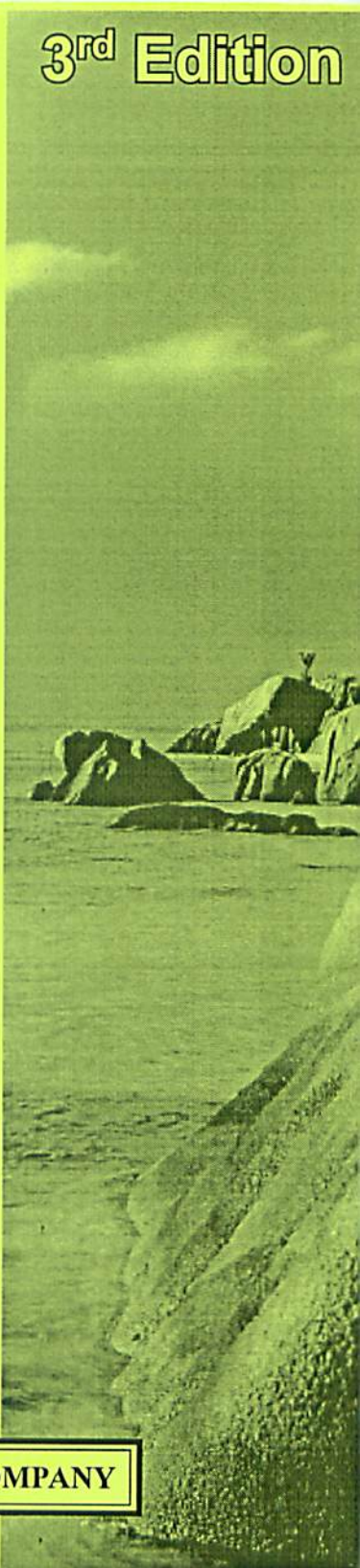


3rd Edition

Answer Key
With Explanations
for
Set 2
Questions

Earth
Science
Reference
Tables
Workbook

TOPICAL REVIEW BOOK COMPANY



Earth Science Reference Tables Workbook 3rd Edition

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EARTH SCIENCE
REFERENCE TABLES WORKBOOK
Set 2 Answers with Explanations

Radioactive Decay Data

12. 3 After the first half-life (5700 yr) 50 g remains, after the 2nd half-life (11,400 yr) 25 g remain.
13. 4 All radioactive elements undergo constant decay, their half-life periods do not change. It is not affected by external forces such as heat, pressure, etc..
14. 2 After the first half-life there would be 16 undecayed atoms (50%). After the 2nd half-life there would be 8, which is shown. Two half-lives would be 2,000 yr.
15. a) 1 On a radioactive decay graph, the half-life is positioned where the graph lines intersect, being 50%R - 50%NR.
b) 4 With a half-life of 5,000 yr, after 15,000 yr, 3 half-lives have passed and 12.5% is still radioactive.
c) 1 The coal has the least amount of the original radioactive material remaining. This makes it the oldest.
16. 2 Time 0 = 1000 mL, 30 s = 500 mL, 60 s = 250 mL, 90 s = 125 mL, 120 s (2 min) = 62.5 mL.
17. 17,100 yr – See the chart on Set 1, question 7 – page 3.
18. C-14 is used for dating relatively young organic material, while U-238 is used to date very old inorganic material.
19. a) 5,700 yr – The bar graph shows 50% has decayed. This equals one half-life.
b) 4.5×10^9 yr – The half-life period for U-238 is 4.5×10^9 yr.
c) The bar should be shaded up to the 75% line. – The second half-life period is always 75% NR and 25% R.

Specific Heats of Common Materials

8. 2 See Set 1, answer 2 – page 11.
9. 2 The lower the S.H., the faster it will heat up and cool down. This would be lead.
10. 1 The higher the S.H., the slower the substance will increase in temperature. This would be water.
11. 2 See Set 1, answer 2 – page 11.
12. A 10°C increase = lead, a 6°C increase = copper, a 4°C increase = basalt
– The higher the S.H., the faster its temperature would increase.

Properties of Water

7. 3 The chart shows that during melting 334 J/g are absorbed or gained.
8. 3 During vaporization 2260 J/g are absorbed or gained.
9. 3 2,260 J/g are released during condensation. For 10 grams, 22,600 J would be released.
10. 4 These sequences of phase changes are correctly listed for the different phases of matter.

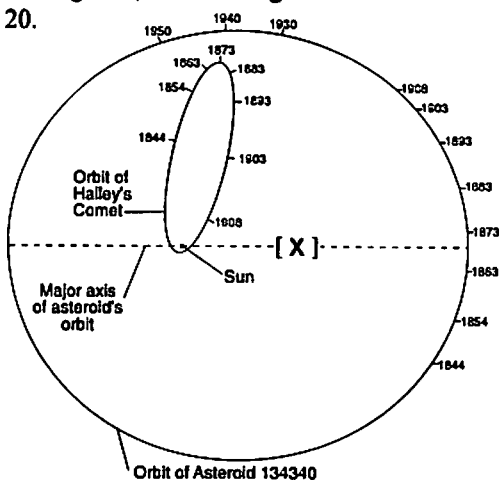
11. 1 At 3.98°C water is most dense (see bottom of chart, page 12), at a higher temperature it would be slightly less dense. Thus, as water is cooled from a higher temperature to 4°C, its density slightly increases.
12. Freezing and Condensation – The chart shows that during these two phase changes, heat is released.
13. Melting and Vaporization (evaporation or boiling) – The chart shows that during these two phase changes heat energy is gained.

Metric Ruler

5. 2 Use the given metric ruler to find the answer.
6. 4 The metric ruler shows that this mineral is 1 cm + 6 mm = 1.6 cm.
7. 1 The pebbles range between 0.5 cm and 2.2 cm, with the average size being close to 1.2 cm.

