Multiple Choice. In the blanks provided before each question write the letter for the phrase that best answers the question or completes the thought and fill in the corresponding area on the computer graded sheets with a number 2 lead pencil.

**D 1.** The Ptolemaic model probably persisted for all these reasons EXCEPT:

A. It was consistent with the doctrines of the Catholic Church.
B. It used perfect circles, which appealed to geometry.
C. It explain why stellar parallax was not observed by the Greeks.
D. It accounted well for Galileo’s observations of the phase cycle of Venus.
E. It had the authority of Aristotle behind it.

**B 2.** Which of the following is not a form of electromagnetic radiation?

A. X-rays  
B. Electrons  
C. Sunlight  
D. Gamma-rays  
E. Radio waves

**E 3.** A photon with energy 5eV is emitted by the hypothetical atom in Figure 1. It must result from the de-excitation of an electron between:

A. n=1 and n=2 states  
B. n=1 and n=3 states  
C. n=1 and n=4 states  
D. n=2 and n=3 states  
E. n=2 and n=4 states

![Figure 1: Hypothetical atom's energy levels](image)
4. It is dusk and the moon is just setting. What is the moon's phase?
   A. Waxing gibbous  
   B. Last quarter  
   C. First quarter  
   D. New  
   E. Full

5. A planet orbits a distant 1 solar mass star with a perihelion distance of 3 AU and an aphelion distance of 5 AU. The semi-major axis of the planet is:
   A. 5 AU  
   B. 8 AU  
   C. 2.5 AU  
   D. 3 AU  
   E. 4 AU

6. What are two advantages of large telescopes over smaller ones?
   A. Large scopes are not subject to atmospheric turbulence and opacity like smaller ones.
   B. Large scopes have a larger field of view and sharper focus.
   C. Large telescopes give higher magnification and are easier to build.
   D. Large telescopes have better resolution and collect more light.
   E. Large scopes are easier to mount and control than small ones.

7. A solar eclipse can only happen during a:
   A. Perihelion passage of the Sun.  
   B. Full moon.  
   C. Solstice.  
   D. New moon.  
   E. First quarter moon.

8. The Orion Nebula, M-42, is a hot, thin cloud of glowing gas, so its spectrum is:
   A. A few bright lines against a dark background.  
   B. A continuum, strongest in the color red.  
   C. A few dark line in the continuum.  
   D. A continuum, but with both bright and dark lines mixed in.  
   E. Not in the visible portion of the spectrum.

9. Why are most large telescopes reflectors, not refractors?
   A. Large, very clear lenses are harder to cast than more tolerant mirror blanks.  
   B. Large lenses deform under their own weight, but mirrors can be supported.  
   C. Large mirrors need only one optical surface, achromats four surfaces to grind.  
   D. Reflectors do not suffer from chromatic aberration like refractors do.  
   E. All of the above are correct.
10. Radio dishes are large in order to:
   A. Increase their angular resolution and collect the very weak radio photons.
   B. Give greater magnification.
   C. Attract funding from NASA and the NSF.
   D. Detect shorter waves than optical telescopes for superior resolution.
   E. Increase the range of waves they can collect.

11. If a light source is approaching you, you will observe:
   A. That all of its spectral lines have become shorter in wavelength.
   B. That the speed of its photons have increased.
   C. An apparent red shift of its spectral lines.
   D. That the amplitude of its waves have increased.
   E. That its light has become much bluer in color.

12. The number of waves passing the observer per second is:
   A. the amplitude (in nanometers)  B. the period (in seconds)
   C. the energy (in milliWatts)     D. the frequency (in Hertz)
   E. the wavelength (in Angstroms)

From the list below, find the best matches for the phrases that follow.

A. Eccentricity  B. Ellipse  C. Equinoxes  D. Ecliptic  E. Eclipse

13. The two times in the year when the sun appears to be overhead at noon at the equator
   A

14. A number indicating the degree of flattening of an ellipse
   B

15. A “flattened” circle
   E

16. When one body prevents sunlight from falling on another body
   D

17. The path the sun appears to take across the sky
   E

18. A mountain top is an especially good site for infrared telescopes since:
   A. Less air above means better seeing in many cases.
   B. You are above most of the carbon dioxide and water vapor in the atmosphere.
   C. The cold weather helps the sensitivity of infrared detectors.
   D. There you are closer to celestial objects.
   E. All of the above are factors.

19. Which of the following describes parallax?
   C

   A. It is best measured over exactly one year intervals.
   B. It is only applicable to objects within the solar system.
   C. It is a method for determining the distance to a nearby star.
   D. It was first observed by Galileo with his new telescope.
   E. All of the above.
From the list of terms below, find the best matches for the phrases that follow.

