Group 1
1) A
2) A
3) C
4) A
5) A
6) C
7) C
8) E
9) A
10) A
11) B
12) A
13) A
14) E
15) B
16) B
17) D
18) D
19) A
20) A
21) C
22) C
23) B
24) D
25) D
26) C
27) C
28) B
29) C
30) C
31) A
32) E
33) C
34) A
35) B
36) A
37) C
38) B
39) C
40) C
41) D
42) C
43) B
44) E
45) D
46) D
47) C
48) B
49) C
50) A
51) D
52) D
53) C
54) D
55) B
56) E
57) E
58) C
59) E
60) B
61) D
62) A
63) A
64) B

Group 2
1) E
2) C
3) B
4) A
5) D
6) C
7) A
8) D
9) B
10) D
11) A
12) C
13) E
14) C
15) B
16) B
17) A
18) A
19) A
20) A
21) B
22) B
23) C
24) C
25) C
26) A
27) C
28) A
29) C
30) D
31) B
32) D
33) E
34) E
35) A
36) D
37) A
38) E
39) A
40) C
41) B
42) D
43) E
44) D
45) D
46) E
47) C
48) D
49) A
50) C
51) C
52) A
53) E
54) D
55) E
56) C
57) A
58) B
59) A
60) C
61) D
62) A
63) A
64) B

Group 3
1) B
2) E
3) E
4) C
5) D
6) E
7) B
8) A
9) D
10) B
11) E
12) B
13) C
14) E
15) B
16) B
17) E
18) C
19) A
20) D
21) A
22) A
23) C
24) B
25) D
26) A
27) C
28) A
29) C
30) C
31) A
32) A
33) B
34) D
35) D
36) C
37) B
38) A
39) C
40) C
41) E
42) B
43) E
44) E
45) C
46) C
47) C
48) B
49) B
50) D
51) B
52) E
53) E
54) B
55) C
56) A
57) D
58) E
59) C
60) A
61) D
62) A
63) A
64) B

1) Even though impacts still occur today, the vast majority of craters formed during the bombardment period that ended around 3.8 billion years ago. A surface region that is still saturated with craters must have remained essentially undisturbed for the last 3.8 billion years. In contrast, a surface region that has few craters indicates that the original craters must have been somehow "erased" since then.

2) It has what looks like dried-up riverbeds and impact craters that appear to have formed in mud; the Mars Pathfinder found rocks of many different types jumbled together, as would occur if there had once been a great flood in the region; some very old craters appear to have been eroded by rain.

3) Sunlight that is not absorbed by the atmosphere, such as visible light on Earth and visible and ultraviolet light on other planets, passes through to the surface of the planet, heating it. The planet then emits infrared radiation, depending on its surface temperature. Carbon dioxide, water vapor, and other greenhouse gases in the atmosphere absorb some of this infrared radiation. These gases in turn warm up and emit infrared thermal radiation in all directions. Some of this radiation is directed back down toward the surface, making the surface warmer than it would be from absorbing visible sunlight alone.

4) Diagram should look like Figure 10.6.

5) The Moon formed from a giant impact of a Mars-size object with Earth. This impact blasted material into Earth orbit that eventually coalesced to form the Moon.

6) To reach a fraction of 1/16, the meteorite has been through four half-lives, which means it is 4 × 1.3 billion = 5.2 billion years old. Since this is older than the solar system, it is probably a rock from interstellar space.

7)
1. Planets orbit in the same direction.
2. Orbital direction is the same direction as the Sun's spin.
3. Most planets spin the same direction that they orbit.
4. Bigger planets are in the outer solar system.
5. Large planets have many moons.
6. Planets lie in approximately the same plane.

8)
a) Every chemical element has a unique set of atomic energy levels and therefore a unique set of spectral lines. Thus, by identifying spectral lines, we can identify the elements that produced them.
b) hotter

9) The orbital period of the planet would be approximately the same as that of the earth (1 year). Kepler's law considers only the sum of the object masses. In comparison with the mass of the star, the mass of the planet can be neglected. Thus, even though the planet is twice as massive as Earth, its orbit will be nearly the same as that of Earth.

10) From Kepler's law, we see that the period depends on the inverse square root of the object masses. Thus, if we have a star four times as massive as the Sun, the period of a planet orbiting at 1 AU will be half that of the earth, or 6 months.