Eccentricity

10. 3 Venus having the lowest e value (0.007), thus must have the least elliptical orbit.
11. 2 Jupiter has an e value of 0.048, while Uranus is 0.047. Their orbit's shape would be almost the same.
12. 1 The least eccentric orbit would have the roundest shape.
13. 2 Planet's orbits are elliptical, with one foci being the Sun.
14. 1 $e = 1.0 \text{ cm} / 4.2 \text{ cm} = 0.24$. Mercury has an e value of 0.206.
15. 1 Due to the gravitational attraction to the Sun, all planets have their greatest orbital velocity when they are closest to the Sun. For Earth, this occurs in the winter.
16. 2 The Moon revolves around the Earth; therefore, one of its foci would be the Earth.
17. a) Eccentricity = distance between foci/length of major axis
b) $e = d/l = 4.0 \text{ cm} / 8.0 \text{ cm} = .5$
18. Planet D has a greater eccentricity than the other shown planets.
19. Becomes less elliptical or becomes rounder – When the foci are brought closer together, the resulting orbit becomes less elliptical.



- a) The **X** must be positioned within the bracket area as shown.
- b) Halley's Comet
Acceptable reasons include:
 - The comet traveled a greater distance during that time.
 - Halley's orbit is closer to the Sun.
 - The Asteroid's orbit is farther from the Sun.
- c) Acceptable responses include:
 - Halley's Comet orbits the Sun.
 - Halley's Comet is under the influence of the Sun's gravity.
- d) Halley's Comet – Its orbit is more elliptical.

Gradient

9. 2 The river begins around 225' and ends at 0'.
 $d = 20 \text{ mi}$ $G = 225' - 0'/20 \text{ mi} = 11.25'/\text{mi}$
10. a) 2 Position *D* is between the 75" and 100" isolines, 85" is between these values.
b) 43° N, 76° W $\pm 2^\circ$ – The greatest snowfall is within the circle of the 200" isoline. Use the latitude/longitude markings on the side of the map for the correct coordinates of this area.
c) 1 $A = 125''$ and $B = 150''$. This makes a change of field value of 25".
 $d = 100 \text{ mi}$ $G = 25''/100 \text{ mi} = 0.25''/\text{mi}$
11. A steep gradient would show contour lines that are close together.
12. 3 The contour interval is 20'. The change in field value between *X* and *Y* = 60'.
The distance is 1.8 mi. $G = 60'/1.8 \text{ mi} = 33'/\text{mi}$
13. a) 0.016 mb/km to 0.018 mb/km – Pressure at *A* = 1016 mb and *B* = 1000 mb,
change in field value = 16 mb, $d = 1000 \text{ km}$, $G = 16 \text{ mb}/1000 \text{ km} = 0.016 \text{ mb}/\text{km}$
b) Acceptable responses include, but are not limited to:
— The isobars are close together between Miles City and Pierre.
— There is a large pressure gradient between Miles City and Pierre.
— The feathers on the station models indicate strong winds in that area.

Rate of Change

5. 1 $Rc = 2'/40 \text{ yr} = 0.05'/\text{yr}$
6. 2 $Rc = 10 \text{ g}/5 \text{ min} = 2.0 \text{ g}/\text{min}$
7. a) Rate of change = change in value/time
b) $Rc = 300 \text{ km}/15 \text{ hr}$
c) $Rc = 20 \text{ km}/\text{hr}$ ($\pm 4 \text{ km}/\text{hr}$)

Density

6. 3 $m = (d)(v) = (3 \text{ g}/\text{cm}^3)(6 \text{ cm}^3) = 18 \text{ g}$
7. 1 From graph 1, go to the volume of 1 cm³. At this value, the mass would be 5 g. Using these values: $d = m/v = 5 \text{ g}/1 \text{ cm}^3 = 5 \text{ g}/\text{cm}^3$
8. 1 When an object is compressed, its volume decreases, causing its density to increase.
9. a) 2 $d = m/v = 320 \text{ g}/64 \text{ cm}^3 = 5 \text{ g}/\text{cm}^3$
b) 4 $m = (d)(v) = (3 \text{ g}/\text{cm}^3)(27 \text{ cm}^3) = 81 \text{ g}$
c) 3 The density value is independent of size. If an object is broken, the density of each piece would be the same as the original substance.
10. Heat causes air to expand. When the volume goes up, density goes down.

Average Chemical Composition

5. 2 The hydrosphere is the water sphere.
6. 2 In the crust, Al is 8.23% by mass, which is the highest of all metals.
7. 1 The chart shows that by volume the crust is 46.10 % oxygen.
8. 1 Adding up 46.10% for O and 28.20% for Si = 74.3%.
9. Crust or Lithosphere – The crust being a solid, is the densest.
10. Atmosphere or Troposphere (the first layer of the atmosphere)
– The gaseous atmosphere is the least dense of all the spheres.

Generalized Landscape Regions of NYS

11. 1 Interior lowlands are interior plains.
12. 2 Plateaus consists of elevated, horizontal strata. Erosion forms hills and valleys.
13. 4 Locate these cities from the Bedrock Geology chart. Using the Landscape map, Jamestown and Ithaca are both situated on the Allegheny Plateau.
14. 1 The Catskills are a part of the Allegheny Plateau. Agents of erosion have cup-up or dissected it to its present topography.
15. 3 The general rule is the higher the elevation, the more active are the forces of erosion.
16. 2 Weathering needs moisture. Physical weathering involves frost action, which needs a cold climate.
17. 1 Locate the Taconic Mountains on the Landscape map. As shown on the key on the Bedrock Geology map, the Taconic Sequence is intensely metamorphosed rocks.
18. 4 Plateau landscapes exhibit horizontal sedimentary layers.
19. 1 Landscape *A* describes features of a mountainous landscape. *B* describes a plain, while *C*, having horizontal layers with medium elevation, must be a plateau.
20. (1) The layers are horizontal. (2) The layers are at a medium to high elevation.
21. Allegheny Plateau and Erie-Ontario Lowlands – Located this river on the Bedrock Geology map. It flows over two different landscape regions as it empties into Lake Ontario.
22. Allegheny Plateau *or* Erie-Ontario Lowlands *or* Appalachian Plateau – The mineral deposits spread over these landscape regions.
23. Bedrock Characteristics: The Adirondacks have faulted, folded and deformed bedrock. *or* The Adirondacks have intensely metamorphosed bedrock. *or* The oldest bedrock is near the center of the Adirondacks.
Land Surface Characteristics: The Adirondacks have high elevations.
or The Adirondacks have steep slopes.
or The Adirondacks are a partially eroded dome.
24. Allegheny Plateau – Locate the Susquehanna River on the Bedrock Geology map. It flows over the Devonian bedrock of the plateau.
25. Adirondack Mountains – Using the latitude and longitude readings from the Bedrock Geology map, the given coordinates intersect northwest of Mt. Marcy within the Adirondacks.

