**Name: _____ Class: _____**

**Targets:**

**Pages _____ by _____**
**Pages _____ by _____**
**Pages _____ by _____**
**Pages _____ by _____**
**Pages _____ by _____**
**Pages _____ by _____**

**Study Tips -** The following summary covers the knowledge and understanding part of the Power Stations unit. You need to know this material thoroughly - you will be tested on it in the Prelim and Final SQA Exam and this material is your basic starting point for tackling problem solving questions.

**Notes -** In order to study effectively, it is best to **make your own notes** in some form that allows for self-testing.

**How? – Use a Note-taking System**
Your objective is to capture on paper the **main facts** and **ideas** so that you can study them thoroughly. Divide an A4 page into a narrow (5 cm) left hand "recall" column and a wide right hand "notes" column. You may also want to leave a margin at the bottom of the page where you can write a one or two sentence summary of all the information contained on that page. The wide column on the right is where you write the notes. Don't crowd them - leave plenty of white space. After completing your notes, read them over and make sure you clearly understand each fact and idea, then, in the narrow column on the left, write a brief, meaningful question (or note down key terms, concepts or formulae).
An alternative is to use a spider diagram (or "Mind Map") as notes or to use "flash cards" with questions on one side and answers and examples on the other. Flash cards are very portable so they are especially useful for testing yourself during spare moments on a bus etc.

It is important to use a method that gets **you** to ask **questions**. The process of asking questions helps you focus on the essential material and helps you understand things more clearly.

**How do I remember it all? -** Recitation is the most powerful method known for embedding facts and ideas into your memory.
E.g. if you have written notes as suggested:
Cover the notes in the wide column exposing only the questions in the narrow column. Recite the answers in your own words. Recite over and over again until you get the right answer

**What else can I do? - Practice!**
A critical component of physics is solving problems. Work at as many problems as possible, especially exam style questions. **Attempt all the questions in this booklet.**

**Section1 Supply and Demand.**

**Sources of Energy:**
There are many sources of energy. Our main source of energy is from **fossil** fuels (coal, oil and gas). Reserves of fossil fuels are **finite**. This means that they will eventually run out. They are **non-renewable**. Other sources will never run out (e.g. solar; water; geothermal; wind; plants). These are called **renewable** sources.
Renewable sources have the advantage of being free and clean but often have the disadvantage of being difficult to convert large amounts to useful forms.
**Conserving energy** is important. A way to conserve energy in:
**industry**: use fans to circulate heat which rises in buildings with high ceilings;
**homes**: improve insulation e.g. loft insulation etc.;
**transport**: encourage car sharing or the greater use of trains and buses rather than cars.

1. List the three fossil fuels ?

2. Why are fossil fuels so called ?

3. State three ways a household could conserve energy.

4. What is the equation used to calculate the efficiency of an energy transformation ?

5. What is meant by a renewable energy source ?

6. Give three examples of renewable energy sources.

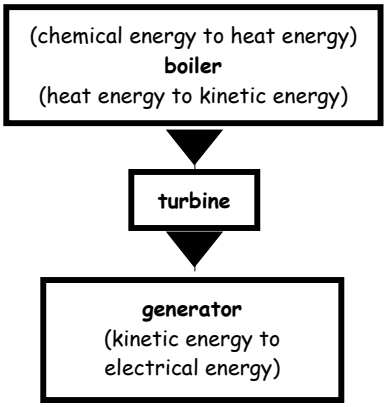
7. Choose one of your answers to question six and explain the advantages and disadvantages associated with using the energy source.

