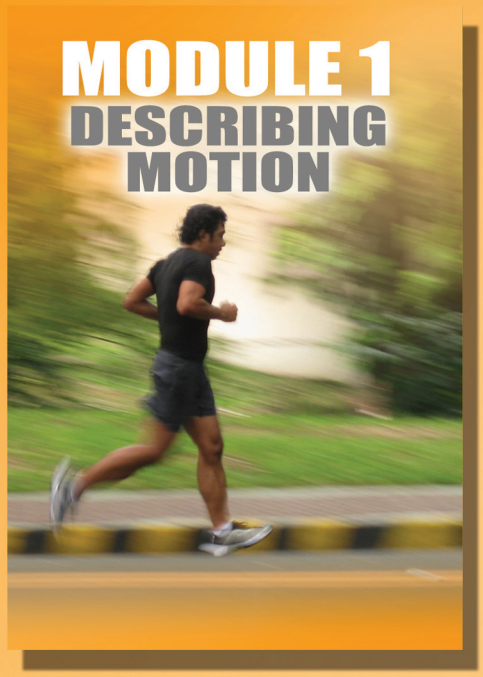
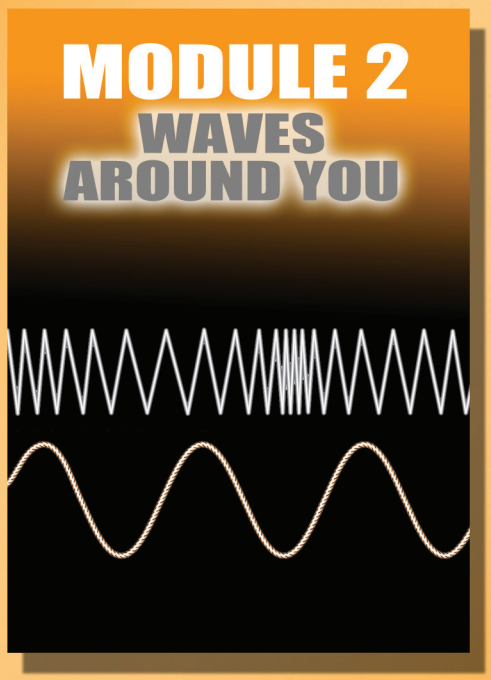
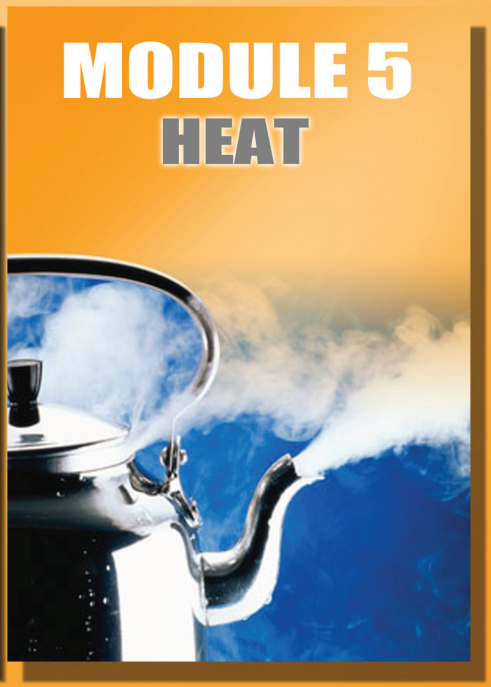
For Teachers

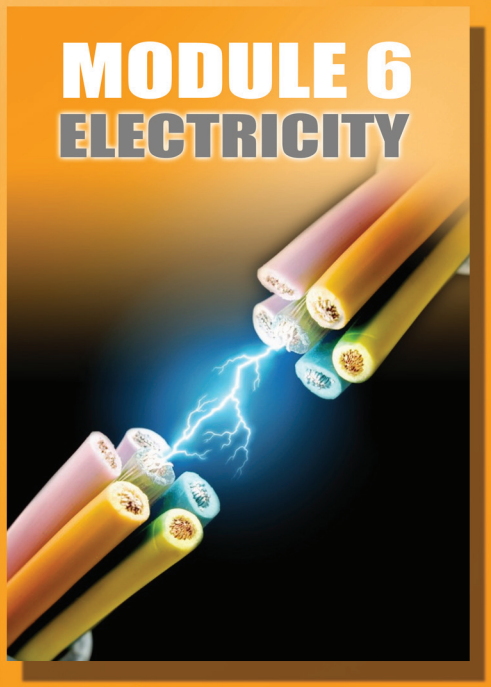
Grade 7 Science

Energy in Motion









Energy in Motion

Overview

The topics covered in Grade 7 deal with the relationship between motion and energy. At the end of the quarter, students should be able to realize that energy exists in different forms, energy transfers from one body to another, and that motion is the concrete manifestation that a body possesses energy.

