Science Inquiry Skills

Scientists use special inquiry skills to answer questions, gather information, and do experiments. You will need to apply similar skills such as the following, as you take the Grade 8 Intermediate-Level Science Test:

- Hypothesizing
- Predicting
- Observing
- Measuring
- Analyzing
- Inferring
- Comparing and Contrasting
- Classifying
- Modeling
- Recognizing Cause and Effect
- Telling Fact from Opinion

Hypothesizing
When you state a hypothesis, you suggest an answer to a problem, based on what you already know. You can also think of a hypothesis as a possible explanation for why something occurs. You can support or reject a hypothesis by observing or experimenting. If your observations or experiments do not support your hypothesis, then you need to state a new hypothesis based on your discoveries. Stating a hypothesis is an important part of the scientific method.

Predicting
When you predict, you state what you think will happen, based on what you already know or have observed.

Example  Astronomers know that the Earth, the other planets, and the Moon move in regular and predictable ways. They can use this knowledge to make accurate predictions. They can tell when lunar and solar eclipses will occur and when and where the planets will appear in the night sky.

If you make careful observations and measure and record what you observe, you can use that information to predict.

Observing
When you observe, you use all your senses. You must pay close attention to everything that happens. Often, you need to record your observations. What you see, hear, smell, touch, and taste can be important clues to figuring out what is going on.

Content Clue
Eclipses can be total or partial. Because of the angle of the Moon’s orbit around the Earth, no more than seven eclipses (lunar and solar combined) can occur in one year.

Content Clue
Observing is part of the scientific method. The scientific method is a step-by-step procedure scientists use to do experiments and make discoveries.
Measuring
When you measure, you compare an unknown value with a known value, using units such as a gram or a millimeter. Measuring makes observations more exact and gives you a means of recording your results when you do an experiment.

Part of the Grade 8 Intermediate-Level Science Test will require you to perform an experiment that has already been set up for you. As part of the experiment, you may be asked to measure something and record the information on a chart.

Example You are asked to measure the temperature and the volume of ice water in a beaker. What unit of measurement would you use for temperature? ________________ What unit would you use for volume? ________________

Suppose the experiment calls for heating the water and measuring its temperature once every minute. What might be a good way to record these measurements? ________________

By measuring how much the temperature changes over time, you are making a new measurement—the rate of temperature change.

Analyzing
After you record your observations and measurements in a table or chart, you can study the chart or table carefully, or analyze it.

Example Suppose you wanted to compare how quickly a truck and a car could stop on a road (stopping distances). After observing and making measurements, you could organize the information into the following table.

<table>
<thead>
<tr>
<th>Speed</th>
<th>Car</th>
<th>Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 kilometers per hour</td>
<td>40 meters</td>
<td>61 meters</td>
</tr>
<tr>
<td>80 kilometers per hour</td>
<td>74 meters</td>
<td>131 meters</td>
</tr>
<tr>
<td>100 kilometers per hour</td>
<td>111 meters</td>
<td>203 meters</td>
</tr>
</tbody>
</table>

Test Tip
You might also be asked on the test to plot this kind of information on a line or bar graph.
After you have analyzed this information, you can use it to make a prediction. For example, if a truck at 60 kilometers per hour needs 61 meters to stop and a car needs only 40 meters, what can you predict about a truck that is following less than 21 meters behind the car?

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**Inferring**

When you infer, you use logic and reasoning to form a statement that can be tested by an experiment or supported by evidence. This statement is based on known facts and observations.

**Example** Suppose you are an archaeologist, and you find the following objects buried at a prehistoric site: a spear, a stone ax head, a bone needle, a bone fishhook, and a stone knife blade. What can you infer about the people who left the objects behind? What activities did they do?

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Your inference should have been based on the knowledge that spears are usually used for hunting and fishhooks for fishing. What do you think people did with the bone needle?

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**Comparing and Contrasting**

When you compare, you observe the characteristics of several things or events to see how they are alike (comparing) or different (contrasting). In the example above, the prehistoric items can be compared to similar objects used today. The bone needle is similar to needles used for sewing today. Therefore, you can infer that it was used for a similar purpose in prehistoric times.

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**Classifying**

When you classify, you group things together based on how they are alike. People classify many different things, such as books in a library, groceries at a supermarket, or clothes in a closet. When given several objects, most people tend to sort them by similarities without even thinking about it.
Example  Look at the illustration that follows. It shows a number of different organisms that can be classified in many different ways. One example might be into kingdoms—plant and animal. Name at least two other ways you could classify these organisms.

