



Class 9 Science Chapter 13 – Important Questions

Earth as a System: Energy, Matter, and Life



New NCERT *Exploration* | 2026–27

Chapter 13 explains Earth as an interconnected system of **geosphere, hydrosphere, cryosphere, atmosphere and biosphere**, and covers **solar radiation, electromagnetic waves, insolation, albedo, atmospheric layers, greenhouse effect, ozone layer, winds, ocean currents, water cycle, carbon cycle, nitrogen cycle, oxygen cycle, eutrophication and human impacts**.



SECTION A – VERY SHORT ANSWER QUESTIONS

- 1. What is meant by Earth as a system?**
- 2. What is the geosphere?**
- 3. What is the hydrosphere?**
- 4. What is the cryosphere?**
- 5. What is the atmosphere?**
- 6. What is the biosphere?**
- 7. Name the five major spheres of Earth.**
- 8. What is solar radiation?**
- 9. What is electromagnetic radiation?**

10. What is insolation?
 11. What is albedo?
 12. What is the solar constant?
 13. What is the greenhouse effect?
 14. What is a greenhouse gas?
 15. What is the ozone layer?
 16. What is wind?
 17. What is an ocean current?
 18. What is a biogeochemical cycle?
 19. What is eutrophication?
 20. What is sustainable development?
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SECTION B – EARTH AS AN INTERCONNECTED SYSTEM

21. Explain the meaning of Earth as an interconnected system.
22. How are the geosphere, hydrosphere, cryosphere, atmosphere and biosphere interconnected?
23. Give one example of interaction between the geosphere and hydrosphere.
24. Give one example of interaction between the atmosphere and hydrosphere.

- 25. Give one example of interaction between the cryosphere and hydrosphere.**
- 26. Give one example of interaction between the biosphere and atmosphere.**
- 27. Why can a disturbance in one Earth sphere affect the other spheres?**
- 28. How can reduced snowfall affect lakes and vegetation?**
- 29. How can melting glaciers affect coastal regions?**
- 30. How can changes in Arabian Sea temperature affect the Indian monsoon?**

The textbook gives the example that reduced snowfall can lower lake levels and affect grass availability, while warmer Arabian Sea water can alter evaporation and monsoon rainfall.

SECTION C – SOLAR RADIATION

- 31. What is the main source of energy for most processes on Earth?**
- 32. In what form does solar energy reach Earth?**
- 33. Why can electromagnetic radiation travel through vacuum?**
- 34. What is the electromagnetic spectrum?**
- 35. Name the major regions of the electromagnetic spectrum.**
- 36. Which part of solar radiation is mainly responsible for photosynthesis?**
- 37. What is visible radiation?**
- 38. What is infrared radiation?**
- 39. What is ultraviolet radiation?**

- 40. Why does Earth not receive solar energy uniformly?
- 41. How does Earth's curved shape cause uneven heating?
- 42. How does latitude affect the amount of solar energy received?
- 43. Why do polar regions receive less solar energy than equatorial regions?
- 44. How does uneven heating drive winds and ocean currents?
- 45. What is the solar constant?

The chapter identifies the **Sun as Earth's main energy source** and explains that solar radiation reaches Earth as electromagnetic waves.



SECTION D – INSOLATION & ALBEDO

- 46. Define insolation.
- 47. What factors affect the amount of insolation received by Earth's surface?
- 48. What is albedo?
- 49. What does a high albedo mean?
- 50. What does a low albedo mean?
- 51. Why do snow and ice have high albedo?
- 52. Why do dark surfaces generally absorb more solar radiation?
- 53. How does albedo influence Earth's temperature?
- 54. How can melting ice contribute to further warming?
- 55. Differentiate between insolation and albedo.

56. Why is the albedo of Earth important for climate?

The chapter's revision material identifies **insolation** as the solar radiation reaching Earth's surface and **albedo** as the fraction reflected by a surface.