Among the many forms of energy, *motion, heat*, *light*, *sound*, and *electrical* energy are the most common and most familiar among students. All these forms belong to kinetic energy; they are all associated with some kind of motion - the motion of waves, electrons, atoms, molecules, and objects.

In this grade level, the focus is on the sources of the different forms of energy and the different ways by which they are transferred from one place to another. Sound and light are introduced as forms of energy that are transferred by waves while heat is introduced as an energy that is transferred either by randomly moving particles, or by electromagnetic waves (radiation). Electrical energy is described as an energy that is transferred by moving electrical charges through a complete circuit.

Motion is considered to be the first topic because it is the most concrete manifestation of the abstract concept of energy. Besides, some of the concepts to be developed in this module will be useful in understanding the succeeding topics, like when students learn about the common characteristics of waves and when they relate these to the characteristics of sound and light waves.

The table below shows the general and specific topics covered in Grade 7:

Module Title	Specific Topics	Focus Questions
Motion	➢ Uniform Motion ➢ Accelerated Motion	– How do objects move?
Wave	➢ Types/Kinds of waves ➢ Common characteristics of waves	– How are waves classified? – What characteristics do waves have in common?

Sound	➢ Sources of sound ➢ Characteristics of sound	– How is sound produced? – How does sound propagate? – How do sounds differ from each other?
Light	➢ Sources of light ➢ Characteristics of light ➢ How the eye sees color	– How is light produced? – How does light intensity vary with distance from the source? – How is color related to frequency and wavelength?
Heat	➢ Heat transfer ➢ Modes of heat transfer ➢ Conductors/insulators of heat	– When does heat transfer take place? – How does heat transfer take place?
Electricity	➢ Electrical charges ➢ Simple circuit	– How do charges behave? – How do charges carry energy?

Each topic or module contains three to five activities, mostly practical work activities, that provide students with opportunities to develop their thinking and manipulative skills. Teachers need to make sure that students are on the right track while performing the activities and are able to grasp the particular concepts involved.

MODULE

1

DESCRIBING MOTION

This module covers basic aspects of motion. Its aim is to enable the students to describe examples of motion along a straight line. Motion is defined as the change in position over an interval of time. Students will therefore describe motion in terms of the positions of the moving object at different points in time, or its distance travelled over a period, or its speed of travel. Furthermore, they will construct or analyze diagrams, graphs, or charts to describe whether an object is in motion or not, or moving with constant speed, or whether it is changing in speed or not.

In this module, the relevant concepts are introduced only at a basic, more conceptual and less mathematical level. But the students' understanding of these concepts will be enhanced when they continue to study about motion in the next grade levels or when they study other relevant topics in physics and in other areas.

Key questions for this module

When do we say that an object is moving?
How can we describe the motion of an object?

This module contains four sections:

I-Where

- In this section, students will describe the position of an object with respect to a point of reference (or reference point).

Activity 1

Where is it?

- Prepare beforehand the instructions to be given to the students. The instructions should be vague to make it less helpful to the students. Examples are given below:

  a. It is right there.
  b. Turn and it is there.
  c. Walk slowly and you will get there.
  d. It is from here to there.

- In this activity, students should be able to realize the importance of the point of reference (or reference point) and direction in describing the position of an object.
- Students may use the terms such as beside, above, below, left, right, in front of, or behind when describing the direction of an object from the reference point.
- During the processing, it should be emphasized that once the students have selected their point of reference, they can easily describe any change in the position of an object. In other words, they can easily tell whether an object is moving or not. At this point, the definition of motion, which is the change in position over time, can be introduced.

Sample answers to the questions

Q1. (Students are supposed to have a hard time in finding the object)

Q2. The instruction is not clear. There should be another object where we can refer to or compare the position of the object.

Q3. (This time, students should be able to find the object)

Q4. The distance of the object and its direction from the point of reference are included in the instruction.

Q5. A point of reference is something that seems steady that is used to compare the position of an object.

Q6. -10 m.

Q7. 5 m.

Q8. The dog is 25 meters to the left of the house

Q9. The tree is 15 meters to the right of the dog.

Q10. The initial position of the ball is at 0 m. Its final position is at 15 m.

Q11. 10 m.

