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

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

2) How are planetary rings made?
   A) From fragments of planets ejected by impacts
   B) From dust grains that escape from passing comets
   C) From accretion within the solar nebula at the same time the planets formed
   D) From the dismantling of small moons by impacts
   E) From the capture of asteroid fragments

3) Why isn’t there a planet where the asteroid belt is located?
   A) The temperature in this portion of the solar nebula was just right to prevent rock from sticking together.
   B) There was too much rocky material to form a terrestrial planet, but not enough gaseous material to form a jovian planet.
   C) There was not enough material in this part of the solar nebula to form a planet.
   D) Resonance with Jupiter prevented material from collecting together to form a planet.
   E) A planet once formed here, but it was broken apart by a catastrophic collision.

4) A comet of mass \( m \) impacts the earth (mass \( M \), radius \( R \)) at the minimum impact speed. What is the expression for the total energy released in the impact?
   A) \( 0.5 \times m / (R^3) \)
   B) \( m \times v \)
   C) \( 0.5 \times m \times (2GM/R) \)
   D) \( GMm/(R^2) \)
   E) \( 0.6 \times G(M^2)/R \)

5) We were first able to accurately measure the diameter of Pluto from:
   A) brightness measurements made during mutual eclipses of Pluto and Charon
   B) a Voyager flyby in the late 1980s
   C) Hubble Space Telescope images that resolved Pluto’s disk
   D) a New Horizons flyby in the 1990s
   E) radar observations made by the Arecibo telescope

6) The belts and zones of Jupiter are
   A) regions of the plasma torus created by ions from Io’s volcanoes
   B) cyclonic and anticyclonic storms.
   C) names for the layers of gaseous and metallic hydrogen deep within the planet.
   D) alternating regions of charged particles in Jupiter’s magnetic field.
   E) alternating bands of rising and falling air at different latitudes.
7) Planetary rings are
   A) nearer to their planet than any of the planet's large moons.
   B) orbiting in the equatorial plane of their planet.
   C) composed of a large number of individual particles that orbit their planet in accord with
      Kepler's third law.
   D) known to exist for all of the jovian planets.
   E) all of the above

8) Which of the following moons is NOT one of the Galilean moons?
   A) Ganymede
   B) Dione
   C) Io
   D) Callisto
   E) Europa

9) The mass of Saturn's rings is $2 \times 10^{19}$ kg. What is the ratio of this mass to that of a 200 km diameter
    spherical moon made entirely of water-ice (density $\sim 1$ g/cm$^3$)? That is, what is $M_{\text{rings}} : M_{\text{icy moon}}$?
    A) 1 : 1
    B) 50 : 1
    C) 0.5 : 1
    D) 0.2 : 1
    E) 5 : 1

10) Pluto's extremely cold ($\sim 40$ K) surface is composed of:
    A) nitrogen, methane, and carbon monoxide ices, which sublimate into an atmosphere near
        perihelion
    B) nitrogen, methane, and carbon monoxide ices, which always remain frozen
    C) roughly half ices and half rocky materials
    D) mainly water ice, which sublimes into an atmosphere near perihelion
    E) mainly water ice, which always remains frozen

11) Where are the Trojan asteroids located?
    A) in the center of the asteroid belt
    B) along Jupiter's orbit, 60° ahead of and behind Jupiter
    C) on orbits that cross Mars's orbit
    D) on orbits that cross Earth's orbit
    E) surrounding Jupiter

12) Which of the following is/are true?
    A) Titan is the only outer solar system moon with a thick atmosphere
    B) Titan is the only outer solar system moon with evidence for recent geologic activity
    C) Titan's atmosphere is composed mostly of hydrocarbons
    D) Titan is the only moon in the solar system with bodies of liquid hydrocarbons on its surface
    E) A and D

13) Why is Saturn almost as big as Jupiter, despite its smaller mass?
    A) Jupiter's strong magnetic field constrains its size.
    B) Saturn has a larger proportion of hydrogen and helium than Jupiter, and is therefore less dense.
    C) Saturn's rings make the planet look bigger.
    D) Jupiter's greater mass compresses it more, thus increasing its density.
    E) Saturn is further from the Sun, thus cooler, and therefore less compact.
14) Which is the least likely cause of death?
   A) Driving while intoxicated, without wearing seatbelts.
   B) Being hit in the head by a bullet.
   C) Caught in the blastwave of a meteorite exploding above a populated city.
   D) Being hit by a small meteorite.
   E) Starvation during global winter caused by a major impact.

15) What about asteroids makes them stand out in sky surveys searching for them?
   A) They reflect enough of the sun's light to make them brighter than most background stars
   B) Asteroids emit pulsed radiation
   C) Asteroids have substantial motion relative to the background stars
   D) Asteroids emit a lot of their own radiation
   E) Asteroids have large angular sizes.

16) Which of the following characteristics would not necessarily suggest that a rock we found is a meteorite.
   A) It has different elemental composition than earth
   B) It has a fusion crust
   C) It contains rare earth elements such as Iridium
   D) It contains solidified spherical droplets
   E) It is highly processed

17) Why do Uranus and Neptune have blue methane clouds but Jupiter and Saturn do not?
   A) Methane reacts with the abundant ammonia clouds in Jupiter and Saturn and is removed from the atmosphere.
   B) Methane did not exist in the solar nebula at the radii of Jupiter and Saturn when the planets formed.
   C) The greater gravitational force of Jupiter and Saturn prevents the methane from rising to the upper edges of the atmosphere.
   D) Methane does not condense into ice in the warmer atmospheric temperatures of Jupiter and Saturn.
   E) The relatively slow rotation of Uranus and Neptune allows methane to migrate to higher levels in the atmosphere and condense into clouds.

