1 The DNA in some blood found at a crime scene is compared with the DNA of a suspect and is found to be different. Which of the following conclusions is correct?

a. The suspect was not at the scence.
b. The suspect was at the scene.
c. The suspect is innocent.
d. The suspect left blood at the scene.
e. The suspect did not leave blood at the scene.

2 Suppose that you try to lift an object by exerting an upward force of 5 Newtons on it. If gravity exerts a force of 10 Newtons downward on the object, what is the total force on the object?

a. 15 Newtons upward
b. 5 Newtons downward
c. 10 Newtons downward
d. 5 Newtons upward
e. 15 Newtons downward

3 Which of the following types of electromagnetic radiation has the shortest wavelength on this list?

a. red light.
b. microwaves.
c. infrared light.
d. green light.
e. ultraviolet light.

4 When viewed looking down from above the Earth's South Pole, the Earth

a. does not rotate.
b. rotates clockwise in the spring and counterclockwise in the fall.
c. always rotates counterclockwise.
d. rotates clockwise in the fall and counterclockwise in the spring.
e. always rotates clockwise.

5 The winter solstice occurs when the Sun is

a. farthest South of the Celestial Equator.
b. farthest North of the Celestial Equator.
c. closest to the Earth.
d. farthest from the Earth.
e. on the Celestial Equator.

6 Consider that a scientific statement is always vulnerable to being proven wrong. In the dispute between Galileo and the Inquisition, which one was treating the Copernican and Ptolemaic Systems as scientific statements?

a. Galileo.
b. the Roman Inquisition.
c. neither.
d. both.

7 X-Ray telescopes need to use mirrors that
   a. are kept extremely hot.
   b. use grazing angles of incidence.
   c. are made of wire mesh.
   d. are kept extremely cold.
   e. are extremely large.

8 The frequency of a wave is defined to be
   a. The number of crests that pass in one second.
   b. The time for a set of crests to pass divided by the number of crests.
   c. The number of seconds that it takes for a crest to pass.
   d. The distance from one crest to the next.
   e. The distance from a maximum to a minimum.

9 You see a telescope with a long tube and the eyepiece sticking out the side near the top. This telescope uses the
   a. Cassegrain Focus.
   b. Prime Focus.
   c. Coudé Focus
   d. Newtonian Focus.

10 A sidereal day is
   a. several hours shorter than a solar day.
   b. a few minutes longer than a solar day.
   c. just the same as a solar day.
   d. a few minutes shorter than a solar day.
   e. several hours longer than a solar day.

11 Freely falling objects with different masses fall with the same acceleration because
   a. gravity acts more strongly on the more massive object.
   b. gravity acts with less force on more massive object.
   c. gravity acts with the same force on both objects.
   d. there is no air resistance.
   e. they have the same amount of inertia.

12 The main reason that telescope mirrors can be much larger than lenses is that the mirrors
   a. are stronger because they are thicker.
   b. can be made of metal.
   c. can have holes in them.
   d. are lighter because they are thinner.

13 Polarized light consists of electromagnetic waves that all
   a. have the same wavefronts.
   b. have the same frequency.
   c. move in the same direction.
   d. have passed through the same narrow slit.
   e. have electric fields in the same direction.

14 In comparison to Kepler's Laws of Planetary Motion, Newton's theory of Universal Gravitation predicted
   a. the same motions interpreted differently.
   b. almost the same motions but with corrections.
   c. a completely different set of motions.
   d. exactly the same motions.

15 A converging lens will send the light from a distant star through a point
   a. at one edge of the lens.
   b. in the center of the lens.
   c. infinitely far away from the lens.
   d. on the side of the lens opposite the star.
   e. on the same side of the lens as the star.

16 The retrograde motion that puzzled the ancients occurs when
   a. Mars is near the Sun.
   b. Mars is in the opposite direction from the Sun.
   c. Venus is near Mars.
   d. Venus is far from Mars.
   e. Venus is in the opposite direction from the Sun.

17 Copernicus said that the daily motions in the heavens were caused by the
   a. earth and the planets orbiting the Sun.
   b. planets speeding up and slowing down.
   c. earth turning on its axis.
   d. planets moving on epicycles.
   e. planets turning on their axes.

18 We can use the pointer stars in the Big Dipper to locate a point in the sky near the
   a. Celestial Equator.
   b. South Celestial Pole.
   c. Star Sirius.
   d. East Celestial Pole.
   e. North Celestial Pole.

