# 26 Graphs

## Tuning-in

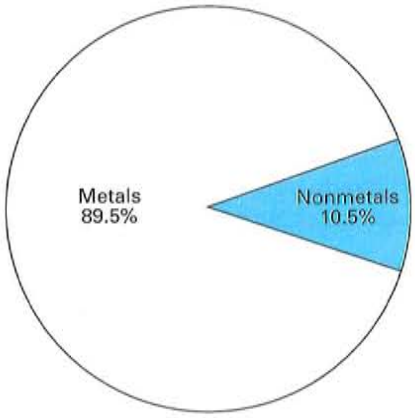
In engineering, graphs and charts are a common way of giving information. They allow a great deal of data to be presented easily in visual form.

**Task 1**

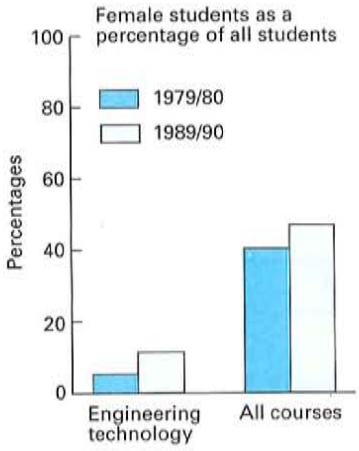
Label the following graphic displays with the correct term from this list:

graph
bar chart
pie chart
bar chart (column chart)

**a**

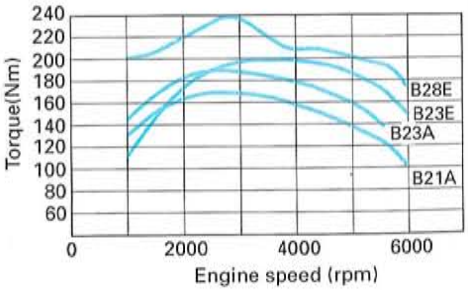



**b**




**c**


**d**




**Task 2**

Study the graph opposite which shows typical daily load curves for a power station. Answer these questions about the graph for weekdays.

1. When is the peak load?
2. When is there least demand?
3. When is the load 65% of capacity?
4. What is the load at 1 p.m.?

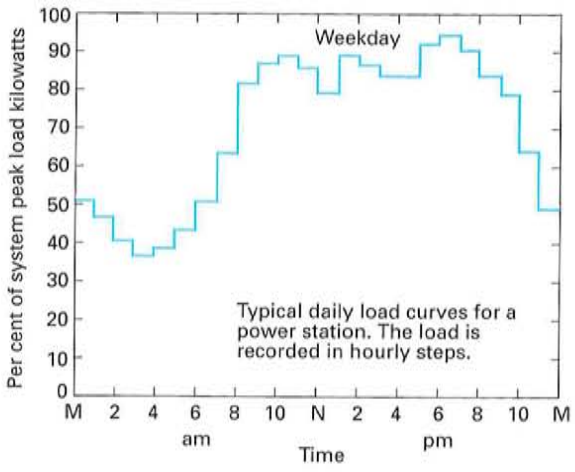



*Fig. 1*

Describe changes in load for these periods:

**5** Between 6 a.m. and 10 a.m.
**6** Between 7 p.m. and midnight.
**7** Between 3 p.m. and 5 p.m.

## Language study *Describing graphs*

Look at the period 6 a.m. to 10 a.m. We can describe the change in load in two ways:

1 *The load rises.*
2 *There is a rise in load.*

We can make our description more accurate like this:

3 *The load rises sharply.*
4 *There is a sharp rise in load.*

Study this table of verbs and related nouns of change. The past form of irregular verbs is given in brackets.

| Direction | Verb | Noun |
|---|---|---|
| Up | climb | |
| | go up (went up) | |
| | increase | increase |
| | rise (rose) | rise |
| Down | decline | decline |
| | decrease | decrease |
| | dip | dip |
| | drop | drop |
| | fall (fell) | fall |
| | go down (went down) | |
| Level | not change | no change |
| | remain constant | |

These adjectives and adverbs are used to describe the rate of change:

| Adjective | Adverb |
|---|---|
| slight | slightly |
| gradual | gradually |
| steady | steadily |
| steep | steeply |
| sharp | sharply |
| sudden | suddenly |
| fast | fast |

**Task 3**

Study this graph which shows the load at weekends.

