1 When Newton calculated the magnitude of the acceleration of Earth’s Moon, and compared it to the acceleration of falling objects on the surface of the Earth, he found that
   a. The Moon’s acceleration was smaller.
   b. The Moon’s acceleration was larger.
   c. the accelerations were the same.

2 The currently accepted theory of how the Moon formed is the
   a. co-formation theory.
   b. breakup or fission theory.
   c. collision theory.
   d. divine intervention theory.
   e. capture theory.

3 Which of the following planets does the moon Triton orbit?
   a. Neptune
   b. Jupiter
   c. Uranus
   d. Saturn
   e. Mars

4 An astronomical unit is defined to be
   a. the average distance from the Earth to the Moon.
   b. the average distance from the Earth to the Sun.
   c. the average distance from our Sun to the nearest star.
   d. the average distance from our Sun to the closest planet, Mercury.

5 So long as air resistance can be neglected, the most accurate description of the path taken by an artillery shell is
   a. an ellipse with the center of the Earth at one focus.
   b. a straight line.
   c. a parabola.
   d. a circle around a point just below the surface of the Earth.
   e. a circle around the center of the Earth.

6 Which of these sequences places the inner planets in the correct order from the Sun, from the closest to the farthest?
   a. Venus, Mercury, Earth, Mars (farthest)
   b. Mercury, Venus, Mars, Earth (farthest)
   c. Mercury, Venus, Earth, Mars (farthest)
   d. Venus, Mercury, Mars, Earth (farthest)

7 Our Sun sends out intense streams of charged particle radiation. The radiation is prevented from hitting the Earth’s atmosphere by
   a. the Earth’s magnetic field.
   b. the Earth’s gravitational field.
   c. the tilt of the Earth’s rotation axis.
   d. the Earth’s Moon.
8 The first human landing on the Moon was
   b. Apollo 10 in 1969.
   c. Apollo 11 in 1969.
   d. Surveyor 1 in 1969.
   e. Apollo 11 in 1974.

9 The density of water is 1000kg/m$^3$, the density of rock is about 3000kg/m$^3$, and the density of iron is 7800kg/m$^3$.
   Which of the following densities would indicate an object that might consist of rock surrounding an iron core?
   a. 4000kg/m$^3$
   b. 20,000kg/m$^3$
   c. 8000kg/m$^3$
   d. 500kg/m$^3$
   e. 1000kg/m$^3$

10 According to the Law of Inertia, a moving object that feels no outside force will
   a. stop immediately.
   b. keep moving.
   c. stop when it runs out of inertia.

11 Milankovich cycles refer to
   a. changes in the intensity of sunlight due to shifts in the Earth's orbit.
   b. the regular shifting of the Earth's rotation axis.
   c. changes in the intensity of sunlight due to shifts in both the Earth's orbit and rotation axis.
   d. the regular shifting of the Earth's orbit.
   e. changes in the intensity of sunlight due to shifts in the atmosphere of the Sun and the Earth's rotation axis.

12 What total force will cause an object with a mass of 5kg to gain 10 meters per second every second?
   a. 5 Newtons.
   b. 50 Newtons.
   c. 10 Newtons.
   d. 9.8 Newtons.
   e. 490 Newtons.

13 Which of the following planets has a magnetic field that is thought to be generated by liquid metallic hydrogen?
   a. Mercury
   b. Venus
   c. Jupiter
   d. Uranus
   e. Mars

14 Pioneer 11 was an early space probe sent to fly past
   a. Mars.
   b. Venus.
   c. Earth's Moon.
   d. Mercury.
   e. Saturn.
15 It is currently thought that moons typically form near
   a. Terrestrial planets such as Earth and Mars.
   b. Any planets of binary star systems.
   c. Any planets of isolated stars.
   d. Jovian planets such as Jupiter and Saturn.

16 Kuiper Belt objects are usually made of
   a. Styrofoam and possibly poster paint.
   b. concrete and possibly marble.
   c. rock and possibly iron.
   d. ice and possibly frozen gas.
   e. gold and possibly silver.

17 Which of the following spacecraft is the only one to have flown past Uranus?
   a. Pioneer 11
   b. Galileo
   c. Cassini-Huygens
   d. Voyager 1
   e. Voyager 2

18 Compared to the Earth, the planet Uranus is roughly
   a. 4 times as large.
   b. half as large.
   c. twice as large.
   d. the same size.
   e. 11 times as large.

19 In Newton’s Theory,
   a. the Earth and Sun move around a common point, which, in turn, goes around the Moon.
   b. the Moon moves around the Earth which, in turn goes around the Sun.
   c. the Earth moves around the Moon which, in turn, goes around the Sun.
   d. the Earth and Moon move around a common point which, in turn, goes around the Sun.

