

## GLOBE Key Concepts – Chapter by Learning Activities

GLOBE Key Concepts - ATMOSPHERE	Observing, Describing and Identifying Clouds	Estimating Cloud Cover: A Simulation	Studying the Instrument Shelter	Building a Thermometer	Land, Water and Air	Cloud Watch	What's the difference (Land Cover)
1. Composition of the atmosphere; human influences on changes in the Earth's atmosphere							
2. Cloud formation (including water cycle) and identification	X					X	X
3. Clouds can be used to forecast / predict the weather						X	
4. Clouds can have a cooling/warming effect of clouds; effects of wind			X				
5. Earth's heat transfer is influenced by movement of water in the atmosphere					X		
6. Density (of rain, snow)							
7. Change of state; energy changes and changes in state; heat capacity							
8. Acids, bases, pH, pH measurement, buffers; acid precipitation and its effects							
9. Heat and temperature				X	X		
10. Heat transfer through radiation, conduction, and convection;			X	X	X		
11. Different substances transfer energy and heat at different rates; some materials are good conductors, some are good insulators			X	X	X		
12. Substances expand and contract as the temperature changes; coefficient of expansion				X		X	
13. Classification helps us organize and understand the natural world.	X			X			

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14. Models allow you to: study a process or phenomenon that would be difficult to study in other ways; compare the predicted values (using the model) and the measured values; modify input parameters in order to predict realistic changes in output.		<b>X</b>					

GLOBE Key Concepts – Chapter by Learning Activities

GLOBE Key Concepts - HYDROLOGY	Water Walk	Model Your Watershed	Water Detectives	The Acids, bases, pH, pH measurement, buffers Game	Practicing the Protocols	Water. Water Everywhere	Macroinvertebrate Discovery	Modeling Your Water Balance
1. Surface water exists in many forms and has many observable characteristics, such as temperature, color, smell, flow and shape.	X		X			X		
2. Water characteristics are closely related to the characteristics of the surrounding land.	X	X						
3. Water moves from one location to another (including the hydrologic cycle); moving water erodes the land.	X	X	X					
4. The nature of a watershed is determined by the physical features of the land.		X						
5. A watershed guides all precipitation and run off to a common watercourse or body of water.		X						
6. Human activities (including land development) affects water sources and the watershed		X	X					
7. Each organism has a range of water characteristics needed for survival and dictate its adaptability to a changing environment.								

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8. Macro-invertebrates are sensitive indicators of water quality.							X	
9. Water transparency and its affects on the growth of photosynthetic plants.				X		X		
10. Water chemistry is an important aspect of habitat requirements and affects species diversity and annual survivability.							X	
11. Water quality can be described using measurements that include temperature, dissolved oxygen, pH and salinity.								
12. Acids, bases, pH, pH measurement, buffers; the effect of acid rain, acid lakes and acid streams				X		X		
13. The role of water in chemical reactions; solutions, solvents, suspensions								
14. Temperature, heat, heat transfer								
15. Electrical resistance, conductivity, factors affecting conductivity								
16. Dissolved solids in water including: salinity, alkalinity, nitrates								

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17. Dissolved oxygen and factors that affect dissolved oxygen in water								
18. Specific gravity								
19. High and low tides								
20. Models allow you to: study a process or phenomenon that would be difficult to study in other ways; compare the predicted values (using the model) and the measured values; modify input parameters in order to predict realistic changes in output.		X						X
21. A map is a symbolic representation of a certain land area.		X						
22. Topographical maps provide 3-dimensional information about the land.		X						
23. Classification helps us organize and understand the natural world.							X	

