1. Base your answer to the following question on the diagram below which shows two identical houses, A and B, in a city in North Carolina. One house was built on the east side of a factory, and the other house was built on the west side of the factory. Both houses originally had white roofs, but the roof on house B has been blackened by factory soot falling on it over the years.

Compared to the amount of insolation reflected by the roof of house A, the amount of insolation reflected by the roof of house B is

A) usually less  
B) usually greater  
C) always the same  
D) less in summer and greater in winter

2. Equal areas of which type of Earth surface will absorb more insolation and radiate more energy back toward space in the same amount of time?

A) light colored and rough  
B) dark colored and rough  
C) light colored and smooth  
D) dark colored and smooth

3. One result of a large volcanic eruption is that surface air temperatures decrease over a sizable region of Earth. This phenomenon occurs because volcanic eruptions usually decrease the

A) transparency of the atmosphere  
B) number of dust particles entering the atmosphere  
C) amount of moisture in the atmosphere  
D) reflection of sunlight within the atmosphere

4. Which color is the best radiator of electromagnetic energy?

A) red  
B) white  
C) black  
D) yellow

5. A person in Florida worked outdoors in sunlight for several hours on a day in July. Which type of clothing should the person have worn to absorb the least electromagnetic radiation?

A) dark colored with a rough surface  
B) dark colored with a smooth surface  
C) light colored with a rough surface  
D) light colored with a smooth surface

6. Equal areas of which surface would most likely absorb the most insolation?

A) infrared  
B) ultraviolet  
C) visible  
D) X-ray

7. Which form of radiation given off by the Earth causes heating of the Earth's atmosphere?

A) infrared  
B) ultraviolet  
C) visible  
D) X-ray

8. If large amounts of dust are added to the atmosphere, the average air temperature will most likely

A) decrease due to increased reflection of insolation  
B) decrease due to increased infrared absorption  
C) increase due to increased reflection of insolation  
D) increase due to increased infrared absorption
9. The data table below compares the percentage of sunlight reflected from various types of Earth surfaces.

<table>
<thead>
<tr>
<th>Surface</th>
<th>Percent of Sunlight Reflected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh snow</td>
<td>80–85</td>
</tr>
<tr>
<td>Old snow</td>
<td>50–60</td>
</tr>
<tr>
<td>Sand</td>
<td>20–30</td>
</tr>
<tr>
<td>Grass</td>
<td>20–25</td>
</tr>
<tr>
<td>Dry soil</td>
<td>15–25</td>
</tr>
<tr>
<td>Wet soil</td>
<td>10</td>
</tr>
<tr>
<td>Forest</td>
<td>5–10</td>
</tr>
<tr>
<td>Water (Sun at sunset)</td>
<td>50–80</td>
</tr>
<tr>
<td>Water (Sun overhead)</td>
<td>3–5</td>
</tr>
<tr>
<td>Thick cloud</td>
<td>70–80</td>
</tr>
<tr>
<td>Thin cloud</td>
<td>25–50</td>
</tr>
</tbody>
</table>

Which statement is best supported by the table?

A) **Light-colored surfaces reflect more sunlight than dark-colored surfaces.**
B) Rough surfaces reflect more sunlight than smooth surfaces.
C) Soil surfaces reflect more sunlight than cloud surfaces.
D) Vegetative surfaces reflect more sunlight than ice surfaces.

10. Which diagram best represents visible light rays after striking a dark, rough surface?

A)

B)

C)

D)
Base your answers to questions 11 through 13 on the diagram below, which represents four stations, A, B, C, and D, in a laboratory investigation in which equal volumes of sand at the same starting temperature were heated by identical light sources. The light sources were the same distance from each station, but at different angles to the surfaces. Two thermometers were used at each station, one just above the surface and the other just below the surface. The lights were turned on for 30 minutes and then removed for the next 30 minutes. Temperatures were recorded each minute for the 60 minutes.