SECTION E – ATMOSPHERE

57. What is the atmosphere?

58. Why is the atmosphere important for life?

59. Name the major layers of the atmosphere.

60. What is the troposphere?

61. What is the stratosphere?

62. What is the mesosphere?

63. What is the thermosphere?

64. What is the exosphere?

65. In which atmospheric layer does most weather occur?

66. In which layer is the ozone layer mainly located?

67. Why does temperature vary between different atmospheric layers?

68. Which atmospheric layer is closest to Earth's surface?

69. Why is the atmosphere essential for maintaining suitable temperatures on Earth?



SECTION F – GREENHOUSE EFFECT

- 70. What is the greenhouse effect?**
- 71. What are greenhouse gases?**
- 72. Name important greenhouse gases.**
- 73. How does the natural greenhouse effect keep Earth warm?**
- 74. Why is the natural greenhouse effect necessary for life?**
- 75. What is meant by enhanced greenhouse effect?**
- 76. How do human activities increase greenhouse gas concentrations?**
- 77. How can increased greenhouse gases affect Earth's temperature?**
- 78. Differentiate between natural greenhouse effect and enhanced greenhouse effect.**
- 79. Why is carbon dioxide considered an important greenhouse gas?**
- 80. How can deforestation contribute to global warming?**

The chapter explains that greenhouse gases trap a portion of outgoing heat and identifies carbon dioxide as a greenhouse gas.



SECTION G – OZONE LAYER

- 81. What is the ozone layer?**
- 82. Where is the ozone layer mainly located?**
- 83. Why is the ozone layer important?**
- 84. What type of radiation does the ozone layer absorb?**
- 85. Why is excessive ultraviolet radiation harmful?**

- 86. How does the ozone layer protect living organisms?**
- 87. What could happen if the ozone layer becomes thinner?**
- 88. Differentiate between ozone and oxygen.**

The textbook identifies the ozone layer in the **stratosphere** and explains its role in absorbing harmful UV radiation.

SECTION H – WINDS

- 89. What is wind?**
- 90. Why does air move from one region to another?**
- 91. In which direction does wind generally move with respect to air pressure?**
- 92. How does uneven heating produce winds?**
- 93. What is a local wind?**
- 94. What is a valley breeze?**
- 95. What is a mountain breeze?**
- 96. Explain the formation of a valley breeze.**
- 97. Explain the formation of a mountain breeze.**
- 98. Differentiate between valley breeze and mountain breeze.**
- 99. What are planetary winds?**
- 100. Why are planetary winds formed?**
- 101. How do differences in heating between the equator and poles produce large-scale winds?**

102. How do winds influence weather and climate?

The chapter explains that wind is associated with pressure differences and that uneven heating drives both local and planetary wind systems.



SECTION I – OCEAN CURRENTS

103. What is an ocean current?

104. What causes ocean currents?

105. How does uneven heating contribute to ocean currents?

106. How do winds influence ocean currents?

107. How do ocean currents affect coastal climate?

108. Why are warm ocean currents important?

109. Why are cold ocean currents important?

110. How can ocean currents affect marine ecosystems?

111. How can changes in ocean temperature influence atmospheric conditions?

112. Explain the relationship between solar heating, winds and ocean currents.



SECTION J – WATER CYCLE

113. What is the water cycle?

114. What is evaporation?

- 115. What is transpiration?**
 - 116. What is condensation?**
 - 117. What is precipitation?**
 - 118. What is infiltration?**
 - 119. What is runoff?**
 - 120. Explain the main stages of the water cycle.**
 - 121. What is the role of the Sun in the water cycle?**
 - 122. How do plants contribute to the water cycle?**
 - 123. How does groundwater become part of the water cycle?**
 - 124. How can deforestation affect the water cycle?**
 - 125. How can human activities disturb the water cycle?**
 - 126. Why is the water cycle important for life?**
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SECTION K – BIOGEOCHEMICAL CYCLES

- 127. What are biogeochemical cycles?**
- 128. Why are biogeochemical cycles important?**
- 129. Name the major biogeochemical cycles discussed in the chapter.**
- 130. How do biogeochemical cycles connect living and non-living components?**
- 131. Why are nutrients continuously recycled in ecosystems?**

