

7TH GRADE SCIENCE CHECKLIST

Goals 11 – 13

Illinois Learning Standards A-F Assessment Frameworks

ISAT test questions are derived from this checklist. Use as a curriculum guide.

SCIENTIFIC INQUIRY

_____ Identify and be able to follow procedures to do scientific investigation including formulating hypotheses, controlling variables, collecting and recording and analyzing data, interpreting results, and reporting and displaying results.

_____ Distinguish among—and perform—the following things: observation, drawing a conclusion based on observation, forming a hypothesis, conducting an experiment, organizing data, constructing and reading charts and graphs, and comparing data.

_____ Define a theory as an explanation or model based on observation, experimentation, and reasoning; especially one that has been tested and confirmed as a general principle helping to explain and predict natural phenomena.

_____ Define a variable as some factor which changes in different phases of an experiment. For example, if we wish to observe how differences in pressure affect the temperature at which water boils, pressure will be a variable in our experiments. Define a constant as something kept the same in every phase of the experiment. Distinguish dependent and independent variables. Understand that most scientific experiments are designed so that only one variable is tested in each experiment. Identify constants and variables in described experiments.

_____ Define the control group or control setup as a group of subjects that are the same in all important ways as the subjects on which we are performing the experiment, except that the control is isolated from what we suspect to be the cause we are seeking to evaluate—the control helps to increase our certainty that the suspected cause really is the cause. Understand that there is a treatment sample and a control sample which is the same in every way except that it does not get the treatment.

_____ Distinguish between the kinds of questions that can be investigated by the scientific method and those that cannot.

_____ Analyze patterns in data from an experiment to determine whether the information gathered helps to answer a given question or hypothesis. A simple example: if all of the plants fertilized in a vegetable garden grew taller than the ones not fertilized, understand that this is an indication that the fertilizer caused the plants to grow taller.

TECHNOLOGICAL DESIGN

_____ Identify a design problem and establish criteria for determining the success of a solution.

_____ Compare design solutions; select which one is best given certain restrictions on available materials, tools, cost effectiveness, and safety.

- _____ Given certain tests which could be performed on a prototype, identify which one is testing for a given feature (e.g., “Given certain tests to be performed on a car, which one is testing for its fuel efficiency?”).
- _____ Identify improvements to a prototype indicated by given test results.

LIVING THINGS

Classification

- _____ Identify common insects, flowers, birds, reptiles, and mammals by their features.
- _____ Understand that animals have parts well suited to the places they live in and to their needs. For example, rabbits radiate heat through their ears, and those living in hotter climates have larger ears to radiate heat more efficiently. Thus, given a list of animals, one of which is clearly better adapted to a given environment, understand that that is the animal which lives in that environment.

Cell Biology

- _____ Understand that all living things are composed of cells: small parts which function similarly in all living things. Understand that different tissues have different, specialized cells with specific functions.
- _____ Identify the main differences between plant cells and animal cells, namely that plant cells have chloroplasts and cell walls (which provide rigidity to the plant, since plants have no skeletons). Identify the basic cell organelles and their functions: membrane, nucleus, cytoplasm, chloroplast, mitochondria, and vacuoles.
- _____ Understand that some organisms are unicellular, others multicellular. Understand that some unicellular organisms are like tiny animals, able to propel themselves or change their shape, and that they are endowed with sensation.
- _____ Understand that the nucleus of cell contains the genetic information for the plant or animal to which it belongs.
- _____ Understand that cells divide to increase their numbers, and the process of cell division called mitosis results in two daughter cells each with identical sets of chromosomes.
- _____ Understand that multicellular organisms begin as zygotes (a single egg cell fertilized by a single sperm cell), and that a zygote grows by cell division, and that as the cells multiply, they also differentiate.

Genetics and Reproduction

- _____ Understand the distinction between sexual and asexual reproduction. Understand that only some animals are capable of limb-regeneration (e.g., sea stars, some amphibians, and many crustaceans).
- _____ Understand that the offspring of sexual reproduction inherits half its genes from each parent.