## GLOBE Key Concepts – Chapter by Learning Activities

GLOBE Key Concepts - SOIL	Just Passing Through	From Mud Pies to Bricks	Soil & My Back-yard	A Field View of Soil – Digging Around	Soil as Sponges: How much water does soil hold?	Soil: The Great Decomposer	Making sense of particle size distribution measurements	The data game	Modeling your water balance (Hydrology)
1. Soil is composed of minerals, organic matter and open spaces.		X				X			
2. Soils vary within a small local area; soil properties change over time.			X	X		X			
3. There are many soil types including: sand, silt, clay and loam.								X	
4. Soil can be classified according to its properties and soil profile (horizon, color, texture, root distribution, pH of soil, particle size distribution)		X	X	X					
5. Soil properties are related to soil forming factors including: moisture content, temperature, land use, organisms, general climate, parent material and topography			X	X					
6. Soils hold moisture; soil properties affect flow rate, water holding capacity, nutrient filtering ability	X			X	X	X	X	X	X
7. Infiltration is the rate at which water flows into the ground; the rate changes depending on the level of soil saturation; soil water content varies around the world.	X				X	X		X	X
8. Decomposition in soil depends upon different environmental conditions.						X			
9. Soil fertility is a measure of stored nutrients (esp. N, P, K)									

## GLOBE Key Concepts – Chapter by Learning Activities

GLOBE Key Concepts - SOIL	Just Passing Through	From Mud Pies to Bricks	Soil & My Back-yard	A Field View of Soil – Digging Around	Soil as Sponges: How much water does soil hold?	Soil: The Great Decomposer	Making sense of particle size distribution measurements	The data game	Modeling your water balance (Hydrology)
10. Soil is an important building material.		X							
11. Different substances transfer energy and heat at different rates; some materials are good conductors, some are good insulators; soil is an insulating layer									
12. Acids, bases, pH, pH measurement, buffers									
13. Chemical reactions									
14. Specific gravity									
15. Density; bulk density									
16. Solutions, suspensions, particle size distribution, Stokes Law							X		
17. Electrical resistance									
18. Models allow you to: study a process or phenomenon that would be difficult to study in other ways; compare the predicted values (using the model) and the measured values; modify input parameters in order to predict realistic changes in output.									X

## GLOBE Key Concepts – Chapter by Learning Activities

<b>GLOBE Key Concepts - LAND COVER</b>	Leaf classification	How accurate is it?	What's the difference?	Odyssey of the eyes	Some like it hot!	Discovery area	Site seeing	Seasonal changes in the study site
1. Earth systems have inputs including: sun's energy, water, carbon dioxide, oxygen, dust; and outputs including: water, carbon dioxide, oxygen, heat.							X	
2. Earth system science studies the interactions of the atmosphere (air), hydrosphere (water), geosphere (land), biosphere (living organisms) and cryosphere (ice masses).								
3. System boundaries differ depending upon the question your study is asking.							X	
4. The GLOBE Study Site is a system with energy-, water-, and C, N, O, and P biogeochemical cycles, and elements such as trees, water, soil, rocks, and animals.							X	
5. Characteristics of the GLOBE Study Site include: pixel Size, canopy cover, ground cover, tree height and circumference, grass biomass, dominant and co-dominant species, GPS location, field measurements/biometry	X	X					X	
6. Biometry is the measurement of ground sites dominated by vegetation.								



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<b>GLOBE Key Concepts - LAND COVER</b>	Leaf classification	How accurate is it?	What's the difference?	Odyssey of the eyes	Some like it hot!	Discovery area	Site seeing	Seasonal changes in the study site
7. Landcover can be divided into the study of the canopy and the study of ground cover								<b>X</b>
8. Most of the Earth's surface is covered by naturally vegetated ecosystems which evolved in response to local geographic and climatic conditions.								
9. Plants absorb and cycle nutrients and water.								
10. Plants form the basic foundation of food chains.								
11. Plants and animals have specialized body parts adapted to living in a particular environment and are affected when land cover types change.		<b>X</b>						
12. Humans have extensively modified and replaced natural vegetation and type of land cover								
13. Classification helps us organize and understand the natural world; dichotomous keys can be used to classify living organisms.	<b>X</b>	<b>X</b>	<b>X</b>					
14. Magnetism, magnets, magnetic compasses								
15. The field of view is the area your eye or camera's eye can perceive; it increases the higher the eye is relative to the ground.				<b>X</b>	<b>X</b>			

