

## Earth and Space Sciences Grade Level Indicators

### **Grade Four**

#### *Earth Systems*

1. Explain that air surrounds us, takes up space, moves around us as wind, and may be measured as barometric pressure.
2. Identify how water exists in the air in different forms (e.g., in clouds, fog, rain, snow and hail).
3. Investigate how water changes from one state to another (e.g., freezing, melting, condensation, evaporation).
4. Describe weather by measurable quantities such as temperature, wind direction, wind speed, precipitation, and barometric pressure.
5. Record local weather information on a calendar or map and describe changes over a period of time (e.g., barometric pressure, temperature, precipitation symbols, cloud conditions).
6. Trace how weather patterns generally move from west to east in the United States.
7. Describe the weather which accompanies cumulus, cumulonimbus, cirrus and stratus clouds.

### **Grade Seven**

#### *Earth Systems*

1. Explain that Earth's capacity to absorb and recycle materials naturally (e.g., smoke, smog, sewage) can change the environmental quality depending on the length of time involved (e.g. global warming).
2. Describe the water cycle and explain the transfer of energy between the atmosphere and hydrosphere.
3. Make simple weather predictions based on the changing cloud types associated with frontal systems.
4. Determine how weather observations and measurements are combined to produce weather maps and that data for a specific location at one point in time can be displayed in a station model.
5. Read a weather map to interpret local, regional and national weather.
6. Describe the connection between the water cycle and weather-related phenomenon (e.g., tornadoes, floods, droughts, hurricanes).

### **Grade Eight**

#### *Earth Systems*

Use models to analyze the size and shape of Earth, its surface and its interior (e.g., globes, topographic maps, satellite images).

## **Grade Nine**

### *Earth Systems*

1. Explain the relationships of the oceans to the lithosphere and atmosphere (e.g., transfer of energy, ocean currents, landforms).

### *Historical Perspectives and Scientific Revolutions*

2. Use historical examples to explain how new ideas are limited by the context in which they are conceived; are often initially rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly, through contributions from many different investigators (e.g., heliocentric theory and plate tectonics theory).

## **Grade Ten**

### *Earth Systems*

1. Explain climate and weather patterns associated with certain geographic locations and features (e.g., tornado alley, tropical hurricanes and lake effect snow).
2. Describe how organisms on Earth contributed to the dramatic change in oxygen content of Earth's early atmosphere.

### *Historical Perspectives and Scientific Revolutions*

3. Describe advances and issues in Earth and space science that have important long-lasting effects on science and society (e.g., geologic time scales, global warming, depletion of resources, exponential population growth).

## **Grade Eleven**

### *Earth Systems*

1. Explain heat and energy transfers in and out of the atmosphere and its involvement in weather and climate (radiation, conduction, convection and advection).
2. Explain the impact of oceanic and atmospheric currents on weather and climate.
3. Use appropriate data to analyze and predict upcoming trends in global weather patterns (e.g., el Niño and la Niña, melting glaciers and icecaps, changes in ocean surface temperatures).
4. Explain how interactions among Earth's lithosphere, hydrosphere, atmosphere and biosphere have resulted in the ongoing changes of the Earth system.
5. Explain the effects of biomass and human activity on climate (e.g., climatic change, global warming).
6. Interpret weather maps and their symbols to predict changing weather conditions worldwide (e.g., monsoons, hurricanes and cyclones).

### *Historical Perspectives And Scientific Revolutions*

7. Use historical examples to show how new ideas are limited by the context in which they are conceived; are often rejected by the social establishment; sometimes spring from unexpected

findings; and usually grow slowly, through contributions from many different investigators (e.g., global warming, heliocentric theory, theory of continental drift).

8. Describe advances in earth and space science that have important long-lasting effects on science and society (e.g., global warming, heliocentric theory, plate tectonics theory).