11. Which type of sand surface would most likely absorb the most radiation?
   A) dark-colored smooth surface  
   B) dark-colored rough surface  
   C) light-colored smooth surface  
   D) light-colored rough surface

12. Which graph best represents the temperatures that would be shown by thermometers 1 and 2 at station A?
   A)  
   B)  
   C)  
   D)  
13. After the light sources were removed, the electromagnetic energy radiated by the cooling sand was mostly
A) infrared rays       B) ultraviolet rays
C) gamma rays          D) visible light rays

14. Base your answer to the following question on the diagram and table below. The diagram shows a cross section of a solar-energy collecting system constructed as a portion of a wall of a house. It consists of an energy-absorbing surface, a clear glass covering, and air ducts through the wall into the house. The table gives the house temperatures during a spring day. No other heat source is available for the house.

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>House Air Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 a.m.</td>
<td>12</td>
</tr>
<tr>
<td>8 a.m.</td>
<td>14</td>
</tr>
<tr>
<td>10 a.m.</td>
<td>16</td>
</tr>
<tr>
<td>noon</td>
<td>19</td>
</tr>
<tr>
<td>2 p.m.</td>
<td>22</td>
</tr>
<tr>
<td>4 p.m.</td>
<td>20</td>
</tr>
</tbody>
</table>

For maximum absorption of solar radiation, the energy-absorbing surface should be
A) smooth and light colored       B) smooth and dark colored
C) rough and light colored       D) rough and dark colored

15. Which of the following Earth surfaces usually reflects the most incoming solar radiation?
A) snow cover       B) green grass
C) dark soil        D) lake water
16. The diagram below shows a cylinder filled with clean water. At the left of the cylinder is a light source, and at the right of the cylinder is a meter that measures the intensity (brightness) of light as it passes through the water. One minute after the light is turned on, a mixture of sand, silt, and clay is poured into the cylinder.

Which graph shows the probable change in light intensity (brightness) recorded during the 6-minute period after the light is turned on?

A)  
B)  
C)  
D)  

Base your answers to questions 17 and 18 on the graphs below which show the intensity and wavelength of radiation given off by the Earth's surface at locations A, B, and C. The temperature of the ground surface is shown for each location.

17. Which graph best represents the radiation intensity and wavelengths for another Earth location that has a temperature of 10°C?

A)  
B)  
C)  
D)  

18. Most of the energy being given off by the ground surface at these locations is

A) in the form of visible light  
B) in the form of gamma rays  
C) similar in intensity  
D) similar in wavelength  

19. When visible light strikes a snow-covered, flat field at a low angle, most of the energy will be

A) absorbed by the snow  
B) refracted by the snow  
C) reflected by the snow  
D) radiated by the snow
20. Base your answer to the following question on the following map and passage. The map shows the extent of summer ice-melt zones on Greenland in 1992 and 2002. The summer melt zone is an area where summer heat turns snow and ice around the edges of the ice sheet into slush and ponds of meltwater. Three coastal locations are shown on the map.

Arctic Meltdown

Scientists are concerned because average arctic temperatures are rising. The Greenland Ice Sheet, the dominant area of continental ice in the arctic region, broke all previous records for melting in 2002. In 2004, the total amount of ice resting on top of the continental crust in the arctic region was estimated to be about 3,100,000 cubic kilometers. If all this ice were to melt, the ocean levels would
rise approximately 8.5 meters. A reduction in ice-covered areas exposes more land surfaces. This increases absorption of insolation and accelerates arctic warming. Scientists continue to collect data to define the role of greenhouse gases in the warming of the arctic region.

A decrease in areas covered in snow and ice leads to an increase in the absorption of insolation because exposed land surfaces are

A) rougher and darker  B) rougher and lighter
C) smoother and darker  D) smoother and lighter

21. An increase in the transparency of Earth’s atmosphere is often caused by

A) a decrease in cloud cover  B) a decrease in solar radiation
C) an increase in airborne dust particles  D) an increase in the duration of insolation

22. Most insolation striking a smooth, light-colored, solid surface is

A) refracted  B) transmitted
C) reflected  D) absorbed

23. Which of these characteristics identify an Earth surface that is likely to be the best absorber of insolation?

A) light colored and smooth  B) light colored and rough
C) dark colored and smooth  D) dark colored and rough

24. As the concentration of pollution particles in the atmosphere increases, the amount of insolation that reaches the Earth's surface will most likely

A) decrease  B) increase
C) remain the same

25. The graph below shows atmospheric temperature variations on Earth between 1956 and 1993. The dates of three major volcanic eruptions are indicated.