Generalized Bedrock Geology of NYS

9. 4 The Hudson River flows south from the Adirondacks to the Atlantic Ocean.
10. 1 These coordinates locate the bedrock of Late Triassic and Early Jurassic. These epochs are part of the Mesozoic Era – the dinosaur era.
11. 1 Latitude reading for NYS are always N of the equator.
12. 1 Use the Landscape chart to locate the Hudson Highlands area on the Bedrock Geology chart. As shown by the Bedrock map key, this area is intensely metamorphosed bedrock.
13. 3 Elmira and Binghamton are both located on Devonian bedrock and would have the same surface fossils, being Devonian in age.
14. 2 These coordinates are position on Silurian bedrock between Rochester and Syracuse.
15. 2 The bedrock around the Finger Lakes is Devonian.
16. 2 The elevation of both lakes are given on the Bedrock Geology map. Water flows from high to low elevation
17. 3 The Mohawk river flows from Utica to Albany, discharging into the Hudson River.
18. 4 Use the Landscape chart to locate the Newark Lowlands on the Bedrock Geology map. From the Key, these rocks are intensely metamorphosed.
19. 1 The key shows that the Paleozoic layers are very abundant in NYS.
20. 1 The Geologic History of NYS chart shows Malurites (letter W) are Ordovician in age. The Bedrock map shows that Ordovician rocks are common in the area of the Tug Hill Plateau. See Landscape map, page 45.
21. 4 The map is showing the drainage area of the major rivers in NYS. These drainage areas are known as watersheds.
22. Becomes older – Elmira is on Devonian age rocks, and the bedrock becomes older as one heads NE to the oldest – Adirondack Precambrian bedrock.
23. Elmira's bedrock is Devonian and Phacops is a Devonian trilobite.
24. The angle of Polaris at Watertown would be higher than the angle at Binghamton.
or The angle of Polaris at Binghamton would be lower than the angle at Watertown.
– The angle of Polaris is equal to the latitude of the observer's location.

Surface Ocean Currents

6. 1 This cold, ocean current is shown above Antarctica.
7. 3 The atmospheric winds move the oceans (hydrosphere) surface currents.
8. 3 The key shows these currents are warm ocean currents.
9. 4 This current warms the north western coastal areas of Europe.
10. 4 The map and the key shows that these currents are cool currents, both flowing toward the equator.
11. 3 The Gulf Stream Current moves warmer ocean water north toward Canada.
12. 1 All of the ocean currents are the same. But, the global winds are different. Open to the Planetary Wind and Moisture Belts in the Troposphere. The directions of the winds below and above 30° N match choice 1.
13. California Current – The key shows this current is a cool current.

Tectonic Plates

7. 1 The ocean plate is thinner than the continental plate especially at ocean ridges.
8. 4 NYS is located near the middle of the North American Plate.
9. 1 The denser oceanic plate is basaltic, while the less dense continental plate is granitic in composition.
10. 4 See first bullet in the Additional Information section, page 67.
11. 3 A convergent plate boundary exists between these two plates – See Key area.
12. 2 The continental crust is less dense, thicker, and older in age than the ocean plate.
13. 2 In the plastic asthenosphere layer major convection currents are located.
14. 4 The Tectonic Plate map shows that hotspots are located on the continents as well as on the ocean floor.
15. 1 Locate the San Andreas Fault line on the map. Its motion matches that of transform plate boundary.
16. 1 The divergent plate boundary at the Mid-Atlantic Ridge is causing the continents on both sides of the ridge to spread farther apart.
17. 1 See first bullet in the Additional Information section, page 67.
18. Shape of the continents *or* the matching or correlation of bedrock *or* age of bedrock *or* extinct fossils *or* similar mountain ranges of the continents that are separated by the Atlantic Ocean.
19. a) C – Ocean ridges are positioned on divergent plate boundary.
b) Convection currents are the mechanics of how plates move or drift.
20. 34° N, 18° W \pm 3° – Use the coordinates found on the edges of this chart.
21. Divergent plate boundary *or* Mid-ocean ridge – The western side of this plate matches a divergent plate boundary.
22. Iceland is located on the Mid-Atlantic Ridge and is shown to be a hot spot. Volcanic activities are associated with these locations.
23. a) Subduction *or* convergence
– See answer 2, page 73.
b) Transform Plate movement *or* faulting *or* the plates slide past each other
– See the key area, transform fault.
24. A – convergent boundary, B – move apart or separate, C – two continental plates collide, D – San Andreas Fault, E – The Andes (on western South America) or the Peru-Chile Trench

Relationship of Transported Particle Size to Water Velocity

9. 3 Move up from the 75 cm/s position and the graph intersection occurs in the Pebbles section. This and all smaller sediments will be transported.
10. 3 The largest size sediments are deposited first when a stream enters a quiet body of water.
11. 1 At a speed of more than 0.2 cm/s, sand starts to move. At 200 cm/s boulders are being transported.
12. 4 Clay, being the lightest sediment, will be remain suspended the longest before settling.
13. 3 Area C matches the sediment size range for silt. Here, siltstone will be produced.
14. 1 As the steam velocity goes up, so does the particle size that can be transported.