Q12. 15 seconds

Q13. 7.5 meters

Q14. 12.5 seconds

Table 1

Time (sec)	Position of the ball
0	0
5	5
10	10
15	15

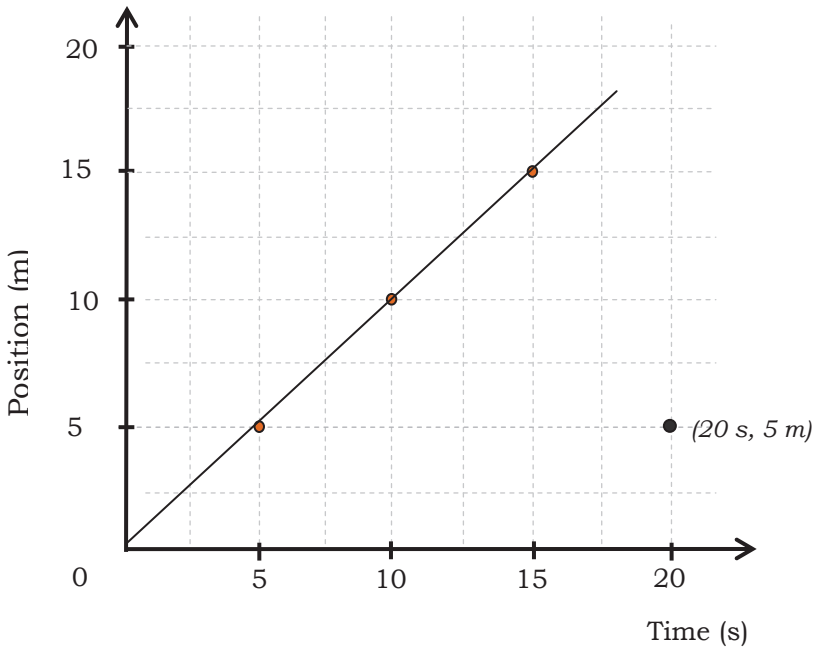


Figure 3

II-How far

- In this section, students will describe the motion of an object in terms of the distance it travelled. They will also differentiate distance from displacement.
- Since vector and scalar quantities are not yet introduced in the module, displacement will be defined as measurement of length plus direction while distance is defined as measurement of length only.
- The following questions are asked to test students' understanding of the difference between distance and displacement. Encourage the students to answer these questions or use them as points for discussion.
  - What have you noticed about the distance and the displacement in the given examples above?

    Displacement always follows a straight line. Distance does not always follow a straight line.

    Displacement measures the length of the straight line that connects the object's point of origin and its point of destination. Distance measures the length of the path travelled by the object.
  - When can displacement be equal to distance?

    When the path travelled is a straight line
  - Can displacement be greater than distance? Why?

    No, it can be shorter but it cannot be greater than the distance.

    Displacement is the shortest length between the object's point of origin and its point of destination.
  - What if the ball, the car, and the dog in the illustration go back to their starting positions, what will be their total distances? What will be their displacements?

    Their total distances will increase two times (will double) but their displacements will become zero.

Activity 2

Home to school roadmap

- Allow students to work either in pairs or in small groups.
- In the absence of ruler, or meter stick, or any standard distance measuring instrument, ask students to design an alternative way to measure the distance. Check their design or device for precision.
- If the students live far from school, they can choose a nearer place as their starting point. Remind them to include in their maps the street names, reference points and precise measurements. Remind them also to stay safe while doing the activity outside the school.
- All answers to the questions depend on the students' data.

III-How fast?

- In this section, students will describe the motion of an object in terms of its speed. They will also differentiate speed from velocity (which is defined as speed plus direction) and average speed from instantaneous speed.

Activity 3

Fun Walk

- In this activity, students should be able to design ways to obtain the speed of each member of the group and decide how to use these values to determine who among them walks fastest.
- In the absence again of a standard instrument for measuring distance, students can use their previous design/device.
- Check their units of distance, time, and speed. If for example, they use meter for distance and minute for time, then their unit for speed must be meter/minute.

Sample answers to the questions

Q1. We measured the total distance travelled and time taken to travel the distance

Q2. We divided the distance travelled by the time of travel

Q3. The fastest participant was the one with the highest computed value of distance over time

Q4. The lesser the time of travel, the greater the speed of travel

Q5. The greater the distance travelled, the greater the speed of travel

Q6. They travelled with the same speed of 2m/s.

IV-How fast is the velocity changing?

- In this section, students will be introduced to the concept of acceleration.
- Since the students are dealing only with motion along a straight line, the concept of acceleration is introduced as due to the change in the speed of the moving object. During the discussion, it should be emphasized that acceleration may also be due to the change in the direction of the object. *Acceleration, by definition, is the change in velocity over a time interval,* and velocity as mentioned earlier is speed plus direction. So even if there is no change in speed but there is a change in direction, acceleration is achieved.

