MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) This is version C of the exam. Please fill in (C).
   A) This is WRONG
   B) This is the WRONG answer
   C) This is the CORRECT answer
   D) This is WRONG
   E) This is WRONG

2) How did Eratosthenes estimate the size of Earth in 240 B.C.?
   A) By observing the duration of a solar eclipse.
   B) By measuring the size of Earth’s shadow on the Moon in a lunar eclipse.
   C) By comparing the maximum altitude of the Sun in two cities at different latitudes at the same time on the same day.
   D) By sending fleets of ships around Earth.
   E) By finding a place on Earth where the Sun passes directly overhead.

3) By locating the north celestial pole (NCP) in the sky, how can you determine your latitude?
   A) The azimuth of the NCP is the angular distance from the North Pole.
   B) The azimuth of the NCP is the same as your latitude.
   C) The altitude of the NCP is the same as your latitude.
   D) The altitude of the NCP is your angular distance from the North Pole.
   E) The altitude of the NCP is the same as your distance from the North Pole.

4) Which statement about an atom is not true:
   A) The nucleus contains most of the atom’s mass, but almost none of its volume.
   B) A neutral atom always has equal numbers of electrons and protons.
   C) A neutral atom always has equal numbers of neutrons and protons.
   D) The electrons can only orbit at particular energy levels.
   E) All of the above are true.

5) What effect or effects would be most significant if the Moon’s orbital plane were exactly the same as the ecliptic plane?
   A) Solar eclipses would be much rarer.
   B) Solar eclipses would last much longer.
   C) Solar eclipses would be much more frequent.
   D) Solar eclipses would not last as long.
   E) both B and C
6) Planet X orbits its sun once every 100 Earth days and rotates in the prograde direction around its axis with a sidereal day of 100 Earth days. How long is a solar day on Planet X?
   A) About 10 earth days
   B) About 100 earth days
   C) About 200 earth days
   D) There is no solar day, Planet X is tidally locked
   E) The solar day is the same as the sidereal day

7) The distance between the Earth and the star Altair is one million times greater than the distance between the Earth and the Sun. How far is Altair from the Earth?
   A) $9.3 \times 10^{13}$ meters
   B) $9.3 \times 10^{10}$ meters
   C) $1.5 \times 10^{14}$ meters
   D) $1.5 \times 10^{17}$ meters
   E) $1.0 \times 10^6$ meters

8) You observe the visible spectrum of a star viewed through a cloud of cool hydrogen gas.
   A) You see only the star’s blackbody spectrum.
   B) You see the star’s blackbody spectrum, with absorption lines due to hydrogen.
   C) You see only emission lines characteristic of hydrogen.
   D) You see only emission lines characteristic of the star’s composition.
   E) You see the star’s blackbody spectrum, with emission lines due to hydrogen.

9) Say the pupil of your eye has a diameter of 5 mm, and you have a telescope with an aperture of 50 cm. How much more light can the telescope gather than your eye?
   A) 10,000 times more
   B) 100 times more
   C) 1,000 times more
   D) 10 times more
   E) 100,000 times more

10) Why is the sky blue?
    A) Because the molecules that compose the Earth’s atmosphere have a blue-ish color.
    B) Because the sky reflects the color of the Earth’s oceans.
    C) Because the atmosphere preferentially scatters short wavelengths.
    D) Because the Earth’s atmosphere preferentially absorbs all other colors.
    E) Because of the ozone layer.

11) Which planet(s) in the solar system has/have active plate tectonics?
    A) Mars
    B) Venus
    C) Earth
    D) Mars and Earth
    E) Earth and Venus
12) You are pushing a truck along a road. Would it be easier to accelerate this truck on Mars? Why?
   (Assume there is no friction)
   A) It would be harder since the truck is heavier on Mars.
   B) It would be easier since the truck is lighter on Mars.
   C) It would be harder since the truck is lighter on Mars.
   D) It would be easier since the truck is heavier on Mars.
   E) It would be the same no matter where you are.

13) In addition to the conditions required for any solar eclipse, what must also be true in order for you to observe a total solar eclipse?
   A) The Earth must lie completely within the Moon's penumbra.
   B) The Moon's penumbra must touch the area where you are located.
   C) The Earth must be near aphelion in its orbit of the Sun.
   D) The Moon's umbra must touch the area where you are located.
   E) The Earth must lie completely within the Moon's umbra.

14) If the Moon is setting at noon, the phase of the Moon must be
   A) third quarter.
   B) waning crescent.
   C) waxing crescent.
   D) full.
   E) first quarter.

15) If you lived on Venus, what phases of the Earth would you see? (Assume your telescope can see through Venus's thick clouds…)
   A) New, first quarter, full, third quarter
   B) Waning crescent, New, Waxing crescent
   C) Waxing gibbous, Full, Waning gibbous
   D) New only
   E) Full only

16) A sand bag has a mass of 5kg and weight 50N on Earth. What is the mass and weight of this sand bag on a planet with half the gravity compared to Earth?
   A) Mass 5kg weight 100N
   B) Mass 5kg weight 50N
   C) Mass 5kg weight 25N
   D) Mass 10kg weight 100N
   E) Mass 2.5kg weight 25N

17) When traveling north from the United States into Canada, you'll see the North Star (Polaris) getting __________.
   A) Brighter
   B) Dimmer
   C) Higher in the sky
   D) Lower in the sky
   E) Closer to the Sun
18) 20,000 years from now ... 
   A) The Moon will be closer to the Earth, and the Earth’s day will be longer.
   B) The Moon will be closer to the Earth, and the Earth’s day will be shorter.
   C) The Moon will be further from the Earth, and the Earth’s day will be longer.
   D) The Moon will be further from the Earth, and the Earth’s day will be shorter.
   E) The Moon will be the same distance it is now, and the Earth’s day will be the same as it is today.