Classification makes the study of large groups or events less complex. In earth science, for example, rocks are classified into categories by how they were formed. If you find an igneous rock formation, you can assume it formed from molten rock. This, in turn, may mean that it came from a volcano.

Modeling
When you model, you use a visual representation of what you are studying to help explain it. A model can be a three-dimensional object, a drawing or blueprint, or a diagram. The model can be larger or smaller than the original. Modeling is especially useful when the object or event you are studying is too small or too large to study under normal conditions.

Example  It is very hard to see an atom, even with a microscope. However, scientists have learned a lot about the structure of atoms from experiments. They can use what they have discovered to make models of atoms and molecules. They can use these models to form and test new hypotheses.

Content Clue
Biologists classify organisms by their characteristics. One of those characteristics is the way the organism gets its food. Most of the organisms shown here get their food in the same way. They are consumers.

Content Clue
Although igneous rock always forms from molten rock, it does not always come from the lava seeping out of a volcano. It may also form from magma inside the Earth.
Recognizing Cause and Effect

A *cause* is what makes something happen. The *effect* is what happens. In science, you must be very careful in determining the actual cause of an effect. For example, just because you observe that it rained the night after a full Moon does not mean a full Moon causes rain.

In experimentation, cause and effect can be determined by controlling variables. A variable is anything that can influence the results of an experiment. A well-designed experiment tests only one variable at a time. That way, the true cause of an effect can be determined.

**Example** The drinking glasses from your dishwasher look cloudy. The repair technician who comes to your house has a hypothesis that there are two possible causes: either the water is not hot enough, or the new detergent you bought is not cleaning properly. How could you experiment to find out which one is the actual cause of the effect?

If neither the water temperature nor the detergent turns out to be the cause, then the technician needs to form a new hypothesis.

Telling Fact from Opinion

A *fact* is a statement that can be proven true. An *opinion* is a statement of how someone feels or thinks about something. An opinion cannot be proven. Sometimes it is not easy to tell fact from opinion. The following steps may help you tell the difference.

1. Look for words such as *I believe* or *I think*. If something is a fact, the writer or speaker will not need to use these phrases.

2. Look for descriptive words or phrases that strongly suggest the positive or negative. For example, to say that gold is a yellow metal is to state a fact. To say that gold is a *beautiful* yellow metal is to state an opinion.

3. Ask yourself whether the statement can be proven by observing or testing. If it can, the statement is a fact.
Practice

Living and Nonliving Things

Base your answers to questions 1–4 on the passage below, which describes the kingdoms of life.

The kingdom Monera includes one-celled organisms, called monerans, that lack a nucleus. Bacteria make up this kingdom. The kingdom Protista contains organisms, called protists, that are also one-celled. However, these organisms have nuclei. Examples of protists include paramecia, amoebas, and some algae.

The kingdom Fungi contains both single-celled and many-celled organisms. These organisms have cell walls. Examples of fungi include molds, yeasts, and mushrooms. The kingdom Plantae consists of organisms with more than one cell, cell walls, and chlorophyll. Plants use chlorophyll during photosynthesis to make food. Examples of plants are mosses, ferns, and seed plants.

The kingdom Animalia also contains organisms with more than one cell. However, unlike plant cells, animal cells do not contain chlorophyll. Therefore, animals cannot make their own food. Animals must eat other organisms to survive. Insects, fish, reptiles, birds, and mammals are animals.

1 What is the term used to describe the major classification groups of organisms?

2 How many major classification groups of organisms are there?

3 Compare and contrast the protist and the moneran classification groups. How are they alike and how are they different?

4 Based on the passage, what can you infer about fish and reptiles?
## Practice

### Genetic Information

The table below shows some dominant and recessive traits discovered in pea plants. Base your answers to questions 1–4 on this table and on your knowledge of science.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Dominant</th>
<th>Recessive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed shape</td>
<td>Round</td>
<td>Wrinkled</td>
</tr>
<tr>
<td>Seed color</td>
<td>Yellow</td>
<td>Green</td>
</tr>
<tr>
<td>Pod color</td>
<td>Green</td>
<td>Yellow</td>
</tr>
<tr>
<td>Flower color</td>
<td>Purple</td>
<td>White</td>
</tr>
<tr>
<td>Stem height</td>
<td>Tall</td>
<td>Short</td>
</tr>
</tbody>
</table>

