1 **(a)** State an example of the conversion of chemical energy to another form of energy.

example .....

energy conversion ..... [1]

(b) The electrical output of a solar panel powers a pump. The pump operates a water fountain. The output of the solar panel is 17 V and the current supplied to the pump is 0.27 A.

(i) Calculate the electrical power generated by the solar panel.

power = ... [2]

(ii) The pump converts electrical energy to kinetic energy of water with an efficiency of 35%.

Calculate the kinetic energy of the water delivered by the pump in 1 second.

kinetic energy = ... [2]

(iii) The pump propels 0.00014 m^3 of water per second. This water rises vertically as a jet. The density of water is 1000 kg/m^3.

Calculate

1. the mass of water propelled by the pump in 1 second,

mass = ... [2]

2. the maximum height of the jet of water.

maximum height = ... [2]

[Total: 9]

2 40 lamps, each of resistance 8.0 Ω, are connected in series to a 240 V supply in order to decorate a tree.

(a) Calculate

(i) the current in each lamp,

current = ... [2]

(ii) the power dissipated in each lamp.

power = ... [2]

(b) The lamps are designed to "fail-short". If a filament fails, the lamp shorts so that it has no resistance. The other lamps continue to light and the current increases.

The lamps are connected through a fuse that blows when the current rises above 0.9 A. At this current, the resistance of each lamp is 5% greater than its normal working resistance.

Calculate the maximum number of lamps that can fail before the fuse blows.

number of lamps = ... [4]

[Total: 8]

3 **(a)** In Fig. 8.1, a magnet is moving towards one end of a solenoid connected to a sensitive centre-zero meter. During this movement a current is induced in the solenoid.

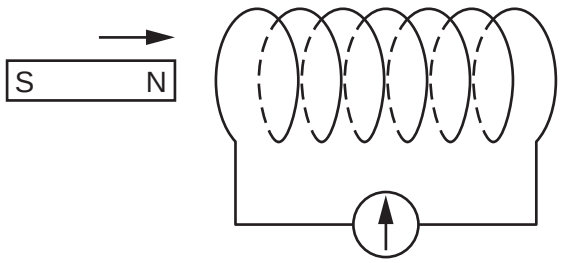

Fig. 8.1

Suggest **three** possible changes to the system in Fig. 8.1 that would increase the induced current.

1. .....

2. .....

3. .....[3]

(b) Fig. 8.2 shows a transformer. P is the primary coil. S is the secondary coil. The coils are wound on an iron core.

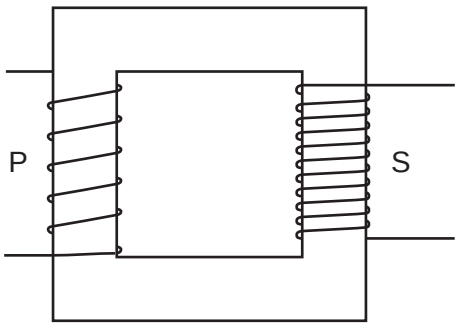

Fig. 8.2

P has 200 turns and S has 800 turns. The e.m.f. induced across S is 24 V. The current in S is 0.50 A. The transformer operates with 100% efficiency.

Calculate

(i) the voltage of the supply to P,

voltage = ...[2]

(ii) the current in P.

current = ...[2]

[Total: 7]

4 The circuit shown in Fig. 10.1 uses a 12V battery.

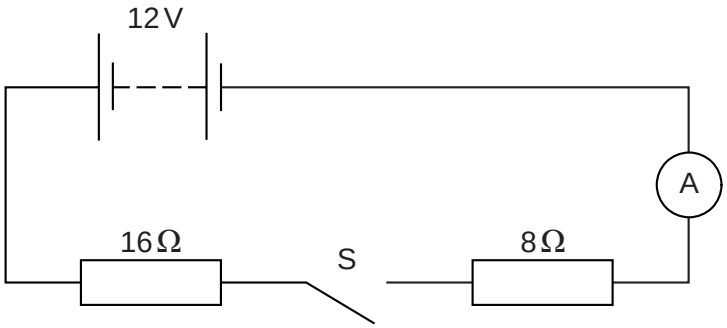

Fig. 10.1

(a) Switch S is open, as shown in Fig. 10.1.

State the value of

(i) the reading on the ammeter,

reading = ... [1]

(ii) the potential difference (p.d.) across S.

p.d. = ... [1]

(b) Switch S is now closed.

(i) Calculate the current in the ammeter.

current = ... [2]

(ii) Calculate the p.d. across the 8Ω resistor.

p.d. = ... [2]

(c) The two resistors are now connected in parallel.