- _____ Understand that an inherited trait can be determined by one or more genes.
- _____ Understand that DNA (deoxyribonucleic acid) is the genetic material of each living thing—like a blueprint or set of instructions for building the organism—and that it is located in the chromosomes of each cell.
- _____ Understand the basic rules of heredity: namely that the offspring of two mated animals (or plants) will have a certain probability of inheriting a given trait for which one or both of the parents carries a gene, and that this probability can be calculated given the genetic make-up of the parents with regard to that kind of trait (e.g., blue eyes).
- _____ Understand that male animals produce sperm cells, and females produce egg cells, and that the combination of these cells resulting from sexual union becomes the offspring.
- _____ Understand the basics of plant reproduction and define and state the purposes of pollen, ovules, seeds, and fruit.

Botany

- _____ Identify the common characteristics of most plants: they nearly all have green parts, many are woody, the majority have flowers, and unlike animals, nearly all plants live their lives rooted to one place in the soil.
- _____ Understand that energy for life primarily derives from the sun; understand the process of photosynthesis.
- _____ Identify the basic anatomy of leaves: blade, vein, and petiole; classify leaves as dicot or monocot, simple or compound, and palmately compound or pinnately compound.
- _____ Classify roots as either fibrous roots or tap roots.
- _____ Understand that flowers are the reproductive organs of flowering plants and that their function is to produce male gametes (sperm) and female gametes (eggs) and to provide a structure for fertilization.
- _____ Understand that some of the structures of flowers are adaptations that enable plants to reproduce sexually while they remain stationary. Understand that a plant's production of pollen is one such adaptation, since it can be transported (by wind, water, insects or other organisms) to the parts of the flowers that contain eggs. Know that this process is called pollination.
- _____ Identify a seed as a reproductive structure consisting of a plant embryo and its stored food. Understand that in flowering plants the seeds develop in a structure called a fruit, which houses and protect seeds and may also help to disperse them to new locations.

Change Over Time

- _____ Understand that competitive feeding habits between species can have a negative effect on their populations. Understand that animals and plants compete for food, shelter, mates, and other things necessary for life and reproduction.

_____ Know what natural selection or survival of the fittest is, and understand that this is thought to be one of the explanations for how animals and plants change over time, and that it was the explanation given by Charles Darwin.

_____ Understand that fossils of complete skeletons are rare, and that many skeletons have to be reconstructed based on what scientists believed the whole body to look like. Understand that the fossil record is not complete or representative of the times in which the fossilized animals and plants lived.

_____ Understand how fossils provide evidence that animals and plants have changed over time, and that new species of organisms changed over time out of older ones.

_____ Identify the temporal order in which major groups of organisms are thought to have appeared on the earth: 1. bacteria and other unicellular organisms, 2. invertebrate animals (trilobites, sponges), 3. jawless fishes, then fishes with jaws, 4. reptiles, 5. flowering plants, 6. mammals, and 7. people and modern animals.

_____ Understand how comparative anatomy offers evidence that organisms have changed over time. (1) Assuming that organisms have changed over time offers some explanation for similarities in body structures of different species by proposing that they descended from the same parent-species. (2) The same assumption can explain vestigial organs by proposing that new organs can make older organs obsolete or unnecessary, which therefore become disused and smaller (like the vestigial legs on some snakes).

ENVIRONMENT AND INTERACTION OF LIVING THINGS

_____ Understand that three important cycles for the survival of living things in Earth's ecosystems are the carbon dioxide-oxygen cycle, the water cycle, and the nitrogen cycle.

_____ Understand that the number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., the quantity of light and water, the range of temperatures, and soil composition). Know that given adequate biotic and abiotic resources and no disease or predators, populations can increase at rapid rates. Understand that lack of resources and other factors (e.g., predation and climate) limit the growth of populations in specific niches in the ecosystem.

_____ Understand that competitive feeding habits between species can have a negative effect on their populations. Understand that animals and plants compete for food, shelter, mates, and other things necessary for life and reproduction.

_____ Distinguish the various members of a food web and identify the order of dependence among these members.

_____ Understand that many plants depend upon certain animals for pollination and the spreading out of their seeds, and therefore to reproduce. Conversely, understand that animals depend on plants for food (either immediately, like herbivores; or intermediately, like carnivores) and shelter.