20 Newton’s Universal Law of Gravity explains all but one of the following things:
   a. how lightning works.
   b. planetary motion.
   c. how objects fall on Earth.
   d. the motion of the Moon around the Earth.
   e. ocean tides.

21 The magnetic field of Mars is
   a. about 1% of the Earth’s magnetic field.
   b. essentially zero.
   c. about 100 times the intensity of the Earth’s magnetic field.
   d. Similar in intensity to the Earth’s magnetic field.
   e. about 10 times the intensity of the Earth’s magnetic field.
22 The distance from the Earth to the Moon
   a. varies enough that sometimes we get an annular lunar eclipse.
   b. varies enough that sometimes we get an annular solar eclipse.
   c. varies, but not enough to affect eclipses.
   d. is always the same.

23 The largest four moons of Jupiter are referred to as the
   a. Trojan satellites.
   b. Ganymedian satellites.
   c. Galilean satellites.
   d. Shakespearian satellites.
   e. Heracletian satellites.

24 The Law of Inertia says that if an object is not acted on by any outside force,
   a. its speed and direction will change.
   b. its speed and direction of motion will not change.
   c. it can do whatever it wants to do.
   d. its speed will be zero.
   e. its speed will not be zero.

25 According to Aristotle, a thrown spear keeps moving after it has left the spear thrower’s hand because
   a. the force of inertia keeps the spear going.
   b. the force of friction with the air is not enough to stop the spear.
   c. the force of the air disturbed by the spear keeps it in motion.
   d. the force of the hand keeps acting on the spear.

26 Compared to the rest of the Lunar surface, the Lunar Maria are
   a. at about the same level and age.
   b. lower and older.
   c. higher and younger.
   d. higher and older.
   e. lower and younger.

27 Which of the following planets or moons has an atmosphere consisting mainly of Hydrogen and Helium?
   a. Mars
   b. Titan
   c. Jupiter
   d. Venus

28 On Earth, you might find a temperature of 59°F on a Spring or Fall day in the temperate zone. On Mars, you might expect that temperature
   a. only at the poles.
   b. at noon near the equator.
   c. almost anywhere on Mars when the Sun is shining.
   d. nowhere on Mars.
29 Comets usually follow orbits which are
   a. nearly circular and close to the Sun.
   b. elliptical with aphelia in the inner Solar System.
   c. nearly circular and farther from the Sun than Mars.
   d. elliptical with aphelia far outside the orbit of Mars.

30 Mariner 10 was the first space probe to reach the
   a. planet Mars.
   b. Moon.
   c. planet Saturn.
   d. planet Mercury.
   e. planet Jupiter.

31 The first space probe to place a robotic rover on the surface of Mars was
   b. Viking 1.
   c. Pathfinder.
   d. Spirit and Opportunity.
   e. Mariner 9.

32 Which of the following planets has no moons at all?
   a. Jupiter
   b. Mercury
   c. Earth
   d. Neptune
   e. Mars

33 Satellites such as the International Space Station orbit above most of the Earth’s atmosphere because
   a. it avoids creating sonic booms that would annoy people.
   b. then the top of the atmosphere can support the satellite.
   c. gravity does not extend beyond the atmosphere, so there is no gravity to pull the satellite down.
   d. there is no air friction to slow the satellite down.

34 Compared to the Earth, the planet Jupiter is roughly
   a. 100 times as large.
   b. 10 times as large.
   c. the same size.
   d. 1000 times as large.

35 Voyager 1 was the first space probe sent to fly past
   a. Saturn.
   b. Venus.
   c. Mars.
   d. Titan.
   e. Earth’s Moon.
36 Venus
   a. rotates backwards so that the Sun rises in the West.
   b. has a solar day that lasts for two complete orbits around the Sun.
   c. has a solar day that is very close to an Earth day in length.
   d. has a solar day that lasts for three complete orbits around the Sun.
   e. always keeps the same side toward the Sun so that solar time never changes.

37 The magnetic field of Uranus is thought to be generated by
   a. a solid iron core.
   b. something that is not on this list.
   c. liquid iron in its core.
   d. liquid metallic hydrogen in its core.

38 The inclination angle of a planet’s rotation axis is defined so that a planet that is rotating in the usual direction about an axis that is perpendicular to the plane of the solar system would have an inclination of $0^\circ$, while a planet that is rotating in the opposite (retrograde) direction about an axis that is perpendicular to the plane of the solar system would have an inclination angle of $180^\circ$. The inclination angle of the planet Neptune is closest to
   a. $0^\circ$.
   b. $180^\circ$.
   c. $30^\circ$.
   d. $200^\circ$.
   e. $98^\circ$.