132. Differentiate between the water cycle and nutrient cycles.

133. How do human activities affect biogeochemical cycles?

SECTION L – CARBON CYCLE

134. What is the carbon cycle?

135. Where is carbon found on Earth?

136. How does photosynthesis remove carbon dioxide from the atmosphere?

137. How does respiration return carbon dioxide to the atmosphere?

138. How does decomposition affect the carbon cycle?

139. How does combustion affect the carbon cycle?

140. How do oceans participate in the carbon cycle?

141. How does deforestation affect the carbon cycle?

142. How does burning fossil fuels affect atmospheric carbon dioxide?

143. Why is the carbon cycle important for life?

144. Explain the carbon cycle with a suitable flow diagram.

SECTION M – NITROGEN CYCLE

145. What is the nitrogen cycle?

146. Why is nitrogen important for living organisms?

147. Why cannot most plants directly use atmospheric nitrogen?

148. What is nitrogen fixation?
149. What role do nitrogen-fixing bacteria play?
150. What is nitrification?
151. What is denitrification?
152. How do plants obtain usable nitrogen?
153. How do animals obtain nitrogen?
154. How does decomposition return nitrogen compounds to the soil?
155. Why is the nitrogen cycle important for agriculture?
156. How can excessive use of nitrogen fertilisers disturb the nitrogen cycle?
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SECTION N – OXYGEN CYCLE

157. What is the oxygen cycle?
158. How is oxygen released into the atmosphere?
159. What is the role of photosynthesis in the oxygen cycle?
160. How do respiration and combustion affect atmospheric oxygen?
161. How is carbon dioxide connected with the oxygen cycle?
162. Why is atmospheric oxygen important?
163. Explain the oxygen cycle.

The chapter's revision material identifies **photosynthesis as the main process restoring atmospheric oxygen**, while respiration, combustion and oxide formation use oxygen.



SECTION O – EUTROPHICATION

- 164. What is eutrophication?**
 - 165. What causes eutrophication?**
 - 166. How do excess nutrients enter water bodies?**
 - 167. What is an algal bloom?**
 - 168. How does excessive algal growth affect aquatic ecosystems?**
 - 169. Why can eutrophication reduce dissolved oxygen in water?**
 - 170. How can eutrophication lead to death of fish and other aquatic organisms?**
 - 171. How can excessive fertiliser use contribute to eutrophication?**
 - 172. Suggest measures to prevent eutrophication.**
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SECTION P – HUMAN IMPACT ON EARTH SYSTEM

- 173. How do human activities affect Earth's spheres?**
- 174. How does deforestation affect the atmosphere?**
- 175. How does deforestation affect the hydrosphere?**
- 176. How does deforestation affect the biosphere?**
- 177. How does burning fossil fuels affect Earth's climate?**
- 178. How does pollution affect the water cycle?**
- 179. How does excessive fertiliser use affect water bodies?**

180. How can urbanisation alter local climate?
181. How does climate change affect glaciers and polar ice?
182. How can melting glaciers affect sea level?
183. How can rising sea levels affect coastal cities?
184. How can human activities disturb biogeochemical cycles?
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SECTION Q – SUSTAINABLE ACTIONS

185. What is sustainable development?
186. What is meant by sustainable use of resources?
187. Why is conservation of water important?
188. How can we reduce our carbon footprint?
189. Suggest ways to conserve energy.
190. Suggest ways to conserve water.
191. How can planting trees help Earth's systems?
192. How can reducing waste help the environment?
193. What is Mission LiFE?
194. How can individual lifestyle choices contribute to environmental protection?
195. Why is collective action necessary to address environmental problems?
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SECTION R – APPLICATION-BASED QUESTIONS

196.  A large forest is cleared near the source of a river.

- a) Which Earth spheres are affected?
 - b) How could river flow change?
 - c) How could the biosphere be affected?
 - d) Explain the interconnectedness of Earth's spheres.
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197.  The temperature of Arabian Sea water increases significantly.

- a) How could evaporation change?
- b) How could this affect the southwest monsoon?
- c) What could happen to rainfall patterns in India?

The textbook itself asks how warming Arabian Sea water can influence the southwest monsoon.

198.  Himalayan glaciers are melting rapidly.

- a) Which Earth sphere is directly affected?
 - b) How could rivers be affected?
 - c) How could sea level eventually be affected?
 - d) How could coastal cities be affected?
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199.  Farmers use excessive nitrogen fertilisers near a lake.