A. Horizon  
B. Declination  
C. Celestial Equator  
D. Celestial North Pole  
E. Zenith

20. Point directly overhead  
21. Angular unit of measure on the sky, equivalent to latitude on the Earth  
22. Extension of the Earth's equator on to the sky  
23. Analog of the Earth's North Pole projected on to the sky

24. Which statement about the day is FALSE?
   A. The solar day is based on consecutive noon transits of the Sun.
   B. The sidereal day is four minutes longer due to our revolution around the Sun.
   C. Relative to the stars, the Earth spins in 23 hours, 56 minutes.
   D. The sidereal day is based on the Earth's rotation alone.
   E. Normal timekeeping is based on the solar day.

From the list of scientists, find the best matches for the phrases that follow.

A. Kirchoff  
B. Galileo  
C. Newton  
D. Einstein  
E. Bohr

25. First observed the moons around Jupiter.  
26. Discovered the three laws dealing with the creation of various types of spectra.  
27. Got the Nobel Prize for the photoelectric effect and the nature of electron orbitals.  
28. Determined the physical reason behind Kepler’s laws.  
29. Devised the first successful model of the hydrogen atom.

30. Using Newtons version of Keplers 3rd law, what do we need to know to determine the mass of the Sun?
   A. The size of the A.U. and exact length of the year.  
   B. The exact timings of the transits of Venus and its diameter.  
   C. The Earth’s mass and circumference.  
   D. Its temperature as found by Wien’s Law.  
   E. Its density as found by spectroscopy.

31. Modern scientific theories are NOT:
   A. Testable.  
   B. Perfect.  
   C. Elegant.  
   D. Simple.  
   E. Continuously tested.
From the list below, find the best matches for the phrases that follow.

A. photons  B. protons  C. neutrinos  D. neutrons  E. electrons

32. The negatively charged particles: **E**
33. The particles in the nucleus that give an element its identity: **B**
34. The neutral particles that insulate the charged particles in the nucleus from each other: **D**
35. The particles of the radiation field that can be absorbed or emitted when an atom shifts between two of its allowed orbits: **A**

36. The diameter of the Earth is about 6400 km. That is equivalent to:
   - A. $6.4 \times 10^9$ m
   - B. $6.4 \times 10^5$ m
   - C. $6.4 \times 10^8$ m
   - D. $6.4 \times 10^6$ m
   - E. $6.4 \times 10^{11}$ m

37. The spectrum of the Sun appears as:
   - A. A rainbow, but with some dark lines mixed in.
   - B. A series of bright, colored lines.
   - C. A very red shifted rainbow due to the expansion of the universe.
   - D. A rainbow with some bright lines on top of the continuum.
   - E. An unbroken rainbow of colors.

38. What is the resolving power of the telescope?
   - A. The ability to distinguish adjacent objects in the sky
   - B. The ability to separate light into its component colors
   - C. The ability to make distant objects appear closer
   - D. The ability to collect a lot of light
   - E. The ability to detect very faint objects

39. Summer in the southern hemisphere occurs in December, January and February because:
   - A. There are fewer solar eclipses then, resulting in more sunlight received.
   - B. The Earth experiences retrograde motion then.
   - C. The Earth moves more slowly around the Sun then, allowing it to absorb more sunlight.
   - D. The Earth is closest to the Sun then.
   - E. The Sun’s light hits that hemisphere most directly then.

40. On the vernal equinox, you will experience:
   - A. The shortest day of the year
   - B. Equal hours of day and night
   - C. The longest day of the year
   - D. Both A and B
   - E. Both B and C
True/False: In the blanks provided before each question write whether the following statements are True (T) or False (F). Fill in A for True and B for False on your score sheet.

F 41. Even the Hubble Space Telescope’s resolution is greatly enhanced by adaptive optics.
F 42. A light year is the time for light to cross the Earth’s orbit.
T 43. Kepler’s second law notes that a planet should move fastest at perihelion.
T 44. Due to our atmosphere’s ozone layer, ultraviolet astronomy must be done from space.
F 45. Measuring the parallax of a star tells you whether its moving towards or away from us.
F 46. As a blackbody gets hotter, it appears redder as its peak wavelength gets longer.

Photon A has a wavelength of 200nm and Photon B has a wavelength of 700nm. Indicate whether the following statements about these photons are True (T) or False (F).

F 47. Photon A is redder than Photon B.
T 48. Photon A is more energetic than Photon B.
F 49. Photon A is moving faster than Photon B.
T 50. Photon A has a greater frequency than Photon B.