18) When will the next major impact occur on Earth?
   A) Hundreds of millennia after the last major impact.
   B) December 2012.
   C) Major impacts can no longer occur since the period of heavy bombardment is over.
   D) Hundreds of millennia in the future.
   E) Could be any time. The probability of impact is the same next year as it is for any later year.

19) Kirkwood gaps are observed in the main asteroid belt, including at the position(s) where:
   A) asteroids would orbit with a period half that of Jupiter
   B) asteroids would orbit with a period twice that of Jupiter
   C) asteroids would orbit with a period twice that of Mars
   D) A and B
   E) A and C
20) What is the source of the material that causes meteor showers?
   A) Near–Earth asteroids disintegrate as they enter Earth’s atmosphere, creating hundreds of bright meteors that appear to radiate from a single location in the sky.
   B) The nuclei of comets gradually disintegrate and spread out along the comet’s orbital path. When the Earth passes through the orbit of a comet, we are bombarded by sand-sized particles which cause a meteor shower.
   C) Asteroid impacts elsewhere in the solar system throw sand-sized particles into space, and occasionally the Earth passes through a cloud of these particles, which burn up in our atmosphere and cause a meteor shower.
   D) Near–Earth asteroids gradually disintegrate and spread out along their orbital path. When the Earth passes through the orbit of an asteroid, we are bombarded by sand-sized particles which cause a meteor shower.
   E) The nuclei of comets disintegrate as they enter Earth’s atmosphere, creating hundreds of bright meteors that appear to radiate from a central location in the sky.

21) Moons cause/contribute to which of the following?
   A) stability of particles within rings.
   B) gravitational effects at ring edges as the moons pass by.
   C) ring material.
   D) gaps between rings.
   E) Moons contribute to all of the above.

22) Our current best observations show that Pluto has
   A) one large satellite and three small satellites.
   B) two medium–sized satellites.
   C) no satellites.
   D) one large satellite.
   E) one medium sized satellite and two small satellites.

23) Where do most short–period comets come from, and how do we know?
   A) The Kuiper belt; short period comets tend to come from random directions indicating a spherical distribution of comets called the Kuiper belt.
   B) The Kuiper belt; short period comets tend to be in the plane of the solar system, just like the Kuiper belt.
   C) The asteroid belt; short period comets have orbital periods similar to asteroids like Vesta, and are found in the plane of the solar system just like the asteroid belt.
   D) The Oort cloud; short period comets tend to be in the plane of the solar system, just like the Oort cloud.
   E) The Oort cloud; short period comets tend to come from random directions indicating a spherical distribution of comets called the Oort cloud.

24) How do scientists know that the majority of meteorites come from the asteroid belt?
   A) The asteroid belt is the only possible source of meteorites, therefore they must originate there.
   B) The spectra of some meteorites are similar to the spectra of asteroids in the asteroid belt.
   C) Bubbles of gas trapped in the crystals within meteorites are identical to the gases trapped in asteroids.
   D) High levels of Iridium have been detected in both asteroids and meteorites, therefore meteorites come from the asteroid belt.
   E) Collisions are common in the asteroid belt, and we can track the fragments from their source asteroid to the Earth, where they become meteorites.
25) What is the Cassini division of Saturn's rings?
   A) a dark ring, visible from Earth, composed of dark, dusty particles
   B) the widest ring of Saturn, located between two large ring gaps
   C) the most opaque ring of Saturn, made of highly reflective ice particles
   D) a large gap, visible from Earth, produced by an orbital resonance with the moon Mimas
   E) the imaginary circle marking the halfway point of Saturn's rings

26) Why are there no impact craters on the surface of Io?
   A) Io did have impact craters but they have all been buried in lava flows.
   B) Any craters that existed have been eroded through the strong winds on Io's surface.
   C) It is too small to have been hit during the Late Heavy Bombardment
   D) Io's thick atmosphere obscures the view of the craters.
   E) Jupiter's strong gravity attracted the planetesimals more strongly than Io and thus none landed on its surface.

27) Where is the crater from the impact that is believed to be responsible for the mass extinction of dinosaurs 65 million years ago?
   A) Quebec, Canada.
   B) Meteor Crater in Arizona.
   C) Crater Lake, Oregon
   D) Tunguska, Siberia.
   E) Chicxulub Crater, Yucatan Peninsula in Mexico.

28) What would happen to Jupiter if we could somehow double its mass?
   A) Its density would stay about the same and its volume would double.
   B) Its density would decrease and its diameter would double.
   C) Its density would increase but its diameter would barely change.
   D) It would become a star, with nuclear fusion in its core.

29) How do astronomers think Jupiter generates its internal heat?
   A) radioactive decay
   B) chemical processes
   C) by contracting, changing gravitational potential energy into thermal energy
   D) nuclear fusion in the core
   E) internal friction due to its high rotation rate
Answer Key
Testname: ASTRO102_EXAM3_FORMB

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