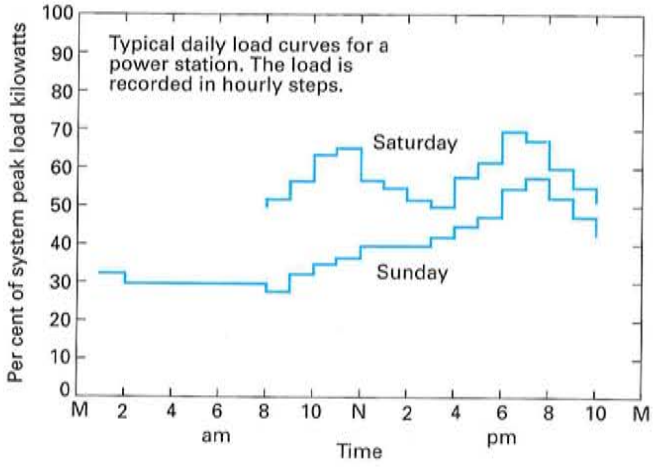



*Fig. 2*

Write sentences to describe the load during these periods.

1 Saturday, 8 a.m. to noon.
2 Saturday, 6 p.m. to 10 p.m.
3 Saturday, noon to 5 p.m.
4 Saturday, noon to 1 p.m.
5 Sunday, 2 a.m. to 8 a.m.
6 Sunday, 8 a.m. to 9 a.m.
7 Sunday, noon to 3 p.m.
8 Sunday, 5 p.m. to 10 p.m.

**Task 4**

Look at Fig. 1 and Fig. 2. Make comparisons of these periods. For example:

Sunday, 4 a.m. to 8 a.m./weekdays at the same time.

*On Sunday the load remains constant between 4 a.m. and 8 a.m. but on weekdays it rises sharply.*

1 Sunday, noon to 3 p.m./Saturday at the same time.
2 Weekdays, 10 p.m. to 11 p.m./Saturday at the same time.
3 Saturday peak load/Sunday peak load.
4 Sunday, noon to 1 p.m./the rest of the week at the same time.

## Word study *Common verbs in engineering*

Study this list of common verbs in engineering which you have studied in this book. They all have the sense of 'make something happen'.

| | |
|---|---|
| lower | make low |
| raise | make high |
| heat | make hot |
| release | make free |
| compress | make smaller volume |
| reduce | make smaller |
| increase | make larger |

**Task 5**

Fill in the blanks in these sentences with suitable verbs from the list above.

1 When thermoplastics are _____, they soften.

2 If a gas is _____, it heats up.

3 Refrigeration preserves food by _____ its temperature.

4 A heater _____ the temperature of the water.

5 The rising piston _____ the fuel mixture.

6 Designers try to _____ the weight of a structure.

7 When the push button is _____, the valve spring pushes up the spool.

8 Pumping fluid into the main cylinder gradually _____ the jack.

9 Aerodynamic design _____ wind resistance.

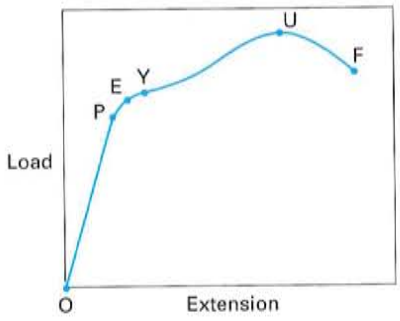
10 The motor starts up slowly, then gradually _____ speed.

11 At intermediate substations, power is _____ to 11 kV for light industry.

12 When the child _____ the handle, the seat swings back under the weight.

## Writing *Describing a graph*

An important mechanical test of a metal is the tensile test to destruction. Increasing loads are applied to a specimen of the metal until it breaks. For a mild steel specimen, a graph of load against extension looks like this:



**Task 6**

The following sentences describe the most important stages of the test. With the help of the graph:

- put the stages in the correct sequence to form a text describing the graph.
- fill in the missing references (O, P, E, Y, U, F)

**a** From _____ to _____ the specimen extends in direct proportion to the load applied.

**b** This rapid extension continues until point _____, the maximum load, is reached.

**c** From _____ there is a rapid increase in length for each increase in load.

**d** At _____ the specimen finally fractures.

**e** After _____ the specimen lengthens further but the load falls.

**f** Soon after P the material reaches its elastic limit, marked on the graph as point _____.

**Task 7**

Add this extra information to your text.