19) You cool a blackbody to half its original temperature. How does its spectrum change? 
   A) Power emitted is 1/16 times as high; peak emission wavelength is 1/2 as long.
   B) Power emitted is 1/4 times as high; peak emission wavelength is 2 times longer.
   C) Power emitted is 1/4 times as high; peak emission wavelength is 1/2 as long.
   D) Power emitted is 1/2 times as high; peak emission wavelength is 1/2 as long.
   E) Power emitted is 1/16 times as high; peak emission wavelength is 2 times longer.

20) How do we know how old the Earth is? 
   A) From the layering of materials within the Earth.
   B) From fossils of ancient life.
   C) From the cratering history of Earth’s surface.
   D) From radioactive dating of rocks and meteorites.
   E) By measuring the rate of change of the Sun’s luminosity.

21) Why did Ptolemy have the planets orbiting Earth on ‘circles upon circles’ in his model of the universe? 
   A) To explain why more distant planets take longer to make a circuit through the constellations of the zodiac.
   B) To explain the fact that planets sometimes appear to move westward, rather than eastward, relative to the stars in our sky.
   C) To explain why the Greeks were unable to detect stellar parallax.
   D) To properly account for the varying distances of the planets from Earth.
   E) To explain why Venus goes through phases as seen from Earth.

22) From shortest to longest wavelength, which of the following correctly orders the different categories of electromagnetic radiation? 
   A) infrared, visible light, ultraviolet, X rays, gamma rays, radio 
   B) radio, infrared, visible light, ultraviolet, X rays, gamma rays 
   C) gamma rays, X rays, visible light, ultraviolet, infrared, radio 
   D) visible light, infrared, X rays, ultraviolet, gamma rays, radio 
   E) gamma rays, X rays, ultraviolet, visible light, infrared, radio 

23) The resolution of a telescope is a measure of its:
   A) Ability to magnify distant objects 
   B) Ability to measure the angular separation of objects 
   C) Ability to measure the distance between objects 
   D) Light-collecting efficiency 
   E) Aperture size
24) Suppose you live on the Moon. How long is a day (i.e., from sunrise to sunrise)?
   A) about 18 years
   B) 24 hours
   C) 29 Earth days
   D) a year
   E) 23 hours 56 minutes

25) A Mars year is approximately how many Earth years long?
   A) 1/2
   B) 1
   C) 2
   D) 4
   E) 7

26) The so-called “bigfoot” on Mars was actually a rock that was about 5 cm tall. It had an angular size of about 0.5 degrees (~30 pixels). How far away was this rock from the rover?
   A) About 6 meters
   B) About 6 feet
   C) About 10 meters
   D) About 10 feet
   E) About 1 meter

27) If you know both the actual brightness of an object and its apparent brightness from your location, then with no other information you can estimate:
   A) Its speed relative to you
   B) Its composition
   C) Its size
   D) Its distance from you
   E) The speed of light

28) Why is the Mars Exploration Rover Spirit currently tilted towards the north?
   A) Because it’s climbing up a big hill.
   B) Because it’s in the southern hemisphere, where it is winter now.
   C) Because it’s in the northern hemisphere, where it is winter now.
   D) Because one of its wheels broke.
   E) Because the Sun is directly overhead.

29) What element is most common among the Jovian Planets?
   A) Hydrogen
   B) Helium
   C) Carbon
   D) Oxygen
   E) Uranium

30) Which of the following is not one of, nor follows directly from, Kepler's laws?
   A) As a planet moves around its orbit, it sweeps out equal areas in equal times.
   B) The orbit of each planet about the Sun is an ellipse with the Sun at one focus.
   C) The force of attraction between any two objects decreases with the square of the distance between their centers.
   D) A planet travels faster when it is nearer to the Sun and slower when it is farther from the Sun.
   E) More distant planets move at slower speeds.
31) You’ve made a scientific theory that there is an attractive force between all objects. When will your theory be proven to be correct?
   A) The first time you drop a bowling ball and it falls to the ground, proving your hypothesis.
   B) After you’ve repeated your experiment many times.
   C) You can never prove your theory to be correct, only “yet to be proven wrong”.
   D) When you and many others have tested the hypothesis.
   E) When you drop a bowling ball and a feather and see both fall to the ground.

32) Which of the following statements about sidereal and solar days is not true?
   A) The time it takes for the Sun to make one circuit of our sky is one solar day.
   B) A solar day is 4 minutes longer than a sidereal day.
   C) A solar day represents more than 360° of rotation for the earth.
   D) The time it takes for a star to make one circuit of our sky is one sidereal day.
   E) The time it takes for the Moon to make one circuit of our sky is one solar day.

33) What drives differentiation?
   A) Spontaneous emission from radioactive atoms.
   B) The minimization of gravitational potential energy.
   C) Thermally induced collisions.
   D) Plate tectonics.
   E) Impacts by other solar system bodies.

34) Why do we see essentially the same face of the Moon at all times?
   A) because the Moon has a nearly circular orbit around the Earth
   B) because the Moon does not rotate
   C) because the other face points toward us only at new moon, when we can't see the Moon
   D) because the Sun illuminates only one half at a time
   E) because the Moon's rotational and orbital periods are equal
Answer Key
Testname: PRELIM1C

1) C
2) C
3) C
4) C
5) C
6) D
7) D
8) B
9) A
10) C
11) C
12) E
13) D
14) A
15) C
16) C
17) C
18) C
19) E
20) D
21) B
22) E
23) B
24) C
25) C
26) A
27) D
28) B
29) A
30) C
31) C
32) E
33) B
34) E