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<b>GLOBE Key Concepts - LAND COVER</b>	Leaf classification	How accurate is it?	What's the difference?	Odyssey of the eyes	Some like it hot!	Discovery area	Site seeing	Seasonal changes in the study site
16. Student remote sensing involves observations made without the use of touch i.e. using eyes, ears, nose and skin surface				X	X			
17. Satellite remote sensing uses cameras sensitive to different wavelengths.				X	X			
18. Thermal radiation photography uses sensors to read the amount of heat radiated by an object; then interpret and digitize the information into a code.				X	X			
19. Image display is accomplished by conversion of stored data to a user-defined by color-coded image and creating a picture based on differences in the reflectance of light.				X	X			
20. Models allow you to: study a process or phenomenon that would be difficult to study in other ways; compare the predicted values (using the model) and the measured values; modify input parameters in order to predict realistic changes in output.								
21. A map is a symbolic representation of a certain land area.				X	X			

GLOBE Key Concepts – Chapter by Learning Activities

GLOBE Key Concepts - SEASONS	What can we learn about our seasons?	What are some factors that affect seasonal patterns?	How do seasonal temperature patterns vary among different regions of the world?	sharing local seasonal markers with other schools around the world?	Seasonal changes in your biology study site (LandCover)
1. Earth systems have inputs including: sun's energy, water, carbon dioxide, oxygen, dust; and outputs including: water, carbon dioxide, oxygen, heat.					
2. System boundaries differ depending upon the question your study is asking					
3. The Earth's axis of rotation is inclined with respect to the plane of its orbit around the sun; this causes seasonal changes that are driven by changes in the amount of the sun's energy reaching the Earth's surface.					
4. Sun – Earth seasonal relationships (solstice, equinox)					
5. Seasons have distinct characteristics.	X			X	
6. Seasonal changes demonstrate the interconnections among Earth's systems.	X	X		X	
7. Seasonal patterns differ based on geographic locations.	X	X	X	X	
8. Seasonal changes follow an annual cycle which can change from year to year.	X		X	X	
9. Seasonal temperature cycles vary.	X	X	X	X	
10. Seasonal patterns are influenced by latitude, elevation and geography.		X	X	X	
11. Seasonal changes impact the atmosphere, ecology (plant and animal adaptations), the soil and the hydrologic cycle					
12. Bud-break is the period in spring when leaf buds appear and grow.	X				X
13. Senescence is the period in the fall when actively growing plant material dies.	X				X

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GLOBE Key Concepts - SEASONS	What can we learn about our seasons?	What are some factors that affect seasonal patterns?	How do seasonal temperature patterns vary among different regions of the world?	sharing local seasonal markers with other schools around the world?	Seasonal changes in your biology study site (LandCover)
14. The Earth has many climate zones: polar, tropical, temperate, continental & marine.					
15. The amount of precipitation is affected by the amount of water vapor in the air and the temperature.					
16. The rising of heated air & sinking of cooled air drives atmospheric convection cells.					
17. Current weather conditions affect regional and global temperature patterns.			X		
18. Classification helps us organize and understand the natural world.	X	X			
19. Models and simulations allow you to: study a process or phenomenon that would be difficult to study in other ways; compare the predicted values (using the model) and the measured values; modify input parameters in order to predict realistic changes in output.			X		
20. A map is a symbolic representation of a certain land area.			X		