1. What are two recessive traits of pea plants?

2. What can you infer from the table is a common type of reproduction in pea plants?
   - 1 asexual
   - 2 budding
   - 3 cloning
   - 4 sexual

3. If a pea plant that has two genes for round seeds is bred with a pea plant that has two genes for wrinkled seeds, what can you predict is the probability of each offspring having wrinkled seeds?
   - 1 75 percent
   - 2 50 percent
   - 3 0 percent
   - 4 100 percent

4. Suppose every pea plant in your garden has a short stem. Short stem height is a recessive trait and should show up only in a small number of the plants. What other possible cause for this effect might there be besides inherited traits?
The peregrine falcon is a beautiful bird of prey. It is blue gray with pointed wings and a black head and cheeks. This makes it look distinguished. Peregrine falcons are strong and fast. They fly high and dive at tremendous speeds. They live in open country and in cities.

By 1970, peregrine falcons were near extinction because of their exposure to a harmful pesticide called DDT. This would have been terrible. There were only 39 pairs of peregrine falcons left. The use of DDT was banned in the United States in 1972. After the ban, the number of peregrine falcons increased. By 1980, there were 99 pairs, and by 1998, there were 1,659 pairs. Their numbers will continue to increase.

1 What are the habitats of the peregrine falcon?

2 What caused the near-extinction of the peregrine falcon?

3 List two facts about peregrine falcons that appear in this passage.

4 List two opinions about peregrine falcons that appear in this passage.

Content Clue

DDT made the eggshells break easily. This usually resulted in the death of the developing bird.

Test Tip

When deciding between fact and opinion, look for words that describe, or adjectives.
Practice

Reproduction and Development

For questions 1 and 2, choose the best answer.

1 The changes a frog undergoes between the tadpole stage and the adult stage are known as
   1 maturation   3 metamorphosis
   2 revolution   4 classification

2 Frogs spend a lot of their lives on land. Their eggs, however, hatch in water, and their young develop in water. Frogs are
   1 mammals      3 reptiles
   2 marsupials   4 amphibians

Base your answers to questions 3–5 on the diagram below and on your knowledge of science. Write your answers in the space provided.

3 Compare the body structures of tadpoles and adult frogs.

4 Compare the way tadpoles and adult frogs breathe.

5 Compare the way tadpoles and adult frogs move around.

Content Clues

Amphibians need to lay their eggs in water because the eggs do not have shells to protect them.

A complete metamorphosis usually includes a change in behavior or environment as well as a change in body shape.

Content Clue

Often the shape of something is related to how it works.

Test Tip

Use your powers of observation as you study the diagram to find ways tadpoles and adult frogs are alike and different.
Meeting Daily Needs

Below is a table that shows how minerals and vitamins are used by the human body. Base your answers to questions 1–3 on the data in the table and on your general knowledge of science.

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Vitamins</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vitamin</td>
</tr>
<tr>
<td>Potassium</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>B</td>
</tr>
<tr>
<td>Iron</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D</td>
</tr>
</tbody>
</table>

1 Which vitamin is most important for maintaining healthy eyes?
   1 B
   2 C
   3 A
   4 D

2 Which nutrients are most important for bone growth?
   1 vitamin A and iron
   2 vitamin D and calcium
   3 vitamin B and potassium
   4 vitamin C and iron

3 Vitamins B and C dissolve in water. This means your body does not store them. Explain what you can infer from this about the foods you need to eat every day.

4 Lack of eating a particular nutrient can lead to what is called a deficiency disease. An example of a vitamin deficiency disease is
   1 diabetes
   2 rickets
   3 influenza
   4 allergies
Practice

Energy in Ecosystems

Base your answers to questions 1–4 on the passage below.

Most organisms get food by eating other organisms. An organism that eats other organisms is a consumer. Rabbits eat grass and other plants. Rabbits are primary consumers. A primary consumer is an organism that eats producers. A producer is an organism, such as a plant, that makes its own food.

Consumers that eat primary consumers are secondary consumers. Consumers that eat secondary consumers are tertiary consumers. Hawks eat small meat-eating animals, such as weasels. Hawks are tertiary consumers. Some animals, such as hawks, are also secondary consumers. Most humans are primary, secondary, and tertiary consumers.

1. What can you infer about tertiary consumers?
   1. They are also producers.
   2. They are eaten by secondary consumers.
   3. They are at the top of the energy pyramid.
   4. They are rabbits.

