across CO?
(v) Determine the resistance across AB, R_{AB}.

[7]

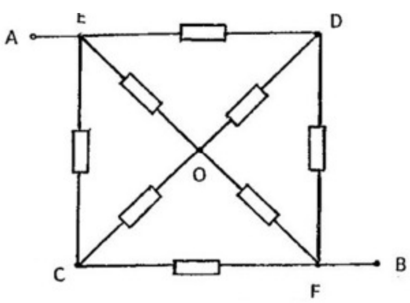


Figure 2.c

(d) Determine the resistance across AO, R_{AO}, in Figure 2.c. [5]

R1-2012 Q9

The charge distribution along a complex molecule can be simplified to the following arrangement of charges.

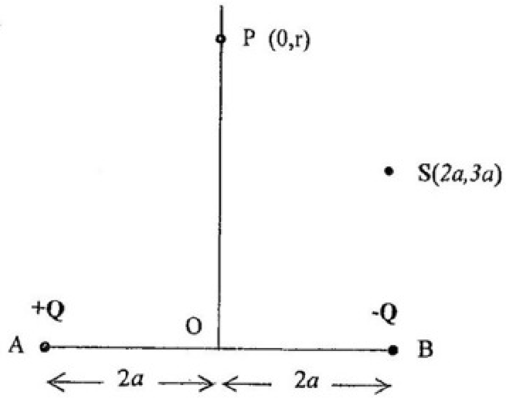


Figure 9.a

Two charges of magnitude, +Q and –Q, are separated by a distance 4a, and located at A and B respectively. O is the mid-point of AB, Figure 9.a.

(a) Determine the potential V_1 and field strength $\mathbf{E}_1$ along the perpendicular bisector of AB through O, at a point P a distance r from O.

[5]

(b) Determine the potential, $V_{2,}$ and the field strength, $\mathbf{E}_{2,}$ at the point S with coordinates (2a, 3a).

[10]

(c) A circular wire, radius 3a, centre C, has a charge +Q uniformly distributed around it. An insulating rod of length 4a and mass m is initially at rest and situated along the axis of the circle. It has a point charge of +Q at one end and –Q at the other end, -Q being 4a from C and +Q being 8a from C. Determine the velocity of the of the charges when –Q reaches C.

[5]

R1-2013 Q2

(a) The circuit in Figure 2.a consists of a DC voltage *E*, a 1.0 ohm load , a 12 V battery with a 0.40 ohm and a 0.20 ohm resistor.

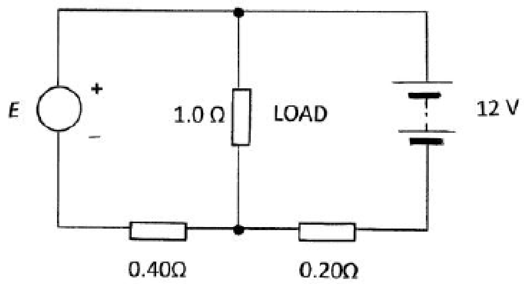


Figure 2.a

(i) At what value of *E* does the battery begin to charge?

(ii) What fraction of the power is delivered to the load by the voltage supply E when the charging current is zero?

(iii) What is the current through the battery when E = 20 V?

[8]

(b) In the circuit in Figure 2.b, with the specified resistors and currents, i_1,... i_6 , and with a pd of *V* across AB:

(i) Determine relations between the currents by reversing V and using symmetry considerations, or otherwise.

(ii) Deduce the total resistance across AB.

(iii) Determine the magnitudes of the currents in terms of V.

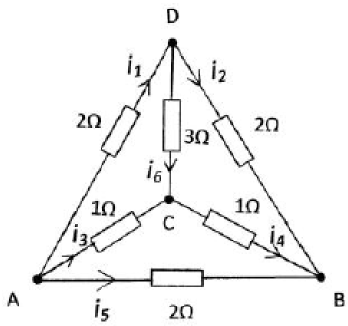


Figure 2.b

(iv) If the voltage is now applied across CD determine, by redrawing the circuit in a similar form to Figure 2.b, with CD as the base, the resistance across CD.

(v) Redraw the circuit with AC as the base. Explain why the resistance across AC cannot be calculated in terms of resistances in series and/or parallel.

[12]

R1-2013 Q4

(a) An oil drop of mass 3.3×10^{-15} kg falls vertically, with uniform velocity, through the air between two vertical parallel plates with zero potential difference that are 3.0 cm apart. Explain this motion.

[2]

(b) When a potential difference of 2.0×10^{3} V is applied between the plates, the drop is observed to move with uniform velocity at an angle of 45° to the vertical. Explain this result, with a diagram, indicating the forces acting on the drop, and calculate the charge on the drop.

[5]

(c) The path of the drop suddenly changes, becoming inclined at 18.43° to the vertical. Subsequently the path changes again and is inclined at 33.70° to the vertical. Explain these results.

Deduce from these observations the best estimate of the elementary unit of charge.

[6]

(d) The plates are now arranged horizontally, 12 mm apart, with no potential difference. A drop of oil, mass 10^{-14} kg, is observed to fall vertically with constant velocity of 4.0×10^{-4} ms^{-1}. When a pd of 1.5 kV is applied to the plates the drop rises vertically with a velocity of 8.0×10^{-5} ms^{-1}. How many electrons are present in the drop?

[7]

The drop experiences air resistance proportional to its velocity