What is the most probable reason that Earth's atmospheric temperature decreased shortly after each major volcanic eruption?

A) Water droplets produced by the eruptions absorbed terrestrial reradiation.
B) Ozone produced by the eruptions absorbed ultraviolet radiation from the Sun.
C) Volcanic dust from the eruptions blocked insolation.
D) Carbon dioxide gas from the eruptions blocked terrestrial reradiation.

26. Changing the color of the roof of a house from light to dark would probably increase the amount of solar energy that is

A) reflected  B) created
C) insulated  D) absorbed
27. The diagram below represents what normally happens to insolation as it enters the Earth's atmosphere.

An increase in cloud cover and water vapor within the Earth's atmosphere will cause an increase in

A) \text{A and B, only} \quad \text{B) A and C, only}
C) \text{C, only} \quad \text{D) B and C, only}

28. When Earth cools, most of the energy transferred from Earth’s surface to space is transferred by the process of

A) \text{conduction} \quad \text{B) reflection}
C) \text{refraction} \quad \text{D) radiation}
Base your answers to questions 29 through 31 on the diagrams and graphs below. The diagrams show the general effect of the Earth's atmosphere on insolation from the Sun at middle latitudes during both clear-sky and cloudy-sky conditions. The graph shows the percentage of insolation reflected by the Earth's surface at different latitudes in the Northern Hemisphere in winter.

29. According to the graph, on a winter day at 70° North latitude, what approximate percentage of the insolation is reflected by the Earth's surface?
   A) 50%          B) 65%          C) 85%          D) 100%

30. Which statement best explains why, at high latitudes, reflectivity of insolation is greater in winter than in summer?
   A) The North Pole is tilted toward the Sun in winter.
   B) Snow and ice reflect almost all insolation.
   C) The colder air holds much more moisture.
   D) Dust settles quickly in cold air.

31. Which factor keeps the greatest percentage of insolation from reaching the Earth's surface on cloudy days?
   A) absorption by cloud droplets
   B) reflection by cloud droplets
   C) absorption by clear-air gas molecules
   D) reflection by clear-air gas molecules

32. Compared to dull and rough rock surfaces, shiny and smooth rock surfaces are most likely to cause sunlight to be
   A) reflected          B) refracted
   C) scattered          D) absorbed
33. The diagram below represents energy being absorbed and reradiated by the Earth.

Which type of energy is represented by the radiation at $B$?

A) insolation  
B) visible light  
C) ultraviolet rays  
D) infrared energy

34. What is the most likely reason for a decrease in air temperature observed between 12 midnight and 6 a.m. in New York State?

A) Air pressure was decreasing.  
B) Cloud cover was increasing.  
C) The Earth was radiating heat.  
D) Plants were giving off water vapor.

35. Under identical conditions, which surface will reflect the greatest amount of insolation?

A) a basaltic sand beach  
B) a pine tree forest  
C) a glacial ice sheet  
D) a blacktop parking lot

36. How do clouds affect the temperature at the Earth's surface?

A) Clouds block sunlight during the day and prevent heat from escaping at night.  
B) Clouds block sunlight during the day and allow heat to escape at night.  
C) Clouds allow sunlight to reach the Earth during the day and prevent heat from escaping at night.  
D) Clouds allow sunlight to reach the Earth during the day and allow heat to escape at night.

37. The diagram below shows a light source that has been heating two metal containers of air for 10 minutes. Both cups are made of the same material and are equal distances from the light source.

Compared to the amount of energy reflected by the shiny cup during the 10 minutes of heating, the amount of energy reflected by the black cup is

A) less  
B) greater  
C) the same
38. The graph below shows the air temperatures recorded at a city in the United States on two days in July: a clear day and an overcast day.

Which statement best explains the differences in temperatures between the clear day and the overcast day?