## GLOBE Key Concepts – Chapter by Learning Activities

GLOBE Key Concepts - GPS	What is the right answer?	Relative and absolute directions	Working with angles	Celestial navigation
1. A map is a symbolic representation of a certain land area; latitude and longitude are used to map locations.		X	X	X
2. Latitude and longitude can be measured indirectly using mathematical calculations that compare it to a nearby location whose latitude and longitude are known.				
3. The spatial relationship between Earth and celestial objects can be used to determine location on Earth; time and sun angle measurements can be used to determine the differences in latitude and longitude between two locations			X	X
4. The Global Positioning System (GPS) consists of a series of satellites, their ground control stations and users with GPS receivers; GPS receivers measures latitude and longitude with an accuracy of 30 meters using angles measured in degrees and minutes.	X		X	
5. Levels of measurement include mathematical techniques to determine the degree of accuracy of the measurement.	X			
6. Speed of sound				
7. Local time vs. Universal time	X			X
8. Formation of shadows				X
9. Magnetism, magnets and magnetic compasses; the Earth has a magnetic field; magnetic variations		X		X
10. Sun – Earth seasonal relationships (solstice, equinox)				X
11. Sun – Earth daily relationships			X	
12. Relative and absolute direction		X		

## GLOBE Inquiry Concepts – Chapter by Learning Activities

ATMOSPHERE Inquiry Concepts	Observing, Describing and Identifying Clouds	Estimating Cloud Cover: A Simulation	Studying the Instrument Shelter	Building a Thermometer	Land, Water and Air	Cloud Watch
1. Students set up a new, appropriate problem/application						
2. Students design an experiment			X		X	
3. Students specify measurements/variables to investigate			X		X	
4. Students pose relevant questions						
5. Observations and measurements are accurate and appropriate	X		X	X		X
6. Equipment is used properly			X	X	X	
7. Measurement Quality - Errors are detected			X	X	X	
8. Measurement Quality - Quality assurance procedures are employed (multiple, repeated readings, re-calibration)			X	X	X	
9. Identify data components				X		
10. Identify similarities and differences	X			X		
11. Explain reasons for differences			X	X		
12. Use appropriate mathematical procedures	X	X		X		
13. Infer patterns, trends			X	X		X
14. Explain data and relationships			X	X		X
15. Create multiple formats for representing data	X	X		X	X	
16. Compose informal and informal discourse to inform, explain, persuade	X		X	X		
17. Create and make presentations of key conclusions and findings			X			

## GLOBE Inquiry Concepts – Chapter by Learning Activities

<b>HYDROLOGY Inquiry Concepts</b>	Water Walk	Model Your Watershed	Water Detectives	The pH Game	Practicing the Protocols	Water. Water Everywhere	Macro-invertebrate Discovery	Modeling Your Water Balance
1. Students set up a new, appropriate problem/application						X		
2. Students design an experiment		X	X					
3. Students specify measurements/variables to investigate		X	X			X		
4. Students pose relevant questions	X	X				X	X	X
5. Observations and measurements are accurate and appropriate	X	X	X	X	X	X	X	X
6. Equipment is used properly			X	X	X	X	X	
7. Measurement Quality - Errors are detected				X	X	X	X	
8. Measurement Quality - Quality assurance procedures are employed (multiple, repeated readings, re-calibration)				X	X		X	
9. Identify data components						X		
10. Identify similarities and differences	X				X	X	X	X
11. Explain reasons for differences						X		X
12. Use appropriate mathematical procedures			X				X	X
13. Infer patterns, trends	X	X				X	X	X
14. Explain data and relationships	X	X		X		X		X
15. Create multiple formats for representing data	X					X	X	
16. Compose informal and informal discourse to inform, explain, persuade	X						X	
17. Create and make presentations of key conclusions and findings								

## GLOBE Inquiry Concepts – Chapter by Learning Activities

SOIL Inquiry Concepts	Just Passing Through	From Mud Pies to Bricks	Soil & My Back-yard	A Field View of Soil – Digging Around	Soil as Sponges ...	Soil: The Great Decomposer	Making sense of particle size ...	The data game
1. Students set up a new, appropriate problem/application								
2. Students design an experiment		X				X		
3. Students specify measurements/variables to investigate								
4. Students pose relevant questions	X							
5. Observations and measurements are accurate and appropriate	X	X	X	X	X	X	X	X
6. Equipment is used properly	X	X		X	X		X	
7. Measurement Quality - Errors are detected	X						X	X
8. Measurement Quality - Quality assurance procedures are employed (multiple, repeated readings, re-calibration)	X						X	X
9. Identify data components							X	
10. Identify similarities and differences	X	X	X	X	X			
11. Explain reasons for differences					X			
12. Use appropriate mathematical procedures					X		X	
13. Infer patterns, trends	X	X	X	X	X			
14. Explain data and relationships	X		X	X	X	X		
15. Create multiple formats for representing data				X	X		X	X
16. Compose informal and informal discourse to inform, explain, persuade					X		X	X
17. Create and make presentations of key conclusions and findings	X				X			