_____ Understand that the behavior of different organisms is influenced by internal cues (e.g., hunger) and by external cues (e.g., a change in the environment).

_____ Identify and describe the basic kinds of habitats: freshwater vs. saltwater, river, pond, desert, forest, and prairie.

_____ Identify and describe the major biomes and their characteristics: desert, grassland, savannah, tropical forest, coniferous forest, and tundra.

MATTER AND ENERGY

Properties of Matter

_____ Understand that matter can be changed in different ways. 1. Physically, a change in the size shape or state of matter (e.g., the melting of an ice cube, tearing of paper). 2. Chemically, where matter can change into another kind of matter (e.g., burning of wood, rusting of iron).

_____ Define and distinguish the following properties of matter: mass, weight, volume, density, color, odor, shape, texture and hardness.

_____ Understand that the phases of matter depend on how the atoms and molecules of a substance move.

_____ Identify the most familiar elements which are gases at room temperature.

_____ Know the definitions of melting point and boiling point and understand the concepts of evaporation and sublimation.

_____ Understand that there is another state of matter called plasma, which can be produced under artificial conditions on Earth. The sun's matter is in the plasma state, as is the matter of the other stars.

_____ Understand that substances can be grouped by similarities in their physical properties.

_____ Define element as a substance that cannot be broken down into simpler substances by chemical interactions. Understand that there are over 100 known elements that combine in many ways to form many kinds of compounds.

_____ Identify the properties common to most metals (especially luster, malleability, ductility, and the ability to conduct electricity). Identify the most familiar metals on the periodic table and understand that they are: magnesium, aluminum, titanium, iron, nickel, copper, zinc, silver, platinum, gold, and mercury.

_____ Identify simple compounds (e.g., H₂O).

The Atom

_____ Define atom as the smallest part of an element that still has the properties of that element.

_____ Identify the 3 subatomic building blocks, namely the electron, proton, and neutron. Know that the electron has a negative charge, the proton has a positive charge, and the neutron is electrically neutral.

_____ Understand that a molecule is two or more atoms joined by bonds. Understand that it is possible to have a molecule of an element, if the atoms are all of the same element, or a molecule of a compound, if the atoms in it are of different elements.

_____ Identify the number of different kinds of elements in a chemical formula. Understand that water is a chemical compound, and that its formula is H₂O.

_____ Understand that during a chemical change atoms are neither created nor destroyed, but are rearranged to make new substances.

Acids and Bases

_____ Identify the basic properties of acids and bases (e.g., acids are found in fruits such as apples, oranges, grapes and lemons). Know that bases are found in products such as lye soap, deodorant and ammonia. Know the relationship between acids, bases and indicators (e.g., blue litmus paper changes to red when placed in an acid).

Energy

_____ Know the laws of the conservation of matter and energy. Apply the conservation of matter as a reason why the number and kinds of atoms in a chemical change remains constant.

_____ Understand that energy is anything that can change the condition of matter, such as heat, light, sound, mechanical motion, and electricity.

_____ Understand that heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature (thermal equilibrium).

_____ Understand that energy can be transferred by radiation, conduction, and convection.

_____ Identify electrical conductors and insulators and give examples of each. Understand that electricity can be converted into heat and light by forcing an electrical current through a conductor. Understand that this is what happens in a toaster and in a light bulb.

Light

_____ Understand that light travels in straight lines as long as it is traveling through one, uniform medium.

_____ Understand that almost all of Earth's energy comes from the sun. Understand that this energy is in the form of visible and invisible light with a range of wavelengths including infrared, ultraviolet, radio waves and x-rays.

_____ Understand that visible light is a small band within a very broad electromagnetic spectrum.

_____ Understand that when a light beam hits an object and is reflected off of it, the angle of incidence equals the angle of reflection.

_____ Understand that light travels at different speeds in different materials. Understand that this is why light refracts—or changes direction—namely because it goes from one material in

which it moves at one speed into another material through which it moves at a different speed.