A) Clear skies usually accompany a warm front.
B) Clear skies occur most often during nighttime hours.
C) Clouds increase the amount of heat energy escaping the Earth's atmosphere at night.
D) **Clouds prevent much of the Sun's heat energy from reaching the Earth's surface during the daytime hours.**

39. For weeks after a series of major volcanic eruptions, Earth's surface air temperatures are often

A) warmer because ash and dust decrease atmospheric transparency
B) warmer because ash and dust increase atmospheric transparency
C) **cooler because ash and dust decrease atmospheric transparency**
D) cooler because ash and dust increase atmospheric transparency
40. Base your answer to the following question on the diagram below, which represents the greenhouse effect in which heat energy is trapped in Earth's atmosphere.

The Earth surface that best absorbs short-wave solar radiation has which characteristics?

A) black and rough  B) black and smooth  
C) white and rough  D) white and smooth

41. Base your answer to the following question on the graph below which shows variations in Earth's monthly temperatures from normal Earth temperatures between January 1990 and January 1995.

In late summer 1991, Mt. Pinatubo, a volcano in the Philippines, exploded and sent thousands of tons of volcanic dust into the atmosphere. Scientists have suggested that Earth's average monthly temperatures for many months after the explosion generally were

A) cooler than normal due to the reflection of sunlight by volcanic dust  
B) cooler than normal due to the formation of a hole in the ozone layer by the explosion  
C) warmer than normal due to the heat released into the atmosphere by the volcanic explosion  
D) warmer than normal due to the heat spread by convection of the volcanic dust
42. A square meter of surface of which of these natural areas would most likely absorb the most insolation during a clear day?

A) a fast-moving river
B) a dark-green forest
C) a beach with white sand
D) a snow-covered field

43. Four trays, each containing sand at the same temperature but with different characteristics, were placed on a sunny windowsill. The type of sand in each tray is listed below:

Tray 1 -light-colored sand which is dry
Tray 2 -light-colored sand which is wet
Tray 3 -dark-colored sand which is dry
Tray 4 -dark-colored sand which is wet

After 30 minutes, which tray would probably contain the sand that had undergone the greatest temperature change?

A) 1  B) 2  C) 3  D) 4

44. Compared to a light-colored rock with a smooth surface, a dark-colored rock with a rough surface will

A) both absorb and reflect less insolation
B) both absorb and reflect more insolation
C) absorb less insolation and reflect more insolation
D) absorb more insolation and reflect less insolation

45. Which change would cause a decrease in the amount of insolation absorbed at Earth's surface?

A) a decrease in cloud cover
B) a decrease in atmospheric transparency
C) an increase in the duration of daylight
D) an increase in nitrogen gas

46. Base your answer to the following question on the diagram below, which represents a cross section of the shoreline of Lake Erie.

Which characteristics of the land surface have the greatest effect on the amount of insolation the land surface absorbs?

A) hardness and age
B) density and hardness
C) age and roughness
D) roughness and color
47. What is the usual cause of the drop in temperature that occurs between sunset and sunrise at most Kansas locations?

A) strong winds  
B) ground radiation  
C) cloud formation  
D) heavy precipitation  

48. Which type of land surface will most likely absorb the greatest amount of incoming solar radiation?

A) rough, dark-colored surface  
B) rough, light-colored surface  
C) smooth, dark-colored surface  
D) smooth, light-colored surface  

49. The diagram below shows four surfaces of equal area that absorb insolation.

Which letter represents the surface that most likely absorbs the greatest amount of insolation?

A) A  B) B  C) C  D) D  

50. On a sunny day at the beach, the dark-colored sand gets hot while the water stays cool because the sand

A) reflects less energy and has a lower specific heat than the water  
B) reflects less energy and has a higher specific heat than the water  
C) reflects more energy and has a lower specific heat than the water  
D) reflects more energy and has a higher specific heat than the water  

51. The diagram below indicates the amount of solar radiation that is reflected by equal areas of various materials on Earth's surface.

Which material absorbs the most solar radiation?

A) grassy field  B) fresh snow  
C) sand  D) forest