Rock Cycle

7. 3 Uplifting brings rocks strata to the surface, where agents of erosion will weather and erode them.
8. 4 Heat and/or pressure are the processes needed for metamorphic rocks.
9. 1 The rock cycle (igneous rock section) does not support answer 1.
10. 2 From the rock cycle, see all the paths to SEDIMENTS.
11. Rock *A* – Sedimentary, Rock *B* – Metamorphic, Rock *C* – Igneous
12. Melting and Solidification – See the Rock Cycle for igneous rocks.
13. Compaction and/or Cementation *or* deposition and burial

Scheme for Igneous Rock Identification

10. 1 These mafic rocks are position on the right side of the chart. Locate MAFIC. As shown, they are rich in Fe and Mg.
11. 4 The texture is vesicular (gas pockets), making it an extrusive igneous rock that was quickly cooled.
12. 2 Lava produces extrusive rocks that cools quickly producing glassy (noncrystalline) or fine texture. Mafic rocks are located on right side of the chart, this makes them darker in color.
13. 3 Pumice, being on the left side of the chart, would contain the given minerals and its texture is vesicular.
14. 1 Volcanoes released lava, producing a glassy or a fine-grain texture.
15. 1 Diagram 1, represents an igneous rock with coarse crystals of different compositions.
16. 1 The picture shows coarse (large) crystals. Granite has a coarse texture and being located on the left side of the chart, would contain the given listed minerals.
17. a) Vesicular Rhyolite – Vesicular rhyolite is fine grain (making it extrusive) and is located on the left side of the chart and contain the minerals shown below it.
b) It would show/have different: mineral composition, color, density, composition – felsic vs. mafic
c) Must state any two of the following: non-crystalline, fine or vesicular texture, mafic in composition, darker in color, higher density, contains the minerals of: plagioclase feldspar, pyroxene, biotite, amphibole, and olivine.
18. Texture – Fine, Color – dark or green, Density – higher or greater or more dense

Scheme for Sedimentary Rock Identification

9. 3 In the Comment section for limestone it states “...biologic origin.”
10. 2 In the Comment section it states “Crystals from chemical precipitates.”
11. 4 From the Map Symbol column, layer *B* is sandstone, which experienced compaction and/or cementation – See Rock Cycle.
12. 2 The Grain Size column shows that sediments smaller than 0.005 cm are in the silt and clay range. These sizes produce siltstone and shale.
13. 4 See Comments section for Rock gypsum.
14. 4 Locate these minerals in the Composition column, then read the Comments section.

15. 4 Most caves are formed from limestone. Acidic water dissolves calcite that makes up limestone producing cave features.
16. 2 Halite forms rock salt. In the Comments section for halite, it states "...from chemical precipitates."
17. 4 The sedimentary rock shows cemented sediments, the igneous rock shows crystals, and the metamorphic rock exhibits banding.
18. 2 Area B is the correct sediment range sizes for sand particles
– See Grain Size column, page 89.
19. 4 In the Comment section for coal it states "Compacted plant remains."
20. 1 Fossils are found in sedimentary rocks. Most of these rocks are formed in a water environment.
21. a) Dolostone or Limestone – The composition of these two rocks are dolomite and calcite. In the Properties of Minerals chart it states "bubbles with acid."
b) Sandstone – This size particles is located in the grain size range of sand. Also read information in Composition column for sandstone.
22. a) Sedimentary rocks are made underwater.
or Sedimentary processes are not destructive to specimen's remains.
or Shells, being hard, produce good fossils when sediments are cemented and/or compressed to produce a sedimentary rock.

Scheme for Metamorphic Rock Identification

9. 2 Heat and pressure are the processes for metamorphic rocks. Gneiss is the only given metamorphic rock.
10. 4 Banding is a metamorphic texture – See Comments for Gneiss, page 96.
11. 2 Contact metamorphism will change sandstone into quartzite.
See Comments for Quartzite, page 96.
12. 4 See the Comments section for Metaconglomerate, see page 96.
13. 1 Locate Phyllite. The descriptive properties for this rock are listed in its row.
14. 3 Clay particles produce shale, which becomes slate when it is metamorphized.
See Comment section for Slate.
15. 3 Marble contains calcite (see Composition column). Calcite bubbles with acids
– See Calcite in the Properties of Minerals chart.
16. 2 Read Comments column for Slate and review – Type of Metamorphism – which shows the change of metamorphic rocks as heat and pressure increases.
17. 1 Gneiss consists of minerals segregated into wave bands.
18. a) Gneiss – The texture for Gneiss states "banding", which aligns the minerals.
b) Heat and pressure – These are the processes needed to form a metamorphic rock.
19. Marble – Dolostone is metamorphized into marble.
See Comments section for Marble.
20. Marble – Contact metamorphism of limestone produces marble.
See Comments section for Marble.

Geologic History of NYS

19. 4 The Trilobites bar in the Time Distribution of Fossils section spans the Paleozoic Era of which the Ordovician Period is part of.
20. 1 In the Important Geologic Events in NY column – Carboniferous Period – shows a diagram and gives information about this orogeny.
21. 2 In the Life on Earth column – Devonian Period – states “Earliest amphibians.”
22. 1 In the Time Distribution of Fossils section, the Brachiopods bar spans to the present time.
23. 1 In the Inferred Positions of Earth’s Landmasses column, it shows this northwest drift of North America.
24. 2 Use the Life on Earth column, to arrive at the correct appearance of the given organisms.
25. 4 In the Time Distribution of Fossils section, the Placoderm Fish bar spans the shortest time range.
26. 3 Dinosaurs became extinct 65.5 mya. At this time a mass extinction occurred that is believed to be caused by a major space impact. This would produce a major global climate change.
27. a) 3 The Life on Earth column shows that earliest birds appeared before earliest flowering plants.
b) 4 The Life on Earth column shows that earliest mammals appeared after earliest dinosaurs.
c) 1 Abundant grazing mammals appeared in the middle of the Cenozoic Era, where letter A is positioned.
28. a) X needs to be positioned close to the 470 mya position – See fossil T (Lichenaria) on the bottom of chart. T is positioned on the Coral bar in the Ordovician Period.
b) Cambrian – “a” is position close to 525 mya, which was during the Cambrian Period.
c) Alleghenian – In the Important Geologic Events column, is diagrammed the Alleghenian orogeny. Reading over to the Epoch time line bar, 290 mya is when this event was occurring.
d) *g* or *f* – *g* is approximately 290 mya and *f* is approximately 330 mya. For both of these time periods there is no bedrock or sediments bar in the NY Rock Record column.
e) Eospirifer – Fossil *Y* (see bottom of the chart) is positioned on the Brachiopods bar close to 425 mya, the estimated age of letter *d*.