- _____ Understand that the angle of refraction is determined by (1) the angle of incidence and (2) the index of refraction of the new material which the light is entering.
- _____ Understand that many lenses operate by refracting light beams that hit their surface in such a way that they will all meet at one point called a focal point. Understand that this is the way refracting telescopes increase the ability of an image to be magnified (namely by brightening it; its objective lens focusing much more light from the object than the human eye can take in), and this is also how they magnify it with another lens. Likewise, know that light microscopes and magnifying glasses work in the same way.
- _____ Understand that light has a dual nature—exhibiting particle properties and also wave properties—depending on what situation we observe it in.
- _____ Identify the basic properties of waves: frequency, wavelength, and velocity.
- _____ Understand that in the spectrum of visible light, lower frequency colors are toward red, and higher frequency colors are toward blue.

FORCE AND MOTION

- _____ Understand the concept of force as any influence that tends to accelerate an object. Know that a force, for example, can speed up an object, or slow it down, or change its direction. Understand that forces can be quantified or measured in various ways, but in particular spring scales can be used.
- _____ Understand the concept of constant, variable and periodic motions.
- _____ Identify the principle of inertia: things at rest or in uniform motion in a straight line tend to stay at rest or to continue in uniform motion in a straight line unless some force is applied to them. Know that this is Isaac Newton's first law of motion. Recognize examples of inertia; for example, when people are traveling in a car that comes to a sudden stop, they lunge forward (since they have a tendency to continue in the uniform motion they were in, and they must be decelerated). Identify Newton's second law of motion (force = mass \times acceleration). Identify the third law, which states that for every action there is an equal and opposite reaction.
- _____ Understand the concept of work and recognize applications of simple machines (wedge, pulley, lever, screw, and inclined plane) in common tools.
- _____ Understand that density is mass per volume, and that what is denser than something else at the same volume will have more mass, but at the same mass will have less volume. Understand that less dense bodies have greater buoyant force in water.
- _____ Understand that the gravitational force between two bodies decreases as the bodies get farther apart from each other. Know that the gravitational force between two bodies decreases as their masses decrease.

- _____ Understand how to calculate average speeds, given the distance traveled and the time taken. Compute the distance covered, given the uniform speed and the time of travel; compute the time taken, given the uniform speed and the distance covered.
- _____ Distinguish between mass and weight. Know that the mass of a body remains the same regardless of where it is, but that the weight of it depends on how strong the force of gravity is in its current location.
- _____ Explain and predict motions in inertial and accelerated frames of reference.

EARTH SCIENCE

The Earth's Structure

- _____ Understand that lithospheric plates constantly move at rates of centimeters per year in response to movements in the mantle. Understand that major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions. Understand that over very long periods of time (millions of years), old mountains wear down, but new ones arise from catastrophic volcanic and earthquake activity.
- _____ Understand that land forms are the result of combination of constructive and destructive forces. Understand that constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, whereas destructive forces include weathering and erosion.
- _____ Understand that soil consists of weathered rocks and decomposed organic material from dead plants, animals, and bacteria. Understand that soils are often found in layers, with each having a different chemical composition and texture.
- _____ Understand that glaciers can move at a rate of centimeters per year (sometimes faster), and that in the past, glacial movement has carved new geological features on various continents.
- _____ Understand that radioactive elements are useful for dating materials because the time it takes for the atoms in them to break apart is known. Know that this information can be used to determine the age of a rock within a certain number of years.
- _____ Understand that there are strata (layers) in many places in the crust of the earth. Understand that the crust of the earth is mostly igneous/metamorphic, with a relatively thin veneer of sedimentary rock layers in many, but not all places. Understand the principle of superposition: in a layered sedimentary sequence, the oldest rocks are usually at the bottom.

The Earth's Dynamic Processes

- _____ Compare seasonal climates in major regions of the globe, considering effects of latitude, altitude, and geography. (i.e., 1. Higher altitude generally means colder temperatures, and lower air pressure; 2. Places along the equator have a 12 hour day and a 12 hour night every day of the year, and do not have strict seasons; 3. Places along latitudes between the equator and one of the earth's poles have seasons, and differing amounts of daylight throughout the year: they have a longest day, a shortest day, and two equinoxes on which the daylight lasts for 12 hours; 4. Places along the Arctic and Antarctic circles have one day of exactly 24-hour daylight, and one day of exactly 24-hour darkness each year).