Calculate the new reading on the ammeter when S is closed, stating clearly any equations that you use.

reading = ... [4]

[Total: 10]

1 Fig. 8.1 is the plan of a small apartment that has four lamps as shown.

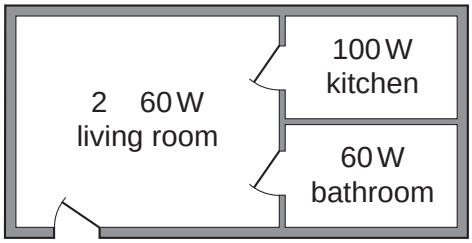

Fig. 8.1

Power for the lamps is supplied at 200 V a.c. and the lamps are all in parallel.

(a) In the space below, draw a lighting circuit diagram so that there is one switch for each room and one master switch that will turn off all the lamps. Label the lamps as 60 W or 100 W.

[3]

(b) The 100 W lamp is switched on. Calculate

(i) the current in the lamp,

current = ... [2]

(ii) the charge passing through the lamp in one minute.

charge = ... [2]

(c) The three 60W lamps are replaced by three energy-saving ones, that give the same light output but are rated at only 15W each.

Calculate

(i) the total reduction in power,

reduction in power = ... [1]

(ii) the energy saved when the lamps are lit for one hour.

energy saved = ... [2]

[Total: 10]

2 Fig. 8.1 shows a car battery being charged from a 200 V a.c. mains supply.

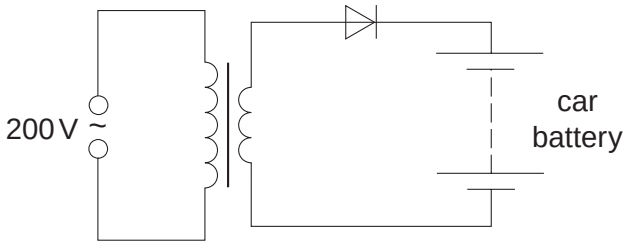

Fig. 8.1

(a) State the function of the diode.

.....

..... [1]

(b) The average charging current is 2.0 A and the battery takes 12 hours to charge fully.

Calculate the charge that the battery stores when fully charged.

charge stored ..... [2]

(c) The battery has an electromotive force (e.m.f.) of 12 V and, when connected to a circuit, supplies energy to the circuit components.

State what is meant by an ***electromotive force of 12 V***.

.....

.....

..... [2]

(d) **(i)** In the space below, draw a circuit diagram to show how two 6.0V lamps should be connected to a 12V battery so that both lamps glow with normal brightness. [1]

(ii) The power of each lamp is 8.0W. Calculate the current in the circuit.

current = ... [2]

(iii) Calculate the energy used by the two lamps when both are lit for one hour.

energy = ... [2]

[Total: 10]

3 Fig. 8.1 shows a low-voltage lighting circuit.

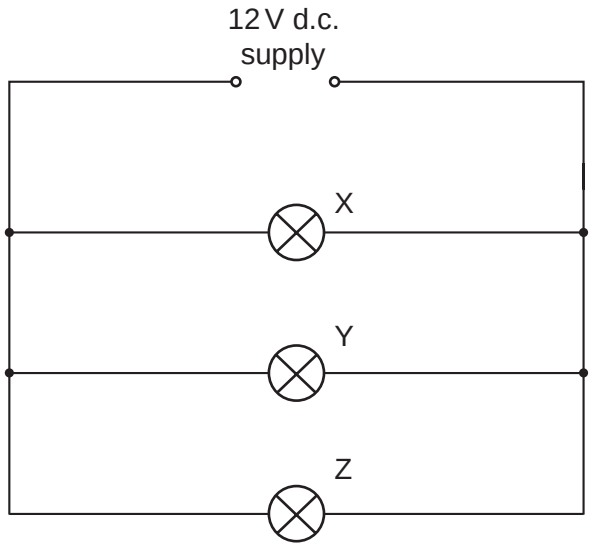

Fig. 8.1

(a) On Fig. 8.1, indicate with a dot and the letter S, a point in the circuit where a switch could be placed that would turn off lamps Y and Z at the same time but would leave lamp X still lit. [1]

(b) **(i)** In the space below, draw the circuit symbol for a component that would vary the brightness of lamp X.

(ii) On Fig. 8.1, mark with a dot and the letter R where this component should be placed.

[2]

(c) Calculate the current in lamp Y.

current = ...[2]

(d) The current in lamp Z is 3.0 A. Calculate the resistance of this lamp.

resistance = ...[2]

(e) The lamp Y is removed.

(i) Why do lamps X and Z still work normally?

.....

.....

(ii) The current in lamp X is 1.0 A. Calculate the current supplied by the battery with lamp Y removed.

current = ...
[2]