Inferred Properties of Earth’s Interior

9. 4 As convection currents rise, they turn and move in opposite directions, thinning the ocean plate. Eventually magma escapes producing mid-ocean ridges.
10. 3 At the 6,300 km position on the Depth scale, move up to pressure graph line. At this intersection point, read over to the Pressure axis.
11. 1 Follow the dash line at the beginning of the inner core downward to the Depth axis.

12. 3 Read the information in the diagrammed core areas. The outer core is a liquid, while the inner core is a solid, both having much Fe and Ni in their composition.
13. 3 C is position on a mid-ocean ridge, where hot rising convection currents and escaping magma are located.
14. a) Rigid mantle – The rigid mantle and the crust make up the lithosphere.
b) Plastic mantle – This is the asthenosphere, where major convection currents circulate.
15. 1 See the sequence of layers as shown in the Earth's Interior diagram.
16. a) S-waves cannot pass through the liquid outer core.
b) 5000°C – Follow the dash line located at the beginning of the outer core downward to the Interior Temperature line.
c) around 1.5 millions of atmospheres – Follow the dash line located at the beginning of the outer core downward to the Pressure graph line.
17. 70 to 700 km – The given description is describing the asthenosphere. Follow the dash lines for the asthenosphere to the Depth axis.
18. 3.0 g/cm³ – See Density, located at the top right of the Earth's Interior diagram.

Earthquake P-Wave and S-Wave Travel Time

8. 4 Seismograms, studied by seismologists, have reveal much information on the Earth's interior.
9. a) 2 The separation time is 4 minutes. See procedure Answers, Set 1 no. 4 – page 130.
b) 2 Information from 3 seismograms are needed in order to located the epicenter, so 2 more are needed.
10. 2 Go up this distance to the P-wave line. Read the Time Travel axis to the left.
11. 1 These destructive waves are generated from underwater earthquakes.
12. 2 At the 6,000 km distance, move up to the P line. At this position, the separation time of the P-wave to the S-wave is 7:40. Add this time to 12:00:00 = 12:07:40.
13. 4 S-waves cannot penetrate the liquid outer core, but P-waves can.
14. a) 3 The distance between the epicenter and the seismic station is about 3,500 km. At this distance on the Epicenter Distance axis move up to the P-wave line and read over to the Time Travel axis.
b) 1 S-waves are slower than the P-waves.
15. 2 At this distance on the Epicenter Distance axis go directly up until the intersection of the S-wave line, read to the left to get travel time.
16. 2 The separation time is 10:30. See procedure Answers, Set 1 no. 4 – page 130.
17. 3 The separation time is 6:00. See procedure Answers, Set 1 no. 4 – page 130.
18. 4 It takes 2 min 40 sec for a P-wave to travel 1200 km. Subtract this time from the time it was recorded: 00:08:40 – 00:02:40 = 00:06:00, for the origin time.
19. 2 Station A, being the closest, would be the first to record the P-wave.
20. 1 The strength or magnitude of seismic waves are revealed by the height of the waves shown on a seismogram.
21. Secure heavy objects – have a first aid kit handy – have the house build to “earthquake proof specifications” – have an emergency plan in place – other answers may be acceptable.

22. a) The separation time of the *P* and *S* wave is greater at Station *A*.
or The arrival of the *P*-wave was later at Station *A*.
or The amplitudes of the wave tracings are greater on Station *B* seismogram.
- b) $15:50 \pm 10$ sec. – Go up this distance to the *S*-wave line, read the Travel Time axis to the left.

Dewpoint

8. 1 The difference is 5°C . See procedure given in Answers – Set 1, no. 1 page 135.
9. 1 The difference is 9°C . See procedure given in Answers – Set 1, no. 1 page 135.
10. 2 As these two temperature get further apart, the RH decreases causing the clouds to diminish.
11. Condensation – When the dewpoint is reach, water vapor changes to liquid droplets.
12. 3 When the difference between the air temperature and dewpoint temperature increases, the chance of precipitation decreases. This inverse relationship is shown by graph 3.
13. Condensation will occur – When the air and dewpoint temperatures are the same, condensation begins.
14. Sling psychrometer – See this instrument on page 132.

Relative Humidity

6. 4 The difference is 8°C . See the procedure given in Answers, Set 1 no. 1 page 141.
7. 4 The difference is 5°C . See the procedure given in Answers, Set 1 no. 1 page 141.
 For dewpoint the difference is still 5° . Use the dewpoint chart and same procedure.
8. 4 Go down the Dry-Bulb Temperature column stopping at 0°C . Move across in this row stopping at the RH value of 28%. This occurs in the 4°C difference column.
9. 3 Go down the Dry-Bulb Temperature column stopping at the 0°C . Move across in this row stopping at the RH value of 81%. This occurs in the 1°C Difference column. Go to the Dewpoint chart and go down the 1°C Difference column stopping at the Dry-Bulb Temperature of 0°C . The intersection of these two temperatures is at the -3°C box for dewpoint.
10. a) 2 The graph shows that as temperature goes up, the RH goes down.
- b) 3 At the noon, the RH is around 47% and the temperature is 8°C . Using the Temperature Scale to convert: $8^{\circ}\text{C} = 48^{\circ}\text{F}$.
- c) 4 Evaporation is highest when the air temperature is high and the RH is low.
- d) The Sun's is getting higher *or* Increase in the angle of insolation of the Sun
or The Sun is warming up the Earth while causing the RH to decrease.
11. 100% – Condensation has occurred to produce a fog. When this occurs RH is 100%.
12. water droplets – Condensation has occurred changing water vapor to droplets, which clouds are made of.
13. a) 66% – The difference is 4°C . Use the RH chart and this difference to arrive at the answer.
- b) Increases – As these two temperatures become closer, the RH will increase.
- c) Evaporation removes heat, causing the wet-bulb temperature to drop.