**a** Up to the elastic limit, the steel will regain its original length when the load is removed.
**b** Up to U there is no change in the cross-section of the steel.
**c** After the elastic limit, the steel will not regain its original length.
**d** After U the specimen undergoes 'waisting'.
**e** Y is the yield point.

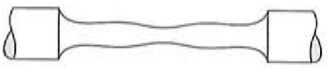
**Task 8**

Refer to each of these figures at an appropriate place in your text. Use expressions such as these:

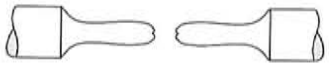
*As shown in Figure A.*
*See Figure A.*
*(Figure A)*

**A**

**B**



**C**

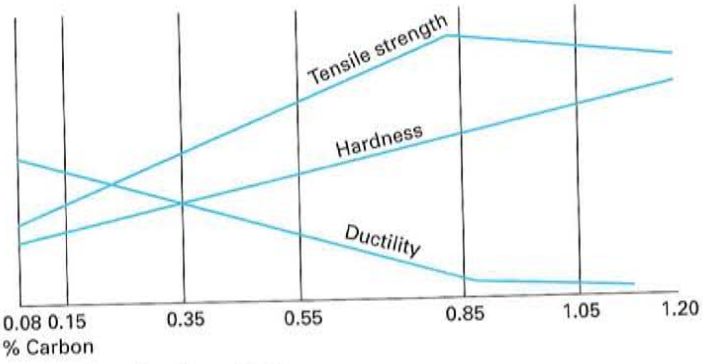


## Technical reading *Properties and applications of carbon steels*

**Task 9**

Study the diagram below which shows how tensile strength, hardness, and ductility vary with the percentage of carbon in carbon steels. Answer these questions:

1 What percentage of carbon gives the greatest tensile strength?
2 What happens to ductility between 0.08% and 0.87% carbon?
3 How does increased carbon affect hardness?
4 What is the effect on tensile strength of increasing carbon beyond 0.84%?
5 What happens to ductility beyond 0.87% carbon?

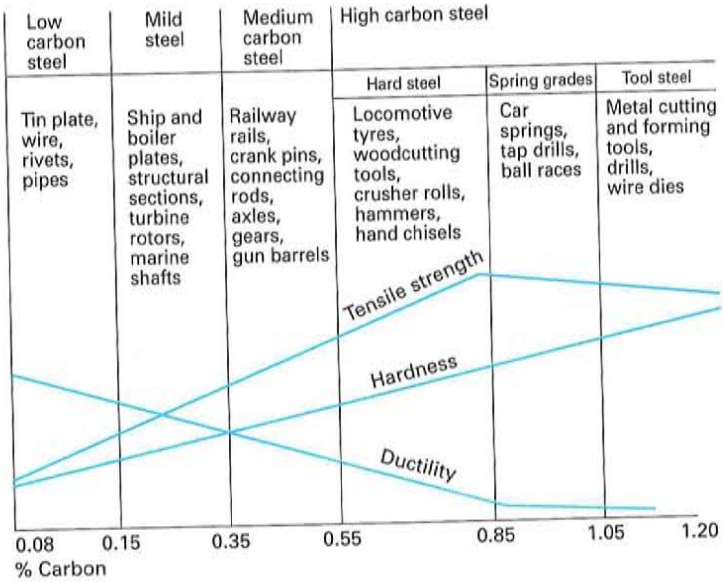



**Properties of carbon steels**

**Task 10**

Now study the diagram below for extra information and answer these questions.

1 What is high carbon steel?
2 How much carbon does tool steel contain?
3 Compare the properties of mild steel and hard steel.
4 What kind of steel is tin plate made from?
5 What kind of steel are car springs made from?




**Properties and applications of carbon steels**