8. Which of the fossil fuels will run out in our lifetime ?

9. State three ways to conserve energy in transport.

10. What is the unit that we use to measure energy ?

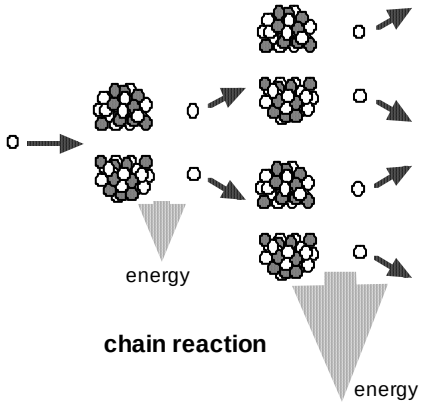
**Section2 Generation of Electricity.**




The flow diagram shows the main stages of energy transformation in a **thermal** (gas, oil or coal) **power station.**

All power stations contain a turbine and a generator. However, in hydroelectric stations there is no boiler - potential energy is changed to kinetic energy as stored water flows to the turbine. In a nuclear station, nuclear energy is converted to heat at the reactor.

**Dangerous radio-active waste** is produced by nuclear reactors which has to be stored safely for hundreds of years.




A common **nuclear** fuel is **uranium**. Large amounts of energy can be obtained when the uranium nucleus is split in two. The nucleus can be split if it is hit by a neutron. When the uranium nucleus splits it produces large amounts of energy and more neutrons. Each of these neutrons can then split another uranium nucleus. This will release more energy and more neutrons. This process is called a **chain reaction**.

**Example**: One kg of uranium releases $5 \times 10^6$ MJ of energy. If 200 000 kg of coal releases the same amount of energy, how much energy is released by 1 kg of coal?

**Answer**:
200 000 kg of coal releases $5 \times 10^6$ MJ so 1 kg releases $\frac{5 \times 10^6}{200\,000}$ MJ = 25 MJ

**Pumped hydroelectric** schemes: Night-time electricity from other power stations is used to pump water to the upper reservoir of the hydroelectric scheme. During the following day, the water is allowed to flow down through the turbines to generate electricity at peak demand times.

**Energy and Power Calculations**.
Energy (E) is measured in joules (J). Power (P) is measured in watts (W).

**gravitational potential energy (Ep) = m x g x h**
[m is mass (kg); g is 10 N/kg (on Earth); h is height (metres)].

**Power** = $\frac{\textbf{energy}}{\textbf{time}}$ $P = \frac{E}{t}$ (time is measured in seconds)

Energy is **never destroyed** in an energy transformation but there is always less 'useful' energy after the transformation. Some of the original energy is 'lost' as heat. Energy is **degraded** in energy transformations.

$$\textbf{Efficiency} = \frac{\textbf{useful energy output}}{\textbf{total energy input}} \times 100\ \%$$

**Example**: A large crate of mass 400 kg is lifted by a fork-lift truck to a vertical height of 2 m. If the fork-lift uses energy at the rate of 10 kW and the lifting operation takes 5 seconds, calculate the efficiency of this operation.

**Answer**:

Useful energy **output** = potential energy gained

$E_p = m \times g \times h = 400 \times 10 \times 2 = 8\,000$ J

Total energy **input** = power x time

$E = P \times t$

$= 10\,000 \times 5$

$= 50\,000$ J

$$\textbf{Efficiency} = \frac{\text{useful energy } \textbf{output}}{\text{total energy } \textbf{input}} \times 100\ \%$$

$$= \frac{8\,000}{50\,000} \times 100\% = 16\ \%$$

1. Describe how a pumped storage hydro-electric scheme operates.
2. What is the most common fuel source used in nuclear power stations ?
3. State one major disadvantage of using nuclear power.
4. What is a chain reaction ?
5. With the aid of a block diagram describe how a coal fired power station produces electricity.
6. On your diagram for question 5 mark in the main energy transformations that take place at each stage.
7. A dynamo has a power out put of 20W. How much electrical energy does it generate in 3 seconds ?
8. Why are some power stations called Thermal ?
9. What is the missing term:
   Gravitational potential energy = gravity x height x ……
10. What is the missing word: ……. is a measure of how quickly energy is converted.