19 The Copernican System was first advocated in print by
   a. Ptolemy.
   b. Galileo Galilei.
   c. Michael Maestlin.
   d. Johannes Kepler.
   e. Tycho Brahe.

20 As compared to lower frequency electromagnetic radiation, higher frequency electromagnetic radiation will usually cause
   a. less damage.
   b. more damage.
   c. about the same damage.

21 Compared to ultraviolet light photons, the photons of visible light have
   a. higher energy.
   b. lower energy.
   c. about the same energy.
   d. higher energy in some cases, lower in others.

22 The changing phases of the Moon are caused by
   a. the motion of the Moon around the Earth.
   b. the changing distance to the Moon.
   c. the rotation of the earth on its axis.
   d. the tilt of the Earth's axis.
   e. the motion of the earth around the Sun.

23 Which of the following can be seen everywhere on the night side of the Earth?
   a. A New Moon.
   b. A partial eclipse of the Sun.
   c. A total eclipse of the Sun.
   d. A total eclipse of the Moon.
   e. A waxing quarter Moon.

24 The frequencies emitted by a hot gas are
   a. unrelated to those it absorbs when cold.
   b. exactly double those it absorbs when cold.
   c. always the same as those it absorbs when cold.

25 Newton's explanation of Kepler's Laws relied upon a force that
   a. acts only on heavenly bodies.
   b. acts on planets but not on comets.
   c. acts on all objects.
   d. acts only on inorganic matter.
   e. acts only on planets.

26 Which of the following tasks would *require* a non-science discipline?
   a. Designing an airplane.
   b. Repairing a motorcycle.
   c. Programming a computer.
   d. Finding a cure for cancer.
   e. Sentencing a criminal.

27 Light with an emission spectrum is usually generated by
   a. hot, dense material.
   b. light from hot dense material passing through a rarefied gas.
   c. a cold, rarefied gas.
   d. a hot, rarefied gas.

28 Which of Kepler's Laws governs how a particular planet speeds up and slows down?

a. The Law of Inertia.
b. The Period-Radius Relation.
c. The Equal Area Law.
d. Orbits are Ellipses.
e. The Law of Averages.

29 The diffraction limit is a problem for radio telescopes because it makes it

a. difficult for radio telescopes to be large.
b. necessary to collect a strong signal.
c. necessary for radio telescopes to be large.
d. difficult to collect a strong signal.

30 The red line of a spectrum is normally at a wavelength of 656 nm. In the light of a star that is moving away from us, we might expect to see that red line at a wavelength of

a. 660nm.
b. 656nm.
c. 650nm.

31 Kepler found that planetary orbits are

a. ellipses with the Sun at the center.
b. circles with the Sun off-center.
c. circles with the Sun at the center.
d. ellipses with the Sun at one focus.

32 Which of the following is a scientific statement (as defined by Popper)?

a. The Moon is made entirely of cheese.
b. Isaac Newton was the greatest scientist.
c. There is cheese on the Moon.
d. There is beauty in a sunset.
e. There is intelligent life on other stars.

33 In addition to being accurate, Tycho Brahe's observations focused on measuring the positions of the planets

a. all the time.
b. when they were in retrograde motion.
c. near the horizon.
d. during the solstices.
e. during conjunctions.

34 Compared to stars of other colors, a blue star will have a surface temperature that is

a. in the middle of the range.
b. among the lowest.
c. among the highest.

35 Mars is farther from the Sun than Earth. Which of the following statements is true?

a. Mars takes longer to go around the Sun than the Earth because it has farther to go, but actually moves at the same speed as the Earth.

b. Mars takes longer to go around the Sun than the Earth because it has farther to go, but actually moves faster than the Earth.

c. Mars takes less time to go around the Sun than the Earth does but moves slower because the Earth keeps making rest stops.

d. Mars takes less time to go around the Sun than the Earth and moves much faster.

e. Mars takes longer to go around the Sun than Earth and moves more slowly than the Earth does.

36 Tycho Brahe's careful observations of the planets agreed, to within observational error, with

a. the Ptolemaic System.

b. the Copernican System

c. the Tychonic System.

d. None of these systems.

37 Eclipses happen when the Full or New Moon occurs on the

a. Vernal Equinox.

b. Celestial Equator.

c. Winter Solstice.

d. Ecliptic.

e. Horizon.

38 A total eclipse of the Sun can be seen

a. Only near the Earth's equator.

b. Everywhere on the night side of the Earth.

c. Only in the Northern Hemisphere.

d. Everywhere on the day side of Earth.

e. Only along a narrow path.