39 The Lunar Maria are thought to have been caused by ancient
   a. oceans of water that have since evaporated.
   b. bombardment by charged particles from the Sun.
   c. lava flows from large impacts.
   d. dust storms in an atmosphere that has now vanished.

40 A book, weighing 10 Newtons, sits on a table. Which of the following pairs of forces is an action-reaction pair?
   a. The force that the book exerts on the table and the force that the table exerts on the book.
   b. The force of gravity on the book and the force that the table exerts on the book.
   c. The force of gravity on the book and the force that the book exerts on the table.
   d. The force that the book exerts on the table and the force of gravity on the table.
   e. The force of gravity on the book and the force of gravity on the table.

41 Which of the following planets or moons has an atmosphere consisting mainly of Hydrogen and Helium?
   a. Venus
   b. Uranus
   c. Saturn
   d. Titan
42 Which of the following objects has no magnetic field at all?
   a. Mercury
   b. Jupiter
   c. Saturn
   d. Mars
   e. Earth’s Moon

43 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, Galileo predicted that
   a. the heavier object would hit the ground long before the lighter one.
   b. the lighter object would hit the ground long before the heavier one.
   c. both objects would hit the ground at the same time.

44 The Russian Venera 9 space probe was sent to Venus, where it
   a. went into orbit and mapped the surface.
   b. received a gravitational boost on its way to Mercury.
   c. crashed on the surface.
   d. landed on the surface and took pictures.

45 Which of these planets has a solar day that is shorter than half an Earth day in length?
   a. Mars
   b. Mercury
   c. Uranus
   d. Jupiter
   e. Venus

46 Relative to the distant stars, Venus
   a. completes less than one full rotation each time it orbits the Sun.
   b. completes 2 rotations each time it orbits the Sun.
   c. completes 1.5 rotations each time it orbits the Sun.
   d. completes just one full rotation each time it orbits the Sun.
   e. does not rotate at all.

47 Comets are usually made of
   a. gold and possibly silver.
   b. ice and possibly frozen gas.
   c. concrete and possibly marble.
   d. rock and possibly iron.
   e. Styrofoam and possibly poster paint.

48 Which of these planets has a solar day that is very close to an Earth day in length?
   a. Jupiter
   b. Saturn
   c. Mars
   d. Venus
   e. Mercury
49 Which of the following planets or moons has an atmosphere with about 90 times the surface pressure of Earth’s.
   a. Titan
   b. Mars
   c. Venus
   d. Mercury

50 In comparison to Kepler’s Laws of Planetary Motion, Newton’s theory of Universal Gravitation predicted almost
   the same motions, but with small corrections due to
   a. small time lags caused by the propagation of gravity to each planet.
   b. the gravitational attractions between different planets.
   c. the gravitational attraction between each planet and the Sun.
   d. velocity-dependent forces that act more strongly on the faster inner planets.
   e. the elliptical orbits of the planets.
1 Choice a.  (The Moon’s acceleration was smaller.)
2 Choice c.  (collision theory.)
3 Choice a.  (Neptune)
4 Choice b.  (the average distance from the Earth to the Sun.)
5 Choice a.  (an ellipse with the center of the Earth at one focus.)
6 Choice c.  (Mercury, Venus, Earth, Mars (farthest))
7 Choice a.  (the Earth’s magnetic field.)
8 Choice c.  (Apollo 11 in 1969.)
9 Choice a.  (4000kg/m^3)
10 Choice b.  (keep moving.)
11 Choice c.  (changes in the intensity of sunlight due to shifts in both the Earth’s orbit and rotation axis.)
12 Choice b.  (50 Newtons.)
13 Choice c.  (Jupiter)
14 Choice e.  (Saturn.)
15 Choice d.  (Jovian planets such as Jupiter and Saturn.)
16 Choice d.  (ice and possibly frozen gas.)
17 Choice e.  (Voyager 2)
18 Choice a.  (4 times as large.)
19 Choice d.  (the Earth and Moon move around a common point which, in turn, goes around the Sun.)
20 Choice a.  (how lightning works.)
21 Choice b.  (essentially zero.)
22 Choice b.  (varies enough that sometimes we get an annular solar eclipse.)
23 Choice c.  (Galilean satellites.)
24 Choice b.  (its speed and direction of motion will not change.)
25 Choice c.  (the force of the air disturbed by the spear keeps it in motion.)
26 Choice e.  (lower and younger.)
27 Choice c.  (Jupiter)
28 Choice b.  (at noon near the equator.)
29 Choice d.  (elliptical with aphelia far outside the orbit of Mars.)
30 Choice d.  (planet Mercury.)
31 Choice c.  (Pathfinder.)
32 Choice b.  (Mercury)
33 Choice d.  (there is no air friction to slow the satellite down.)
34 Choice b.  (10 times as large.)
35 Choice d.  (Titan.)
36 Choice a.  (rotates backwards so that the Sun rises in the West.)
37 Choice b. (something that is not on this list.)
38 Choice c. (30°.)
39 Choice c. (lava flows from large impacts.)
40 Choice a. (The force that the book exerts on the table and the force that the table exerts on the book.)
41 Choice c. (Saturn)
42 Choice e. (Earth’s Moon)
43 Choice c. (both objects would hit the ground at the same time.)
44 Choice d. (landed on the surface and took pictures.)
45 Choice d. (Jupiter)
46 Choice a. (completes less than one full rotation each time it orbits the Sun.)
47 Choice b. (ice and possibly frozen gas.)
48 Choice c. (Mars)
49 Choice c. (Venus)
50 Choice b. (the gravitational attractions between different planets.)
Where to find these questions in the notes