2. Compare a producer with a consumer.

3. How would you classify humans?
   1. plant-eating animals
   2. primary, secondary, and tertiary consumers
   3. primary consumers
   4. secondary consumers

4. Suppose the secondary and tertiary consumers were removed from this ecosystem. Which of the following predictions is most reasonable?
   1. The number of primary consumers would increase.
   2. The number of producers would increase.
   3. The number of primary consumers would decrease.
   4. The number of primary consumers would remain the same.

Test Tip
If you are allowed to write in your test booklet, sometimes it helps to make notes in the margin as you read long passages.

Content Clue
Scavengers and decomposers eat or break down the remains and wastes of other organisms.
Practice

Humans and the Environment

For questions 1–4, choose the best answer. For question 5, write your answer on a separate sheet of paper.

1. The major cause of air pollution is
   1. the cutting down of trees
   2. the burning of fossil fuels
   3. global warming
   4. overpopulation

Content Clue
Cars and factories are the main sources of air pollution and acid rain.

2. Without carbon dioxide in the atmosphere, most of the Sun’s energy would escape into space. Instead, carbon dioxide reflects the energy back to the Earth. What is this called?
   1. the ozone layer
   2. the greenhouse effect
   3. the carbon dioxide cycle
   4. refraction

Content Clue
Ozone is a type of oxygen molecule that forms when ultraviolet radiation strikes oxygen in the upper atmosphere. Some aerosol sprays and refrigerants (CFCs) contain chemicals that break down ozone.

3. Scientists have observed another problem caused by air pollution. The ozone layer of the atmosphere, which normally filters out harmful radiation from the Sun, is damaged by air pollution. Based on this information, which prediction best describes the problem?
   1. If air pollution increases, the ozone layer may get thicker.
   2. If air pollution decreases, the ozone layer may get thinner.
   3. If air pollution increases, more people may get skin cancer.
   4. If air pollution decreases, more people may get skin cancer.

4. A major cause of water pollution is
   1. fertilizers and pesticides washed off farm fields
   2. overuse of water in urban areas
   3. damming up rivers to form reservoirs
   4. introducing exotic species into the environment

Content Clue
The study of the relationship between living things and their environment is called ecology.

5. Some greenhouse effect is necessary for life to exist on Earth. Too much greenhouse effect, however, can harm life on Earth by causing global warming. On a separate sheet of paper, explain the relationship between burning fossil fuels and global warming.
Practice

The Earth and Space

Base your answers to questions 1–4 on the table below, which compares the Earth to the Moon.

<table>
<thead>
<tr>
<th></th>
<th>Earth</th>
<th>Moon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>4.5 billion years</td>
<td>4.5 billion years</td>
</tr>
<tr>
<td>Rotation period</td>
<td>24 hours</td>
<td>27.3 days</td>
</tr>
<tr>
<td>Surface area</td>
<td>510 million km²</td>
<td>38 million km²</td>
</tr>
<tr>
<td>Circumference</td>
<td>40,075 km</td>
<td>10,927 km</td>
</tr>
</tbody>
</table>

1 The Moon’s period of revolution around the Earth is about 27.3 days. Which statement is best supported by the data in the table?
1 The Moon’s year is equal to its day.
2 The Moon’s rotation period is the same as its period of revolution around the Earth.
3 The Moon takes as long to spin on its axis as it does to go around the Sun.
4 The Earth and the Moon have about the same length of day.

2 Based on the data in the table, which of the following statements is the most reasonable inference?
1 The Moon is much bigger than the Earth.
2 Rotation period is another way of saying “day-night cycle.”
3 The Moon has half the surface area of the Earth.
4 Surface area is another way of saying “circumference.”

3 What can you infer about the Earth and the Moon based on the age data in the chart?
1 The Earth and the Moon formed at about the same time.
2 The Earth is much older than the Moon.
3 The Moon is much older than the Earth.
4 The Moon is made of the same material as the Earth is.

4 On a separate sheet of paper, use the data in the table to write a paragraph that compares the Earth to the Moon. In what ways are they alike? In what ways are they different?

Test Tip
Read long questions and answers carefully. Try to eliminate some answer choices by picking out key words. The Sun isn’t mentioned anywhere in the table, so you can probably eliminate choice 3.