- a) Which nutrient cycle is affected?
 - b) How can nutrients reach the lake?
 - c) What may happen to algae?
 - d) What is eutrophication?
 - e) How can aquatic life be affected?
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200.  A region experiences large-scale deforestation.

- a) How could atmospheric carbon dioxide change?
 - b) How could the water cycle be affected?
 - c) How could soil erosion increase?
 - d) How could local biodiversity change?
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SECTION S – COMPETENCY-BASED QUESTIONS

201. Case Study – Earth Spheres

A region experiences reduced snowfall for several consecutive years.

- a) Which Earth sphere is directly affected?
 - b) How could lake levels change?
 - c) How could vegetation be affected?
 - d) Which other spheres would be affected?
 - e) Explain why.
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202. Case Study – Solar Radiation

Two regions receive different amounts of solar energy.

- a) What causes uneven heating?
 - b) How does latitude affect insolation?
 - c) How can uneven heating produce winds?
 - d) How can winds influence ocean currents?
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203. Case Study – Greenhouse Effect

The concentration of carbon dioxide in the atmosphere increases.

- a) What happens to the greenhouse effect?
- b) How could Earth's average temperature be affected?
- c) How could melting ice change Earth's albedo?
- d) Explain the possible feedback.

204. Case Study – Eutrophication

A lake receives large quantities of fertiliser-rich runoff.

- a) What is likely to happen to algae?
 - b) What happens when large amounts of algae die?
 - c) Why can dissolved oxygen decrease?
 - d) What effect can this have on fish?
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205. Case Study – Human Impact

A forest is replaced by a large urban settlement.

- a) Which Earth spheres are affected?
 - b) How can the water cycle change?
 - c) How can surface temperature change?
 - d) How can biodiversity be affected?
 - e) Suggest two sustainable measures.
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SECTION T – HIGHER-ORDER THINKING QUESTIONS

206. Why is Earth described as an interconnected system rather than a collection of separate spheres?

207. Why can a change in one Earth sphere produce changes in several others?

208. Why does Earth receive uneven solar heating?

209. Why are equatorial regions generally warmer than polar regions?

210. Why does a high-albedo surface generally absorb less solar energy?

- 211. Why can melting snow and ice accelerate warming?
 - 212. Why is the natural greenhouse effect essential for life?
 - 213. Why can an increase in greenhouse gases lead to climate change?
 - 214. Why does most weather occur in the troposphere?
 - 215. Why does uneven heating produce wind?
 - 216. Why are ocean currents important in regulating climate?
 - 217. Why is water continuously recycled rather than permanently used up?
 - 218. Why are biogeochemical cycles essential for life?
 - 219. Why is excessive fertiliser use harmful to aquatic ecosystems?
 - 220. Why does deforestation affect both the carbon and water cycles?
 - 221. Why can melting glaciers affect people living far away from glaciers?
 - 222. Why is environmental conservation a shared responsibility?
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SECTION U – LONG ANSWER QUESTIONS

- 223. Explain Earth as an interconnected system of five major spheres.
- 224. Explain how energy flows through Earth's system.
- 225. Explain why Earth receives uneven solar heating.
- 226. Explain electromagnetic radiation and the major regions of the electromagnetic spectrum.

227. Explain insolation and albedo and their importance in Earth's energy balance.
228. Describe the layers of the atmosphere and their major features.
229. Explain the greenhouse effect and its importance.
230. Explain the importance of the ozone layer.
231. Explain how uneven heating produces local and planetary winds.
232. Explain the formation of valley and mountain breezes.
233. Explain ocean currents and their effect on climate.
234. Explain the water cycle with a labelled diagram.
235. Explain the carbon cycle with a flow diagram.
236. Explain the nitrogen cycle with a flow diagram.
237. Explain the oxygen cycle.
238. Explain eutrophication, its causes and effects.
239. Explain the major human impacts on Earth's interconnected systems.
240. Explain sustainable actions that can help protect Earth's systems.
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MOST IMPORTANT QUESTIONS FOR EXAM

If students have limited time, prepare these **first**:

- ★ 1. Explain Earth as an interconnected system of five spheres.
- ★ 2. What are geosphere, hydrosphere, cryosphere, atmosphere and biosphere?
- ★ 3. Explain why a disturbance in one Earth sphere can affect the others.