14. a) 100% – A cloud has an RH of 100%, because condensation has occurred forming the cloud.
- b) A decrease of air pressure – As an air parcel moves up in the atmosphere, the surrounding pressure decreases, causing the air parcel to expand.

Temperature

5. 3 24°C = 76°F and 20°C = 68°F
6. Celsius scale – This is what the Celsius scale is based on.
7. 68°F, 20°C, 293 K – See Room Temperature on Temperature scales.
8. 32°F, 0°C, 273 K – Ice melts at the same temperature that water freezes.

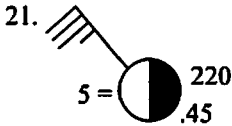
Air Pressure

9. 2 Locate 992.0 mb, read over to obtain the inches value.
10. 2 Warm air rises. Rising air, off the Earth's surface, produces less pressure.
11. 3 Without air molecules, there would be no air pressure.
12. 3 Add a 10 and a decimal to station model pressure readings that are less than 500.
13. 2 Add a 9 and a decimal to a station model pressure readings that are higher than 500.
14. 4 Drop the 10 and the decimal to arrive at the station model pressure reading.
15. 2 On station model pressure readings higher than 500, insert a 10 at the front of the reading and put in the decimal.
16. 3 Drop the 9 and the decimal to get the station model reading.
17. 4 As the air pressure gradient increases, the speed of the winds increase and isobars on a weather map become closer.
18. 4 The mb units and the in (inches) units represent air pressure readings.
19. 4 Winds blow from H pressure to L pressure regions.
20. a) 2.8 - 3.2 mb/hr – $RC = 1000\text{ mb} - 970\text{ mb} / 10\text{ hrs} = 30\text{ mb}/10\text{hr} = 3\text{ mb/hr}$
See page 34.
- b) Passage of a L-pressure system *or* Passage of a front – Precipitation is usually found at fronts. Moisture causes the barometer to drop, see last bullet page 145.

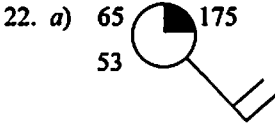
Key to Weather Map Symbols

15. a) 4 An air mass from the Gulf of Alaska would contain much moisture (m) and be cold (P).
- b) 2 Shown on the map is the symbol for a cold front. The cold air, which is behind the front, is moving in a southeast direction.
- c) 3 Air mass symbols are based on relative temperature and moisture conditions of the air mass.
16. 2 The m = maritime for water, and the T = tropical for warm temperatures.
17. 1 See Station Model Explanation section for visibility location.
18. 3 Adding a 10 and a decimal to the pressure reading becomes 1014.6 mb. The Present Weather symbol is for smog.
19. 2 When the dewpoint and air temperatures are the same, the RH is 100%.

20. 4 The cold front is moving southeast. When the front passes station A, the colder air will drop the temperature and it will remain cold throughout the night.



Note: Feathers for wind speed can be placed on either side of shaft.



Note: Feathers for wind speed can be placed on either side of shaft.

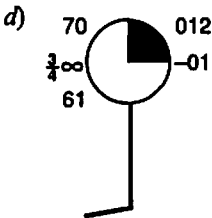
b) 25% *or* one quarter – This is the percentage that is shaded.

23. The area that the air mass had its origin. Here, it acquires its temperature and moisture properties.

24. a) 1020.1 mb – Since the station model air pressure is less than 500, add a 10 and decimal.

b) Utica's air and dewpoint temperatures are very close and the is cloud cover 100%. – As these temperatures become closer, the RH increases. The higher the RH, the greater the chance of precipitation.

c) 1019.1 mb – Niagara Falls has a barometric pressure of 1020.1 mb. The barometric trend has risen +10, which equals +1.0 mb in the last 3 hours. So, 3 hours ago it must have been 1.0 mb lower than now, or 1019.1 mb.



e) 1001.2 mb – Being less than 500, add a 10 and the decimal.

25. a) The denser, dry, cold air is forcing the less dense warmer, moist air upward. *or* its less dense *or* The cold air is displacing the warmer air.

b) Condensation – This process changes the invisible water vapor (g) to liquid water, which we see as a cloud.

c) Gulf of Mexico – This source area has much moisture (m), with warm temperatures (T).

d) Increase or goes up – Cold dry air, having a greater density will sink, produces high barometer readings.

26. Hurricane – evacuate, board up windows, secure all loose articles outside house, have a battery radio or a weather radio, have a supply of fresh water. (Other answers maybe acceptable.)

Tornado – get to a storm shelter, go to the basement or crawl space, have a first aid kit available, have a battery radio or a weather radio. (Other answers maybe acceptable.)

Selected Properties of Earth's Atmosphere

8. 2 All these properties exist in the stratosphere and are shown on the graphs.
9. 2 The spheres of the atmosphere are given on the Temperature Zones area of the chart.
10. 2 The greatest concentration (in August) is at an altitude of 17 mi or 30 km. This altitude is within the stratosphere.
11. 1 The top of the convection cell is 10 km. On the chart, the altitude scale shows that 10 km is in the troposphere.
12. Temperature – As the climber ascends in the troposphere, the temperature normally decreases. On the return trip the temperature normally increases.
Pressure – Pressure decreases as elevation increases, and would increase as elevation decreases.