Activity 4 Doing detective work

- In this activity, students will analyze an example of motion wherein speed (or velocity) is changing by examining the record of the dots on a strip of paper.
- Prepare beforehand the paper strips containing dots. The dots should be arranged such that the distance between two successive dots increases uniformly, like the one shown in the module.

- However, each group can be also asked to work on a strip having different arrangement of dots. Some can be decreasing uniformly; others can be increasing or decreasing but not uniformly.
- During the discussion, emphasize *that any change in the velocity* of an object results in an acceleration. This includes change in speed (increasing speed or decreasing speed which is also called deceleration) or change in direction (although this is not discussed in the module). This is to correct the common conception among people that acceleration only refers to objects with increasing speed.

Sample answers to the questions

Q1. The distance between two successive dots increases uniformly.

Q2. The length of the strips of tape in the chart increases uniformly.

Q3. Each strip of tape provides the speed (or velocity) of the object every 1 second.

Q4. Because the length of the tape increases uniformly, it means that the speed (or velocity) of the object increases uniformly.

Q5. The change in length of the tape is constant. The change in speed is constant.

or

The length of the tape increases by the same amount in each time interval. The speed increases by the same amount in each time interval.

Q6. The object is moving with constant acceleration.

Q7. The graph is curved or parabolic.

Q8. The shape of the speed-time graph is different from the. It is a straight-line graph.

Q9. Similar to the answers in Q5 and Q6

Q10. If the arrangement of oil drops left by the car is similar to what we used in this activity, then the suspect was not telling the truth.

PRE/POST TEST

1. When is an object considered to be in motion?

   I. When its position changes with respect to a point of reference.
   II. When its distance changes with respect to a point of reference.
   III. When its direction changes with respect to a point of reference.

   A. I and II only
   B. I and III only
   C. II and III only
   D. I, II, and III

For questions 2 and 3, refer to the table below. Data were obtained from a 200-meter dash competition.

Female Athlete	Recorded Time	Male Athlete	Recorded Time
1	26.5	1	22.4
2	26.1	2	21.9
3	25.3	3	23.0
4	26.7	4	22.6

2. Which of the following statements is/are true?

   I. The male athletes are faster than the female athletes.
   II. Compared to the speed of the fastest male athlete, the average speed of the fastest female athlete is slightly less.

   A. I only
   B. II only
   C. Both I and II
   D. Neither I nor II

3. How do you compute for the average speed of each athlete?

   A. Multiply 200 meters by the recorded time of travel.
   B. Divide 200 meters by the recorded time of travel.
   C. Divide the recorded time of travel by 200 meters.
   D. Divide 200 meters by twice the recorded time of travel.

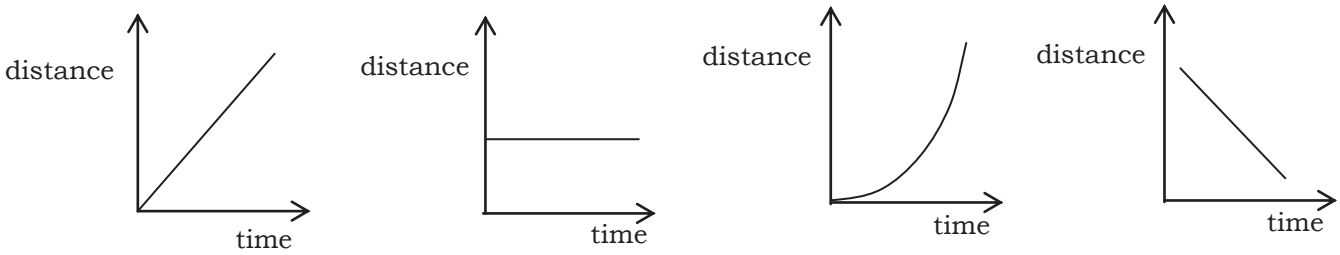
4. Which of the following is true about an object that travels 5 meters to the left, then 2 meters up, then another 5 meters to the right?

   A. The displacement of the object is equal to 12 meters.
   B. The total distance travelled by the object is equal to 12 meters.
   C. The displacement of the object is equal to 12 meters down.
   D. The total distance travelled by the object is equal to 12 meters down.

5. Which of the following statements is NOT true about the object moving with constant speed?

   A. The object is not accelerating
   B. The speed of the object is equal to zero.
   C. The distance travelled by the object increases uniformly
   D. The speed of the object remains the same all throughout the travel

6. Which of the following graphs shows that the object's motion is accelerating?



A B C D

Answer Key

1. D
2. C
3. B
4. B
5. B
6. C

Links and References

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