- _____ Understand that the solid Earth is layered with a crust, under which is a hot convecting mantle, and that at the center of the earth is a dense, metallic core.
- _____ Understand that some changes in the solid earth can be described as the rock cycle: rocks at the earth's surface weather, forming sediments that are buried, then compacted, heated, and often recrystallized into new rock. Eventually, those new rocks may be brought to the surface by the forces that drive plate motions, and thus the rock cycle continues. Identify the three basic kinds of rock. Igneous rock is the result of cooled magma; granite, pumice, and scoria are examples. Sedimentary rock is the result of fine particles from eroded rocks being re-deposited by water or wind; sandstone and limestone are examples. Metamorphic rock is the result of rocks being changed by high temperatures and/or pressures; marble is an example.
- _____ Understand that the theory of plate tectonics explains the formation and movement of the earth's plates. Understand that the similar contours of the continents, seafloor spreading, and the location of frequent earthquakes and volcanoes provide evidence for plate tectonics.
- _____ Understand that movements of the earth's continental and oceanic plates have affected the distribution of living things on Earth. Understand that major earthquake and volcanic activity can give rise to new mountain ranges, severing different species from each other, which from then on undergo independent lines of gradual change, each adapted to its own, new ecosystem.
- _____ Understand that changes in climate (e.g., the ice ages) have affected the distribution of living things on Earth. A change in climate from warm to cold might force many animals to move closer to the equator in order to survive. Identify dynamic forces that affect land and water distributions between solid Earth, oceans, atmosphere, and organisms.
- _____ Understand that geologic layers and radioactive dating of rocks and meteorites provide evidence that the earth is about 4.6 billion years old, and that life has existed on Earth for over 3 billion years.
- _____ Understand that life on Earth has been changed by major catastrophes (e.g., the impacts of asteroids and volcanic eruptions).

The Atmosphere

- _____ Understand that the atmosphere is a mixture of nitrogen, oxygen, argon, and trace gases that include water vapor and carbon dioxide. Understand that atmospheric conditions change as one changes altitude.
- _____ Understand that clouds, formed by the condensation of water vapor, affect weather and climate. Understand that clouds cause precipitation and lightning, and that they insulate heat and moisture in the air.
- _____ Understand that patterns of atmospheric movement influence local weather. Understand that oceans have a major affect on climate because water in the oceans holds and distributes a large amount of heat.

Water

- _____ Identify the basic stages in the hydrologic cycle on Earth, namely evaporation, condensation, and precipitation.
- _____ Understand that water is a solvent.
- _____ Know that about three fourths of the earth is covered with water. Understand that most of the earth's water is salt water (oceans), and only about 3 percent of the earth's water is freshwater. Know that freshwater is found mainly in icecaps, glaciers, lakes, rivers, and the atmosphere.

ASTRONOMY

- _____ Identify the relative positions of the earth, moon, and sun when the moon appears full, new, half, and when a lunar or solar eclipse occurs. From a diagram of the earth and sun in some definite position, identify what season it is at a given latitude in either hemisphere (and why). Understand how much daylight there will be at that latitude (and why). Given a diagram of the sun and the earth in some definite position with its axis of rotation drawn (and with the poles labeled), identify the earth in the positions of summer solstice, winter solstice, spring equinox, and fall equinox (for the northern hemisphere).
- _____ Define what a light year is, how many miles or kilometers it is, and know that galactic distances are measured in light years.
- _____ Understand that objects in the solar system are for the most part in regular and predictable motion. Know that those motions explain such phenomena as the day, the year, the phases of the moon, and eclipses.
- _____ Understand that gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system. Know that changes in gravitational forces explain the phenomenon of the tides.
- _____ Understand that rock samples taken by astronauts walking on the moon show that the earth and moon have a common history.
- _____ Identify the differences among the planets in our solar system: the four closest planets to the Sun are called the inner planets. The inner planets are small and have rocky surfaces. The five farthest planets from the Sun are called the outer planets. All outer planets except Pluto are much larger than Earth, are made of gases, and have no solid surfaces.
- _____ Understand that because it takes the moon the same amount of time to rotate on its axis as it does to revolve around the earth, the same side of the moon always faces the earth.
- _____ Understand that valleys on the surface of a planet or moon might be evidence that water is or once was there.
- _____ Understand that the speed of a planet's rotation is one cause of the daily variations in temperature on its surface.

