

When engineers design equipment for use in industry they have to take into account running costs, as well as the cost of making a system. Below is some information about two electromagnet pick up systems for use in the waste recycling industry. Read through the information and then answer the questions below.

Handy Grabbit £40 000

The Handy Grabbit is a compact system suitable for a wide range of applications. The maximum load the Grabbit can be used for is 2000 kg. The strength of the electromagnet is controlled by varying the current. The electric power for lifting a range of masses is listed below.

| | | | | |
|--------------------------|------|--------|--------|--------|
| power (kW) | 5000 | 10 000 | 15 000 | 20 000 |
| maximum load (kg) | 800 | 1300 | 1600 | 2000 |

Maxilift £45 000

The Maxilift is a powerful and economical system for moving ferromagnetic materials. The Maxilift electromagnetic system uses a revolutionary cellular core that increases lifting capacity at relatively low electrical powers. The lifting capacities are shown below.

| | | | | | | | | | |
|--------------------------|-----|-----|------|------|------|------|------|------|------|
| power (kW) | 10 | 10 | 10 | 10 | 14 | 19 | 25 | 28 | 30 |
| maximum load (kg) | 100 | 500 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 |

- Which system can lift the largest load? [Level 4]
- Draw a graph that shows the loads and power for both systems. The load should be shown on the *x*-axis, and the power required to lift the load on the *y*-axis. [Level 5]
- Describe the difference in the shape of each graph.
- Explain which system you would choose as the most economical for moving small loads. [Level 5]
- Explain which system you would choose as the most economical for moving larger loads. [Level 5]
- Produce a short comparison for the readers of *Recyclers' Monthly* magazine, explaining the merits and drawbacks of the two systems. [Level 6]
- If electricity costs 10 p per unit (this is the price per kilowatt hour) produce a cost comparison for running each system under the following conditions: [Level 7]
 - 10 hours per day lifting average loads of 1000 kg, 5 days a week, 50 weeks a year, for 5 years
 - 10 hours per day lifting average loads of 2000kg, 5 days a week, 50 weeks a year, for 5 years