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LAND COVER Inquiry Concepts	Leaf classification	How accurate is it?	What's the difference?	Odyssey of the eyes	Some like it hot!	Discovery area	Site seeing	Seasonal changes in the study site
1. Students set up a new, appropriate problem/application								
2. Students design an experiment					X			
3. Students specify measurements/variables to investigate				X				
4. Students pose relevant questions								
5. Observations and measurements are accurate and appropriate					X		X	X
6. Equipment is used properly					X		X	X
7. Measurement Quality - Errors are detected					X		X	
8. Measurement Quality - Quality assurance procedures are employed (multiple, repeated readings, re-calibration)		X	X		X		X	X
9. Identify data components				X				
10. Identify similarities and differences	X	X	X	X	X	X	X	
11. Explain reasons for differences					X		X	
12. Use appropriate mathematical procedures		X	X					X
13. Infer patterns, trends	X	X	X	X				
14. Explain data and relationships		X	X			X		
15. Create multiple formats for representing data		X	X	X	X	X	X	
16. Compose informal and informal discourse to inform, explain, persuade								
17. Create and make presentations of key conclusions and findings						X		

## GLOBE Inquiry Concepts – Chapter by Learning Activities

<b>SEASONS Inquiry Concepts</b>	What can we learn about our seasons?	What are some factors that affect seasonal patterns?	How do seasonal temperature patterns vary among different regions of the world?	Sharing local seasonal markers with other schools around the world?
1. Students set up a new, appropriate problem/application				
2. Students design an experiment		<b>X</b>		
3. Students specify measurements/variables to investigate		<b>X</b>		<b>X</b>
4. Students pose relevant questions		<b>X</b>		
5. Observations and measurements are accurate and appropriate	<b>X</b>			
6. Equipment is used properly				
7. Measurement Quality - Errors are detected				
8. Measurement Quality - Quality assurance procedures are employed (multiple, repeated readings, re-calibration)				
9. Identify data components				
10. Identify similarities and differences		<b>X</b>	<b>X</b>	
11. Explain reasons for differences		<b>X</b>	<b>X</b>	
12. Use appropriate mathematical procedures				
13. Infer patterns, trends		<b>X</b>	<b>X</b>	
14. Explain data and relationships	<b>X</b>	<b>X</b>	<b>X</b>	
15. Create multiple formats for representing data	<b>X</b>	<b>X</b>	<b>X</b>	
16. Compose informal and informal discourse to inform, explain, persuade		<b>X</b>		<b>X</b>
17. Create and make presentations of key conclusions and findings		<b>X</b>		

## GLOBE Inquiry Concepts – Chapter by Learning Activities

GPS Inquiry Concepts	What is the right answer?	Relative and absolute directions	Working with angles	Celestial navigation
1. Students set up a new, appropriate problem/application				
2. Students design an experiment				
3. Students specify measurements/variables to investigate				
4. Students pose relevant questions				
5. Observations and measurements are accurate and appropriate		X	X	X
6. Equipment is used properly		X		X
7. Measurement Quality - Errors are detected		X		X
8. Measurement Quality - Quality assurance procedures are employed (multiple, repeated readings, re-calibration)		X		X
9. Identify data components	X			X
10. Identify similarities and differences	X			
11. Explain reasons for differences				
12. Use appropriate mathematical procedures	X	X	X	X
13. Infer patterns, trends	X			X
14. Explain data and relationships				
15. Create multiple formats for representing data	X			
16. Compose informal and informal discourse to inform, explain, persuade		X		
17. Create and make presentations of key conclusions and findings				