_____ Understand that the cause of the earth's seasons and the change in the amount of daylight throughout the year is the tilt of its axis of rotation with respect to the plane of its orbit. Given a diagram of the earth depicting (1) its relative position to the sun and (2) the orientation of its axis of rotation and (3) some circle of latitude, identify the following: (a) what time of year it is (if the circle of latitude is other than the equator), and (b) whether there is more daylight or more dark hours at that time of year. Understand why the seasons and daylight hours in opposite hemispheres are opposite to each other.

_____ Understand that the sun is an average star. Know that a solar system consists of a sun and planets and other objects that revolve around it.

SAFETY and PRACTICES OF SCIENCE

_____ Identify potential hazards in the laboratory and the means of reducing them.

_____ Explain how peer review helps to assure the accurate use of data and improves the scientific process.

_____ Indicate that repeatability of results is necessary for the scientific community to accept someone's findings.

_____ Understand that one datum is not sufficient evidence for making a generalization. For example, if a drug is given to one cancer patient, and the patient is cured, this might be mere coincidence—the drug must be given to many cancer patients with the same results before there is some kind of evidence that it is a cure for cancer. Identify the kind of reasoning called induction, and know that the more cases that are seen, the greater the certainty of the generalization drawn from those cases.

_____ Understand that the scientific community establishes and observes certain conventions about nomenclature, units of measurement, and ways of presenting data.

_____ Identify the risks associated with: natural hazards (e.g., fires, floods, tornadoes, hurricanes, earthquakes, and volcanic eruptions), chemical hazards (e.g., pollutants in air, water, soil, and food), and biological hazards (e.g., pollen, viruses, bacteria, and parasites).

_____ Understand that important social decisions are made on the basis of risk/benefit analysis (e.g., whether or not to administer a smallpox vaccine).

_____ Understand that science influences society insofar as its theories enter into people's everyday thinking, and affect how they understand themselves and the world they live in.

SCIENCE, TECHNOLOGY, SOCIETY

_____ Identify important contributions to science and technology that have been made by individuals such as George Washington Carver, Jane Goodall, Wilbur and Orville Wright, Rachel Carson, Thomas Edison, Edward Jenner, Louis Pasteur, Anton van Leeuwenhoek, Elijah McCoy, Florence Nightingale, Daniel Hale Williams, Marie Curie, Benjamin Franklin, Alexander Graham Bell, Copernicus, Mae Jemison, John Muir, Benjamin Banneker, Elizabeth Blackwell, Charles Drew, Michael Faraday, Galileo Galilei, Percy Lavon Julian, Ernest Just, and Carl Linnaeus.

- _____ Understand that society influences science because social priorities often influence research priorities.
- _____ Understand that natural resources are materials from the environment that are used by people. Distinguish between renewable and non-renewable resources.
- _____ Understand that pollution is the contamination of soil, water, or the atmosphere by the discharge of harmful substances.
- _____ Understand that fossil fuels meet most of our energy needs. Know that fossil fuels include coal, oil, and natural gas. Understand that burning fossil fuels can harm the environment, and that this constitutes one type of pollution.
- _____ Recognize that technologies made possible by science can be harmful as well as beneficial (e.g., Einstein's theories contributed to the development of the atomic bomb).
- _____ Recognize the common units of the metric system—especially units of length, volume, and mass—and interpret the symbols for these units.
- _____ Work in both Celsius and Fahrenheit, and understand the differences between these types of measurement.
- _____ Multiply lengths of sides to calculate the volume of a solid contained by rectangular faces. Understand that the best way to find the volume of an irregular solid is to measure how much water it displaces.
- _____ Select appropriate scientific instruments and technological devices to take measurements, perform calculations, organize data, or make observations.