2. Module 011.418 The Terrestrial Planets Moon Oddities of the Moon Formation of the Moon
3. Module 012.410 The Jovian Planets Neptune Moons
4. Module 010.102 Solar System Overview The Big Picture
5. Module 009.603-g01 Science Models of Gravity Artificial Satellites
6. Module 010.106 Solar System Overview The Big Picture
7. Module 011.308 The Terrestrial Planets Earth Magnetic Field
8. Module 011.422 The Terrestrial Planets Moon Space Probes
9. Module 010.201-g01 Solar System Overview The Terrestrial Planets
10. EModule 008.502-g01 Science Models of Motion Force and Mass (F20113:97%)
11. Module 011.305 The Terrestrial Planets Earth Orbit and Rotation
12. Module 008.507 Science Models of Motion Force and Mass F=ma
14. Module 012.222 The Jovian Planets Saturn Space Probes
15. Module 010.303-g01 Solar System Overview The Jovian Planets
16. Module 010.601 Solar System Overview The Kuiper Belt
17. Module 012.317 The Jovian Planets Uranus Space Probes
18. Module 012.305 The Jovian Planets Uranus Surface
20. Module 009.404-g01 Science Models of Gravity Unifying Physical Law
21. **Module 011.511 The Terrestrial Planets Mars Magnetic Field (32%)
22. Module 011.410 The Terrestrial Planets Moon Orbit and Rotation (48%)
23. Module 012.117-g01 The Jovian Planets Jupiter Moons
24. Module 008.304-g01 Science Models of Motion Acceleration
25. Module 008.103 Science Models of Motion Aristotle (44%)
26. **Module 011.401-g01 The Terrestrial Planets Moon Surface Features (31%)
27. Module 012.102 The Jovian Planets Jupiter Surface
28. Module 011.504-g01 The Terrestrial Planets Mars Surface
29. *Module 010.503 Solar System Overview Comets (36%)
30. *Module 011.116 The Terrestrial Planets Mercury Space Probes (38%)
31. Module 011.525 The Terrestrial Planets Mars Space Probes
32. Module 011.112 The Terrestrial Planets Mercury Moons
33. Module 009.606-g01 Science Models of Gravity Artificial Satellites
34. Module 012.107 The Jovian Planets Jupiter Surface
35. ****Module 012.224 The Jovian Planets Saturn Space Probes (15%)
36. Module 011.205 The Terrestrial Planets Venus Orbit and Rotation
Module 012.313 The Jovian Planets Uranus Magnetic Field
Module 012.405-g01 The Jovian Planets Neptune Orbit and Rotation
Module 011.402-g01 The Terrestrial Planets Moon Surface Features
Module 008.601 Science Models of Motion Action and Reaction
Module 012.202 The Jovian Planets Saturn Surface (46%)
Module 011.413 The Terrestrial Planets Moon Magnetic Field
Module 008.401 Science Models of Motion The Universality of Free Fall
Module 011.212 The Terrestrial Planets Venus Space Probes (42%)
Module 012.110 The Jovian Planets Jupiter Orbit and Rotation
***Module 011.206 The Terrestrial Planets Venus Orbit and Rotation (28%)
Module 010.501 Solar System Overview Comets
Module 011.508 The Terrestrial Planets Mars Orbit and Rotation
Module 011.202 The Terrestrial Planets Venus Surface
Module 009.503-g01 Science Models of Gravity Making New Predictions