مناهج عربية

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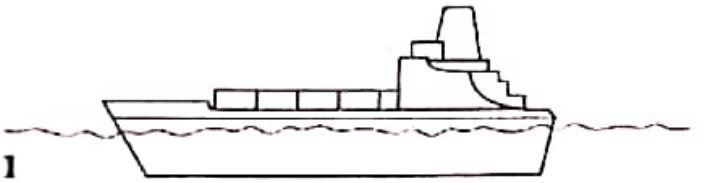
5 Forces in engineering

Tuning-in

Task 1

Working in your group, try to explain these problems.

1 Why doesn't the ship sink? because there is equilibrium
2 What makes the spring stretch and what keeps the weight up? weight,
3 Why doesn't the box slide down the slope? Friction, Resultant



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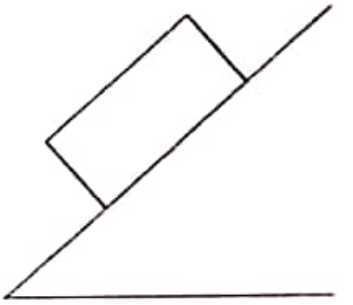

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Reading 1 *Predicting*

As you learnt in Unit 1, it is important to think about what you are going to read before you read. Do not start to read a text immediately. One way to help your reading is to think about the words which might appear in the text. The title might help to focus your thoughts. Which words might appear in a text with the title *Forces in engineering*?

Task 2

The text you are going to read is called *Forces in engineering*. Here are some of the words it contains. Can you explain the link between each word and the title of the text?

weight	buoyancy	equilibrium
elasticity	magnitude	resultant
newton	gravity	

Task 3 Now read the text. Use the information in the text to check the explanations you made in Task 1.

Forces in engineering

To solve the ship problem, we must look at the forces on the ship (Fig. 1). The weight, W, acts downwards. That is the gravity force. The buoyancy force, B, acts upwards. Since the ship is in equilibrium, the resultant force is zero, so the magnitudes of B and W must be the same.

مقدار ١

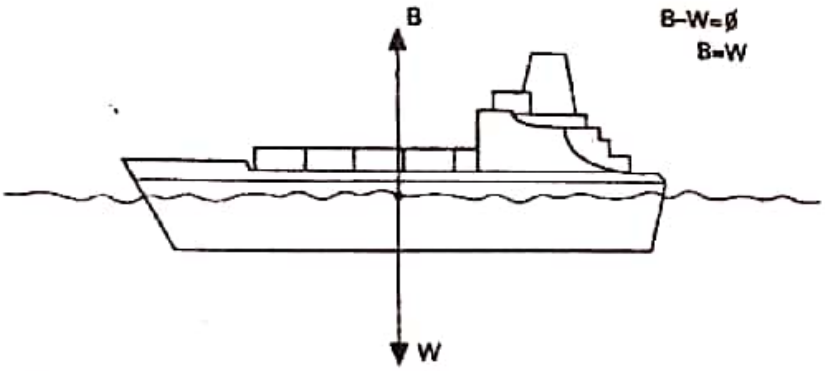

Fig. 1

Another very important force in engineering is the one caused by elasticity. A good example of this is a spring. Springs exert more force the more they are stretched. This property provides a way of measuring force. A spring balance can be calibrated in newtons, the unit of force. The block in Fig. 2 has a weight of 10 newtons. The weight on the balance pulls the spring down. To give equilibrium, the spring pulls up to oppose that weight. This upward force, F1, equals the weight of the block, W.

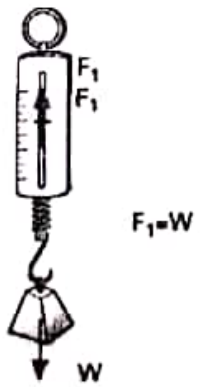

Fig. 2

فرق

It is important to get the distinction between mass and weight absolutely clear. Mass is the quantity of matter in an object. Weight is the force on that object due to gravity. Mass is measured in kilograms, whereas weight, being a force, is measured in newtons.