39 Suppose that you drop two objects from the same height at the same time. Both objects are heavy enough to be unaffected by air resistance. If one object is twice as heavy as the other, Aristotle predicted that

a. both objects would hit the ground at the same time.

b. the heavier object would hit the ground long before the lighter one.

c. the lighter object would hit the ground long before the heavier one.

40 In comparison to the established, earth-centered theory, the Copernican Theory of planetary motion made predictions that were of

a. about the same accuracy.

b. much higher accuracy.

c. much less accuracy.

41 The wavelength of the sound waves that correspond to middle-C is about 4 feet. If you are standing 8 feet away from a piano that is playing that note, then between you and the piano there will usually be

a. one region of maximum pressure.
b. three regions of maximum pressure.
c. two regions of maximum pressure.
d. maximum pressure every two seconds.
e. maximum pressure every four seconds.

42 Electrons that are bound to the nucleus of an atom (so that energy is needed to remove them) can have

a. any positive energy at all.
b. only certain isolated positive energies.
c. any negative energy at all.
d. only certain isolated negative energies.

43 What total force will cause an object with a mass of 1kg to gain 10 meters per second every second?

a. 5 Newtons
b. 1 Newton
c. 9.8 Newtons
d. 2.5 Newtons
e. 10 Newtons

44 Who discovered Newton's First Law of Motion?

a. Kepler
b. Tycho Brahe
c. Galileo
d. Newton
e. Aristotle.

45 Adaptive optics is used to correct telescopes for

a. spherical aberration.
b. chromatic aberration.
c. atmospheric turbulence.
d. poor light collection ability.
e. the diffraction limit.

46 Suppose that a sound wave has a wavelength of 12 meters and a frequency of 100Hz. What is the speed of sound?

a. 100 m/s
b. 12 m/s
c. 0.012 m/s
d. 8.34 m/s
e. 1200 m/s

47 As seen from North America, the constellation Ursa Major
   a. sets in the north.
   b. never sets.
   c. sets in the west.
   d. sets in the south.
   e. sets in the east.

48 An ion rocket engine produces 5 Newtons of thrust. What acceleration can it give to a space probe with a mass of 1000kg?
   a. 5 m/s^2
   b. 0.5 m/s^2
   c. 0.005 m/s^2
   d. 0.05 m/s^2
   e. 5000 m/s^2

49 The first major failure of the Ptolemaic Theory to predict the results of observations was
   a. the Moons of Jupiter.
   b. the precise observations of Tycho Brahe.
   c. the retrograde motion of the planets.
   d. the mountains of the Moon.
   e. the phases of Venus.

50 A problem that is peculiar to infrared telescopes is a need for
   a. grazing incidence mirrors.
   b. cooling to low temperature.
   c. large reflector sizes.
   d. very long exposure times.

51 The International Space Station (ISS) is in a roughly circular orbit near the surface of the Earth, moving at around 5 miles per second. Suppose the Space Shuttle pushes it and quickly increases its speed to 6 miles per second. The ISS will then
   a. coast up to a higher circular orbit.
   b. escape from the Earth.
   c. follow an ellipse that descends and then rises again.
   d. follow an ellipse that rises and then descends again.

52 Compared to a proton, an electron has
   a. much more mass.
   b. much less mass.
   c. about the same mass.

Answer Key: Fall 2007 AHX1A

1 Choice e. (The suspect did not leave blood at the scene.)
2 Choice b. (5 Newtons downward)
3 Choice e. (ultraviolet light.)
4 Choice e. (always rotates clockwise.)
5 Choice a. (farthest South of the Celestial Equator.)
6 Choice c. (neither.)
7 Choice b. (use grazing angles of incidence.)
8 Choice a. (The number of crests that pass in one second.)
9 Choice d. (Newtonian Focus.)
10 Choice d. (a few minutes shorter than a solar day.)
11 Choice a. (gravity acts more strongly on the more massive object.)
12 Choice d. (are lighter because they are thinner.)
13 Choice e. (have electric fields in the same direction.)
14 Choice b. (almost the same motions but with corrections.)
15 Choice d. (on the side of the lens opposite the star.)
16 Choice b. (Mars is in the opposite direction from the Sun.)
17 Choice c. (earth turning on its axis.)
18 Choice e. (North Celestial Pole.)
19 Choice d. (Johannes Kepler.)
20 Choice b. (more damage.)
21 Choice b. (lower energy.)
22 Choice a. (the motion of the Moon around the Earth.)
23 Choice d. (A total eclipse of the Moon.)
24 Choice c. (always the same as those it absorbs when cold.)
25 Choice c. (acts on all objects.)
26 Choice e. (Sentencing a criminal.)
27 Choice d. (a hot, rarefied gas.)
28 Choice c. (The Equal Area Law.)
29 Choice c. (necessary for radio telescopes to be large.)
30 Choice a. (660nm.)
31 Choice d. (ellipses with the Sun at one focus.)
32 Choice a. (The Moon is made entirely of cheese.)
33 Choice a. (all the time.)
34 Choice c. (among the highest.)
35 Choice e. (Mars takes longer to go around the Sun than Earth and moves more slowly than the Earth does.)
36 Choice d. (None of these systems.)