Planetary Wind and Moisture Belts in the Troposphere

9. 3 As shown on the Planetary Wind globe, NYS is situated in the S.W. wind belt. Weather systems would be pushed toward the NE.
10. 4 Many hurricanes enter the Gulf of Mexico after traveling westward over the Atlantic Ocean. These systems are moved by planetary wind belts.
11. 3 The Planetary Wind globe diagram has “wet” at the equatorial area. On the side of the globe at the equator, are drawn rising air currents. Rising air produces low-pressure zones that release moisture.
12. 1 Descending air is compressed due to the increasing atmospheric pressure. This compression of air molecules causes the air to become heated.
13. 1 Heat causes the volume of a gas to expand. When volume increases, density decreases.
14. 2 The Equator is labeled a “wet” region. Other areas labeled “wet” are 60° N and S regions. The poles are very dry areas.
15. 3 The Planetary Wind globe diagram shows that at the “wet” equatorial zone, air is converging (moving toward each other). On the side of the chart at the equator, rising air is diagrammed.
16. a) 4 At the poles, air is extremely cold. Cold air cannot hold much moisture. The chart shows sinking convection currents over the poles.
b) 2 The Earth's rotation produces the Coriolis effect. This force causes a curvature or a change of direction of objects that move over our spinning Earth.
17. a) West *or* southwest – The gray area representing the ash, is spreading westward over the Pacific Ocean.
b) Planetary winds – The ash cloud is in the N. E. planetary wind belt. In this wind belt, air and the ash cloud is moving west. .
18. They enter a new wind belt. *or* They are push towards the NE by the SW wind belt.
– Hurricanes are pushed along by planetary wind belts. They will change directions when they enter a new wind belt.

Electromagnetic Spectrum

10. 4 X-rays wavelengths are between the shortest gamma wavelengths and longest UV wavelengths.
11. 1 Red is situated farthest to the right within the visible light spectrum. This position is on the increasing wavelength side.
12. 2 Ozone absorbs harmful UV rays.
13. 3 It is the wavelengths (short, long etc.) that determine the type of EM waves. Their speeds are the same – speed of light.
14. 3 The Sun's radiation consists of electromagnetic energy. This radiation energy needs no medium to travel through.
15. 3 Dark, rough surfaces absorbs much visible energy, with little being reflected.
16. 3 CO₂ is recognized as a greenhouse gas. These gases absorb infrared radiation that is radiated by the Earth.
17. 3 Visible wavelengths are between UV and infrared wavelengths.
18. 1 The chart shows that the average microwave wavelengths are longer than the average infrared wavelengths. Of the choices, 10⁻¹ cm is the only given wavelength that is longer than 10⁻³ cm.
19. 3 The diagram shows that the shaded area exists mostly in the visible range of the spectrum.
20. Wavelengths – It is the different wavelengths that produces the different types of electromagnetic waves.
21. As more forest areas are cleared, less CO₂ is removed from the atmosphere. CO₂, a greenhouse gas, absorbs infrared radiation.
or The burning of trees releases much CO₂, a greenhouse gas, into the atmosphere. Greenhouse gases absorbs infrared radiation.
22. More UV radiation can reach the Earth's surface.
or The greenhouse effect would be more severe.
or The average global temperature will rise.
or Skin cancer would increase.
or More eye damage would occur.
or We would be exposed to more UV rays.
or Climate would gradually change.
Other answers are possible.

Characteristics of Stars

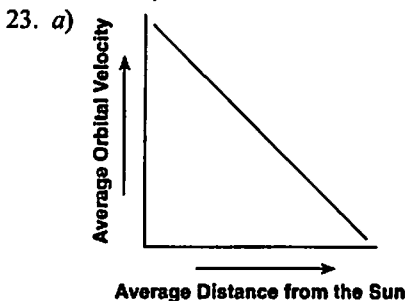
10. 3 Smaller stars on the Main Sequence, are positioned at the lower right side. At this position, they have low luminosity and cooler surface temperatures.
11. 4 Locate Spica position on the graph. Move directly down to the Surface Temperature axis to get its temperature.
12. 3 Open up to pg 115. The temperature at the mantle-core boundary is 5,000° C, which equals 5273 K (5000 + 273). Our Sun is very close to this temperature.
13. a) Nuclear fusion – This nuclear reaction produces the radiation energy of stars.
b) A line needs to be drawn between Venus and Earth. *or* up to Earth's orbit – This is stated in the passage.

14. It is more massive – A star may be cooler than our Sun, but if it is more massive, it will have a greater luminosity value.
15. a) Blue – The Temperature axis shows that blue color stars would radiate around 21,000 K.
- b) Sirius – Sirius is the only star that is located on the Main Sequence. Stars on the Main Sequence are in the early stages of evolution.
- c) Most luminous
- | | | |
|-----------------------|-----------|-----------------------|
| (1) <u>Rigel</u> | <i>or</i> | (1) <u>Betelgeuse</u> |
| (2) <u>Betelgeuse</u> | | (2) <u>Rigel</u> |
| (3) <u>Aldeharan</u> | | (3) <u>Aldebaran</u> |
| (4) <u>Sirius</u> | | (4) <u>Sirius</u> |
| (5) <u>Procyon B</u> | | (5) <u>Procyon B</u> |
- ↓
- Least luminous
16. As temperature increases so does luminosity. *or* It shows a direct relationship.
17. a) Its luminosity will increase as it moves to the Giant star area (intermediate stage), then its luminosity will decrease as it moves to the White Dwarf area (late stage). – Compare the path of the Sun to that on the Characteristics of Stars graph, noting the changing luminosity values it will undergo.
- b) 40 Eridani B *or* Procyon B – Both of these stars are white dwarf stars, which is the final predicted stage of our Sun.
- c) Dust and gases – This is shown on the given graph.
- d) Nuclear fusion – See first sentence, 2nd paragraph in Overview, see page 177.

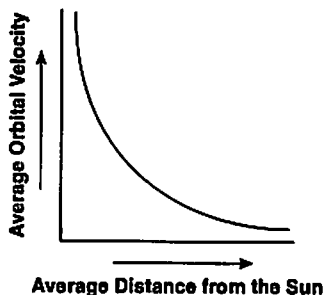
Solar System Data

10. 4 Mars with a density of 3.9 g/cm^3 , has the lowest density.
11. 2 Neptune is a giant gaseous planet, making it larger and less dense than the Earth.
12. 3 The closer an object is to the Sun, the faster it will revolve.
13. 4 Our Earth is 149.6 mkm from the Sun. $149.6 \times 30 = 4,488 \text{ mkm}$, which is close to Neptune's mean distance from the Sun.
14. 4 Our solar system is located in the Milky Way galaxy.
15. 2 Saturn and Neptune are also giant gaseous planets.
16. 3 Using the equatorial diameter column, it shows that Saturn diameter is slightly smaller than Jupiter.
17. 3 From the Earth's Moon data, it shows that the Moon's period of rotation equals its period of revolution. This makes the same side of the Moon to always face the Earth.
18. 1 The giant gaseous planets are less dense than the solid terrestrial planets.
19. 1 Venus period of rotation is the longest of all planets being 224.7 d.
20. a) Mercury – Mercury's equatorial diameter is 4879 km.
- b) The geocentric model has all celestial objects revolving around the Earth. *or* The moons orbit Jupiter, not Earth.