ظروف

We have looked at buoyancy, elasticity, and gravity. There is a fourth force important in engineering, and that is friction. Friction is a help in some circumstances but a hindrance in others. Let us examine the forces on the box (Fig. 3). Firstly, there is its weight, W, the gravity force, then there is the reaction, R, normal to the plane. R and W have a resultant force trying to pull the box down the slope. It is the friction force, F, acting up the slope, that stops it sliding down.

hindrance عائق
obstacle مرادف

أعاق عرقله

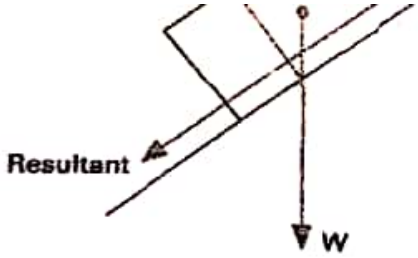

Fig. 3

Reading 2 *Grammar links in texts*

One of the ways in which sentences in a text are held together is by grammar links. In this extract, note how each expression in italics links with an earlier expression.

> Another very important force in engineering is *the one* caused by elasticity. A good example of *this* is a spring. Springs exert more force the more *they* are stretched. *This* property provides a way of measuring force.

Sometimes these links cause problems for readers because they cannot make the right connection between words in different parts of a text.

Study these common grammar links:

1 A repeated noun becomes a pronoun.
Springs becomes *they*.

2 A word replaces an earlier expression.
Force in engineering becomes *one*.

3 A word replaces a whole sentence or clause.
Springs exert more force the more they are stretched becomes *This property*.

With which earlier expressions do the words in italics link? Join them as in the example above.

Friction in machines is destructive and wasteful. *It* causes the moving parts to wear and *it* produces heat where *it* is not wanted. Engineers reduce friction by using very highly polished materials and by lubricating *their* surfaces with oil and grease. *They* also use ball
5 bearings and roller bearings because rolling objects cause less friction than sliding *ones*.

Source: S. Larkin and L. Bernbaum (eds.), The Penguin Book of the Physical World

The Dark Prince

Language study *The present passive*

Study these instructions for a simple experiment on friction.

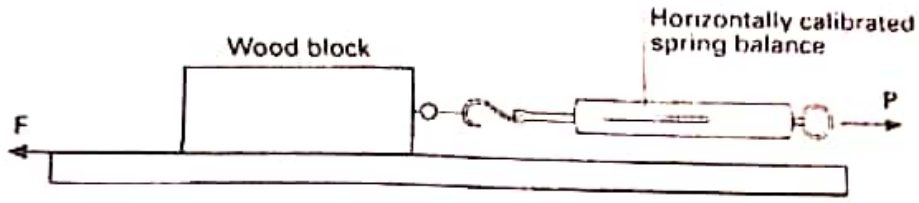

Fig. 4

1 Place a block of wood on a flat surface.
2 Attach a spring balance to one end of the block.
3 Apply a gradually increasing force to the balance.
4 Note the force at which the block just begins to move.
5 Pull the block along so that it moves at a steady speed.
6 Note the force required to maintain movement.
7 Compare the two forces.

When we describe this experiment, we write:

> A block of wood *is placed* on a flat surface. A spring balance *is attached* to one end of the block.

This description uses the present passive. We form the present passive using *is/are* + past participle.

Task 5

Complete this description of the experiment using the present passive.

A block of wood [1] is placed on a flat surface. A spring balance [2] is attach to one end of the block. A gradually increasing force [3] is applied to the balance. The force at which the block just begins to move [4] is noted

The block [5] is pulled along at a steady speed. The force required to maintain movement [6] is noted. The two forces [7] are compare. It is found that the first force is greater than the second.

What does this experiment show?

Listening *Listening to lectures*

The listening passage you are going to hear is an extract from a typical engineering lecture. Here are some of the features of lectures.

1 Incomplete sentences: Spoken language is not divided neatly into sentences and paragraphs. For example: