Section D: Energy Resources and Energy Transfer
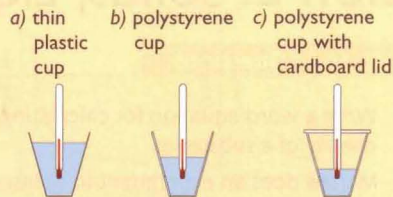
1 *a)* State the law of conservation of energy. *[2]*

b) 1 litre of petrol will produce approximately 30 million joules of energy when burnt.

(i) If it is used to power a small electric generator which is 60% efficient how much useful energy is produced? *[2]*

(ii) State two unwanted energy conversions which take place. *[2]*

(iii) Draw a Sankey diagram to represent this energy conversion process. *[3]*

c) The electrical output of the generator is used to run a refrigerator that has a power rating of 250 W. Calculate how long it can run on the generator output from 1 litre of petrol. *[3]*

2 *a)* Complete the following sentences about heat transfer:

Thermal _____ is the transfer of _____ _____ through a substance without the substance itself _____. Heat energy is transferred in fluids by _____; as the fluid is heated it expands and become less _____ and the warmer fluid is displaced _____ by colder _____ fluid. Thermal _____ is the transfer of energy in the form of _____ _____; this heat transfer mechanism does not require a _____ medium. *[12]*

b) In an experiment to test the best way of keeping a drink warm, Liam devises three sets of apparatus, shown below:

a) thin plastic cup   b) polystyrene cup   c) polystyrene cup with cardboard lid

He timed how long it took for the contents of each cup to cool down by the same amount.

He had hoped to demostrate that one particular improvement on the basic thin plastic cup would have the best effect on keeping the tea warm, but his results were inconclusive.

Explain what he did wrong with his experiment and describe a fair way of testing the effect of different types of insulation. *[6]*

3 A weight lifter lifts a barbell of mass of 50 kg from chest height to above his head (a distance of 75 cm) 15 times in 1 minute.

a) Calculate the weight of the barbell. *[1]*

b) Calculate the work done in lifting the barbell once. *[3]*

c) Calculate the power developed by the weightlifter in this set of 15 lifts. *[3]*

4 A hydroelectric power station uses surplus energy produced at certain periods of the day to pump river water from a pumping station in the valley back to a reservoir in the mountains. The reservoir is 600 m above the pumping station. During one pumping session 10000 litres of water are pumped up to the reservoir. [Take the mass of 1 litre of water as 1 kg.]

a) State the energy conversions that take place in this process. *[4]*

b) Calculate how much energy is given to the water in the pumping session. *[3]*

c) Explain why the process of moving water in this way cannot be 100% efficient. (Hint: think about the energy conversions.) *[3]*

d) Given that both the processes of pumping the water up to the mountain and then, at some later time, converting the energy back into electricity are less than 100%, explain why is this done. *[2]*

5 Electricity can be generated in different ways. Name an example of:

a) A fossil fuel that is used to generate electricity.

b) A renewable energy source that is used to generate electricity.

c) An energy source that cannot deal with a steady demand for electricity.

d) An energy source that can only be utilised in cetain places. *[4]*

6 Scotland is an ideal place for the generation of hydroelectricity.

a) Give two reasons why this is so. *[2]*

b) Scotland is a long way from major industrial centres in England. Give a reason why this is a drawback for the generation of hydroelectricity. *[2]*

c) Explain why the first nuclear power plant was constucted in the far north of Scotland. *[2]*