37 Choice d. (Ecliptic.)

38 Choice e. (Only along a narrow path.)

39 Choice b. (the heavier object would hit the ground long before the lighter one.)

40 Choice a. (about the same accuracy.)

41 Choice c. (two regions of maximum pressure.)

42 Choice d. (only certain isolated negative energies.)

43 Choice e. (10 Newtons)

44 Choice c. (Galileo)

45 Choice c. (atmospheric turbulence.)

46 Choice e. (1200 m/s)

47 Choice b. (never sets.)

48 Choice c. ($0.005\ m/s^2$)

49 Choice e. (the phases of Venus.)

50 Choice b. (cooling to low temperature.)

51 Choice d. (follow an ellipse that rises and then descends again.)

52 Choice b. (much less mass.)

Solutions

1. Module 003 Scientific Proof: Question 003.14
2. Module 007 Definitions of Force and Mass: Question 007.33
3. Module 010 The Electromagnetic Spectrum: Question 010.15
4. Module 001 Celestial Coordinates: Question 001.26
5. Module 001 The Path of the Sun: Question 001.56
6. Module 005 The Science Writer: Question 005.43
7. Module 013 X-Rays: Question 013.41
8. Module 009 Frequency: Question 009.21
9. Module 012 Telescope Designs: Question 012.31
10. Module 001 Apparent Motion of the Sun: Question 001.44
11. Module 008 Unifying Physical Law: Question 008.23
12. Module 012 Focal Point of a Mirror: Question 012.23
13. Module 009 Polarization: Question 009.42
14. Module 008 Making New Predictions: Question 008.33
15. Module 012 Focal Point of a Lens: Question 012.11
16. Module 004 Wandering Planets: Question 004.13
17. Module 004 The Copernican System: Question 004.23
18. Module 001 The Celestial Sphere: Question 001.11
19. Module 005 Advocate for Copernicus: Question 005.32
20. Module 011 Photons: Question 011.22
21. Module 013 Ultraviolet: Question 013.34
22. Module 002 Phases of the Moon: Question 002.11
23. Module 002 Lunar Eclipses: Question 002.32
24. Module 011 The Reason for Spectra: Question 011.44
25. Module 008 Explaining Kepler's Laws: Question 008.12
26. Module 003 Non-science: Question 003.32
27. Module 010 Spectra: Question 010.32
28. Module 006 Equal Area Rule: Question 006.32
29. Module 013 Radio Telescopes: Question 013.12
30. Module 010 The Doppler Effect: Question 010.43
31. Module 006 Orbits are Ellipses: Question 006.21
32. Module 003 How to test a statement : Question 003.21
33. Module 004 Tycho Brahe's Role: Question 004.43
34. Module 010 Temperature and Color: Question 010.22
35. Module 006 The Period-Radius Relation: Question 006.43
36. Module 006 Death of a Theory: Question 006.12

37. Module 002 Predicting Eclipses: Question 002.43
38. Module 002 Solar Eclipses: Question 002.21
39. Module 005 The First Physicist: Question 005.14
40. Module 004 Why Copernicus Lost: Question 004.31
41. Module 009 Wavelength: Question 009.12
42. Module 011 Atomic Energy Levels: Question 01131
43. Module 007 Definitions of Force and Mass: Question 007.22
44. Module 007 The Law of Inertia: Question 007.11
45. Module 012 Telescope Limitations: Question 012.44
46. Module 009 Speed of a Wave: Question 009.34
47. Module 001 Star Motions: Question 001.31
48. Module 007 The Law of Force and Mass: Question 007.45
49. Module 005 The First Astrophysicist: Question 005.24
50. Module 013 Infrared: Question 013.21
51. Module 008 Artificial Satellites: Question 008.42
52. Module 011 The Building Blocks: Question 011.12