- ★ 4. Explain uneven heating of Earth by solar radiation.
 - ★ 5. Define insolation and albedo and explain their importance.
 - ★ 6. Explain the greenhouse effect.
 - ★ 7. Explain the importance of the ozone layer.
 - ★ 8. Explain the different layers of the atmosphere.
 - ★ 9. Explain the formation of winds due to uneven heating.
 - ★ 10. Differentiate between valley breeze and mountain breeze.
 - ★ 11. Explain ocean currents and their effect on climate.
 - ★ 12. Explain the water cycle with a diagram.
 - ★ 13. Explain the carbon cycle.
 - ★ 14. Explain the nitrogen cycle.
 - ★ 15. Explain the oxygen cycle.
 - ★ 16. What is eutrophication? Explain its causes and effects.
 - ★ 17. Explain how human activities disturb Earth's natural cycles.
 - ★ 18. Suggest sustainable actions to protect Earth's environment.
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QUICK REVISION BOX

 **Earth System** → Interacting spheres of Earth

 **Geosphere** → Rocks, soil, landforms and Earth's interior

 **Hydrosphere** → Liquid water

 **Cryosphere** → Ice and snow

 **Atmosphere** → Air surrounding Earth

 **Biosphere** → Living organisms and their habitats

-  **Solar radiation** → Main source of energy for Earth
-  **Electromagnetic waves** → Radiation through which solar energy reaches Earth
-  **Insolation** → Solar radiation received by Earth's surface
-  **Albedo** → Fraction of solar radiation reflected by a surface
-  **Greenhouse effect** → Warming caused by atmospheric gases trapping outgoing heat
-  **Ozone layer** → Absorbs harmful UV radiation
-  **Wind** → Movement of air due to pressure differences
-  **Ocean current** → Large-scale movement of ocean water
-  **Water cycle** → Continuous movement of water through Earth systems
-  **Biogeochemical cycle** → Cycling of elements between living and non-living components
-  **Carbon cycle** → Movement of carbon through atmosphere, organisms, soil, oceans and rocks
-  **Nitrogen cycle** → Movement and conversion of nitrogen through ecosystems
-  **Oxygen cycle** → Movement of oxygen through living and non-living systems
-  **Eutrophication** → Nutrient enrichment of water causing excessive algal growth and oxygen depletion
-  **Sustainability** → Using resources responsibly while protecting future needs
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TOP DIAGRAMS TO PRACTISE

1. Earth's Five Spheres

Geosphere ↔ Hydrosphere ↔ Cryosphere ↔ Atmosphere ↔ Biosphere

2. Electromagnetic Spectrum

Radio → Microwave → Infrared → Visible → Ultraviolet → X-rays → Gamma rays

3. Layers of Atmosphere

Troposphere → Stratosphere → Mesosphere → Thermosphere → Exosphere

4. 💧 Water Cycle

Evaporation → Condensation → Precipitation → Runoff/Infiltration → Collection

5. 🌿 Carbon Cycle

CO₂ → Photosynthesis → Plants → Animals → Respiration/Decomposition → CO₂

6. 🌱 Nitrogen Cycle

Atmospheric N₂ → Nitrogen Fixation → Soil Nitrogen → Plants → Animals → Decomposition → Atmosphere

7. 🫁 Oxygen Cycle

Photosynthesis → O₂ → Respiration/Combustion → CO₂ → Photosynthesis

8. 🌬️ Local Winds

Valley Breeze ↔ Mountain Breeze

★ EXAM TIP

For Chapter 13, students should focus especially on **cause** → **process** → **effect** questions.

For example:

Uneven solar heating → **pressure differences** → **winds** → **movement of air and water** → **changes in weather and climate**

And:

Excess fertiliser → **nutrient runoff** → **algal growth** → **decomposition** → **oxygen depletion** → **harm to aquatic life**

The chapter is designed around these connections between Earth's spheres rather than treating each process in isolation.