Content Clue
One theory states that a giant asteroid hit the Earth in our distant past and broke off the piece that became the Moon.
Practice

The Interaction of Air, Land, and Water

Base your answers to questions 1–3 on the weather map below.

1. In the Northern Hemisphere, wind circulates in a counter-clockwise direction in a low pressure area and in a clockwise direction in a high pressure area. Which of the following inferences is the most reasonable?
   1. The wind in Salt Lake City is blowing from the north.
   2. The wind in Salt Lake City is blowing from the south.
   3. The wind in Salt Lake City is blowing from the east.
   4. The wind in Salt Lake City is blowing from the west.

2. A low pressure area usually means rainy or stormy weather, and a high pressure area usually means clear weather. Compare the weather in Salt Lake City with the weather in New York City.

3. Predict what kind of weather Salt Lake City will be having soon. How do you know?
Practice

Physical Properties of Matter

Base your answers to questions 1–4 on the table below, which shows five unknown mineral samples.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Color</th>
<th>Hardness</th>
<th>Other Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>Bright yellow</td>
<td>2.5</td>
<td>Shiny</td>
</tr>
<tr>
<td>Sample 2</td>
<td>Clear</td>
<td>10.0</td>
<td>8-sided crystals</td>
</tr>
<tr>
<td>Sample 3</td>
<td>Bright yellow</td>
<td>6.5</td>
<td>Shiny</td>
</tr>
<tr>
<td>Sample 4</td>
<td>Black</td>
<td>6.0</td>
<td>12-sided crystals, magnetic</td>
</tr>
<tr>
<td>Sample 5</td>
<td>Black</td>
<td>6.0</td>
<td>12-sided crystals</td>
</tr>
</tbody>
</table>

1. Compare the mineral samples in the table. Which of the following statements is the most accurate comparison?
   1. Sample 5 is exactly the same as Sample 4.
   2. Sample 2 is the hardest mineral and Sample 1 is the softest.
   3. Sample 1 and Sample 3 are probably the same mineral.
   4. Sample 4 is harder than Sample 2.

2. Analyzing the data in the table and using your knowledge of science, what can you infer about the mineral samples?
   1. Sample 2 is probably a diamond.
   2. Sample 2 is the softest mineral and Sample 1 is the hardest.
   3. Sample 5 is probably gold.
   4. Sample 3 has more mass than Sample 5.

3. Arrange the mineral samples in order of hardness, beginning with the hardest.

4. If Sample 4 and Sample 5 were broken up and mixed together, how could you separate them?

**Content Clues**

Minerals are classified by their properties. Two of those properties are hardness and color.

Mineral hardness is rated on a scale of 1 to 10.
The softest rating is 1.
Talc has a hardness of 1.
The hardest rating is 10.
Diamond has a hardness of 10.

**Test Tip**

When being asked to arrange objects in order, be absolutely sure of the order you need to put the objects in. Although it might seem more natural, for question 3 don’t start with the softest mineral and work your way up to the hardest.
Practice

Forms of Energy

Base your answers to questions 1–3 on the diagrams below, which show some different forms of energy.

1 Compare the diagrams. Which of the following statements is the most reasonable inference?
   1 The plant is converting light energy to chemical energy.
   2 The boy is converting chemical energy to nuclear energy.
   3 The candle is converting heat energy to light energy.
   4 The lawnmower is converting chemical energy to electrical energy.

2 Which two diagrams show energy being stored as chemical and potential energy?
   1 Figure 1 and Figure 3
   2 Figure 5 and Figure 6
   3 Figure 2 and Figure 4
   4 Figure 4 and Figure 6

3 Analyze the diagrams. Do you see a relationship between Figure 1 and Figure 3? If there is a relationship, what sort of energy transformation is taking place?
Practice
Forces and Motion

Base your answers to questions 1–3 on the diagram below, which compares a man's weight on the Earth to his weight on the Moon.

1 Based on the diagram, which of the following statements is the most reasonable inference?
   1. The Moon has about the same mass as the Earth.
   2. The Moon has about half the mass of the Earth.
   3. The Moon has about one-sixth the mass of the Earth.
   4. The Moon has about one-eighth the mass of the Earth.

2 The measure of the force of gravity on an object is its weight.
The stronger the pull, the greater the weight. Compare the mass and weight of the man on Earth and on the Moon. Explain why his mass is the same but his weight is different.

3 If the man in the diagram were transported to a planet with half the mass of the Earth, what would his mass be? What would his weight be?