21. a) Saturn – Earth’s diameter is $12,756 \text{ km} \times 10 = 127,560 \text{ km}$. This is very close to the diameter of Saturn.
 b) Planet *B* is closer to the Sun than Planet *C*.
 or Planet *B* has more gravitational attraction to the Sun than Planet *C*.
 – The closer an object is to the Sun, the faster it will revolve.
22. 503 mkm or 503.15 mkm – Mar’s distance from the Sun is 227.9 mkm and Jupiter’s distance is 778.4 mkm. The average distance (where the asteroid belt is located) is: $227.9 \text{ mkm} + 778.4 \text{ mkm} = 1006.3/2 = 503 \text{ mkm}$.



or



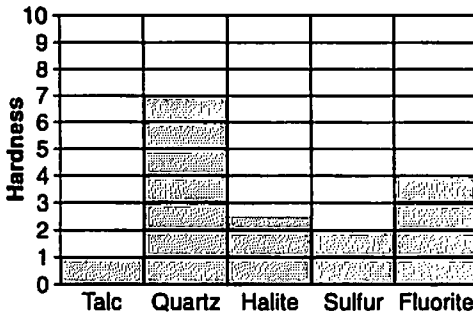
The closer a planet is to the Sun, the greater its orbital velocity will be.

- b) CO_2 or Venus contains a rich CO_2 atmosphere. or Venus has a runaway greenhouse effect. – CO_2 is a greenhouse gas that absorbs much infrared radiation. This is occurring in the atmosphere of Venus.

Properties of Common Minerals

13. 3 Both of these minerals have a hardness less than 2.5.
 14. 2 Use the Composition column and the chemical symbols given at the bottom of the chart for both of these minerals.
 15. 3 Halite has cubic cleavage. This 90° split is evident in the picture.
 16. 3 Quartz with a hardness of 7 will scratch the softer glass. Calcite’s having a hardness of 3 cannot scratch a higher hardness number as glass.
 17. 1 This is given in the USE(S) column.
 18. 4 The internal arrangement of the atoms determines the mineral crystal shape.
 19. 4 The chart shows that both of these minerals have “2 directions at 90° .”
 20. a) 1 Cleavage is the smooth splitting of a mineral. Streak is the mineral’s powder. Glass is one substance used to determine the hardness number of a mineral.
 b) 2 Identifying a mineral’s properties leads to the identification of the mineral.
21. Luster is the way a mineral shines, while streak is the color of the mineral’s powder when rubbed on an unglazed porcelain plate.
 22. Check their properties such as: cleavage angles, hardness and their chemical compositions. In this case taste them, halite is salt.
 23. A mineral containing a valuable substance, usually a metal.
 24. Mg or Magnesium – Use the Composition column for these two minerals..

25. a)



b) Mineral: Quartz

Reason: Hardest of the given minerals. *or* Quartz has a hardness of 7.

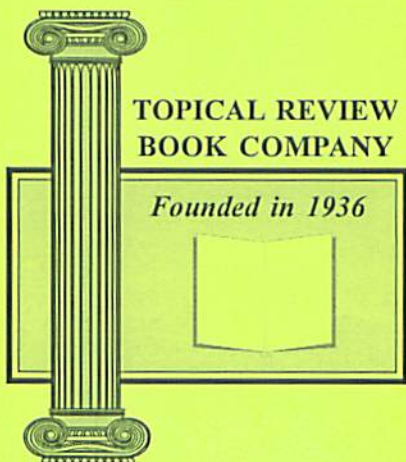
c) Talc and Sulfur – Both of these minerals have a lower hardness number than halite.

d) 10 – Diamond is the hardest of all minerals and is rated a 10 on the Moh's mineral hardness scale.

26. Luster – Group *A* are all in the nonmetallic luster column. Group *B* are all in the metallic luster column.

Latitude, Longitude and Time Zones

12. 4 As one travels from the equator to the North Pole, the angle of Polaris increases. The altitude of Polaris is equal to the observer's latitude.
13. 4 The Earth rotates one complete turn in 24 hours. This equals 360°/day or 15°/hr.
14. 3 The farther north one is, the higher Polaris would be. The Arctic Circle is 66.5°N.
15. 2 Latitude lines are measured N and S from the equator, but run E and W. These parallels get smaller as they approach the poles.
16. 2 The Prime Meridian is the 0° longitude line. The altitude of Polaris equals the northern latitude of the observer.
17. 3 $75^\circ = 5$ time zones ($75/15 = 5$). England being east would have a later time, 12 p.m. (noon) + 5 hrs = 5 p.m.
18. 3 Traveling on a latitude line, one does not get any closer to the North Pole, so the angle of Polaris would remain the same.
19. 2 a.m. – Each time zone going west would be one hour earlier.
20. 43° N – Since Polaris is observed to be 43°, the latitude of the observer must be 43° N.
21. a) 43° S, 67° W \pm 2° – F is very close to the 43° S latitude line and F is between the 60° W and 75° W longitude lines.
b) 6° N, 78° W \pm 2° – G is very close to the 6° N position. The longitude reading would be slightly more than the 75° W.
22. a) 34° N, 118° 30' W *or* 34° N, 118.5° W
– Use the coordinates located on the sides of the map.
b) 1 p.m. – Utah is east of Oakland by one time zone. Traveling east, the time becomes later 1 hour per time zone.



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