Topic IV Part 1

Modern Astronomy

Big Bang Theory - the most accepted theory which explains how a huge e approximately 13.8 billion years ago.	explosion formed the Universe		
Evidence #1			
Evidence #2			
Each gas has its own spectral line pattern (bright line spectrum) that is unique. Scientists can determine the composition of gases within a star based on observing bright line spectra.			
<u>Red Shift</u>	<u>Blue Shift</u>		
Diagram Illustrating <u>Red Shift</u> of Spectral Lines			
normal laboratory spectrum of a gas (in this case - hydrogen)			

Hubble's Law –

Aim:

Topic: Modern Astronomy

Firs	First: The Universe formed ~13.8 billion years ago				
	Second:				
	а				
	b.				
	C.				
	1				
	Third:				



The Universe, Galaxies, and Solar System Review

- 1. In which list are the celestial features correctly shown in order of increasing size?
 - (1) galaxy \rightarrow solar system \rightarrow universe \rightarrow planet
 - (2) solar system \rightarrow galaxy \rightarrow planet \rightarrow universe
 - (3) planet \rightarrow solar system \rightarrow galaxy \rightarrow universe
 - (4) universe \rightarrow galaxy \rightarrow solar system \rightarrow planet

The diagram represents a side view of the Milky Way Galaxy.

- 2. At approximately which position is Earth's Solar System located?
 - (1) *A* (3) *C*
 - (2) B (4) D



3. The diagram below represents the bright-line spectrum for an element.

Violet	Red

The spectrum of the same element observed in the light from a distant star is shown below.



The shift in the spectral lines indicates that the star is moving

- (1) toward Earth
- (2) away from Earth

- (3) in an elliptical orbit around the Sun
- (4) in a circular orbit around the Sun
- 4. In the geocentric model, which motion would occur?
 - (1) The Earth would revolve around the Sun.
 - (2) The Earth would rotate on its axis.
 - (3) The Moon would revolve around the Sun.
 - (4) The Sun would revolve around the Earth.

5. Which statement best describes the age of our solar system and the universe?

- (1) The universe is at least twice as old as our solar system.
- (2) Our solar system is at least twice as old as the universe.
- (3) Our solar system and the universe are estimated to be 5 billion years old.
- (4) Our solar system and the universe are estimated to be 10 billion years old.
- 6. Most scientists believe the Milky Way Galaxy is
 - (1) spherical in shape
 - (2) 4.6 billion years old
- (3) composed of stars revolving around Earth
- (4) one of billions of galaxies in the universe

- 7. The picture represents the shape of the Milky Way Galaxy. The Milky Way Galaxy is best described as (1) elliptical
 - (2) irregular

(3) circular (4) spiral



- 8. Which planetary model is used today by scientists to predict the exact positions of the planets in the night sky over many years?
 - (1) The planets orbit the Sun in a geocentric model.
 - (2) The planets orbit the Earth in a geocentric model.
 - (3) The planets orbit the Sun in a heliocentric model.
 - (4) The planets orbit the Earth in a heliocentric model.
- 9. Which diagram best represents a heliocentric model of a portion of the solar system?
 - Key: E = Earth P = planet S = Sun



10. Which statement best describes galaxies?

- (1) They are similar in size to the solar system.
- (2) They contain only one star but hundreds of planets.
- (3) They may contain a few hundred stars in a space slightly larger than the solar system.
- (4) They may contain billions of stars in a space much larger than our solar system.
- 11. The theory that the universe is expanding is supported by the
 - (1) blue shift of light from distant galaxies
 - (2) red shift of light from distant galaxies
 - (3) nuclear fusion occurring in the Sun
 - (4) radioactive decay occurring in the Sun
- 12. Cosmic background radiation provides direct evidence for the origin of
 - (1) the universe
- (3) Earth's ozone layer
- (2) our solar system
- (4) Earth's earliest atmosphere

Astronomical Unit (A.U.) - unit used to measure distances in our Solar System

1 A.U. = average distance between Earth and Sun (149.6 million km)

Examples: 1. Express the Jupiter to Sun distance in A.U. :

2. Express the Mercury to Sun distance in A.U.: _____



Light Year - the <u>distance</u> that light travels in one year (9.5 trillion km)

a light year is used to measure **large distances** between stars and galaxies

Speed of light = 300,000 km/sec

186,000 mi/sec

EXAMPLE: The Sun is the closest star to the Earth. The next closest star is Proxima Centauri. Proxima Centauri is 4.2 light years away from the Earth. What does that really mean?

The Sun

an average-sized star

cooler dark spots known as sunspots reappear cyclically every 11 years

Characteristic	Terrestrial Planets	Jovian Planets
Distance from Sun		
Period of Revolution		
Average Temperatures		
Period of Rotation		
Equatorial Diameter (size)		
Mass		
Density		
Composition		

Mercury

no atmosphere - lacks protection against meteorite impacts - many craters from meteorite impacts

<u>Venus</u>

experiences greenhouse effect because of a thick atmosphere of CO₂ gas - hottest temperatures (900°F)

"day is longer than year" (rotation takes longer than revolution)

<u>Saturn</u>

- entire planet is less dense than water (has a density of 0.7g/ml)

Other "space junk" that would be found in our Solar System:

the asteroid belt - rocks orbiting the Sun between Mars and Jupiter

comets - masses of rocks, ice, and a tail of dust and gas that travel in highly elliptical orbits around the Sun

meteoroids - rocks freely floating through space

meteors - rocks burning up in Earth's atmosphere - "shooting stars"

meteorites - rocks that hit the Earth's surface

The Solar System Review

Base your answers to **questions 1 and 2** on the four graphs below, which represent trends for four characteristics of the planets in Earth's Solar System. The planets are indicated in order of increasing distance from the Sun.



The diagram below represents two planets in our solar system drawn to scale, Jupiter and planet A.

8. Planet A most likely represents

(1) Earth
(2) Venus
(3) Saturn
(4) Uranus



- 9. Compared to the Jovian planets, the terrestrial planets are
 - (1) smaller and have lower densities
 - (2) smaller and have greater densities

- (3) larger and have lower densities
- (4) larger and have greater densities

Base your answers to **questions 10 and 11** on the data table below, which shows information about the four largest asteroids found in our Solar System.

- 10. The asteroids shown in the data table are located between
 - the orbits of
 - (1) Venus and Earth(2) Earth and Mars
- (3) Mars and Jupiter(4) Jupiter and Saturn

Name	Average Diameter (kilometers)	Period of Revolution (years)		
Ceres	848.4	4.60		
Pallas	498.1	4.61		
Juno	247.0	4.36		
Vesta	468.3	3.63		

- 11. Compared to the diameter of Earth's Moon, the diameter of Ceres is about
 - (1) one-fourth of the Moon's diameter
 - (2) one-half of the Moon's diameter
 - (3) twice the diameter of the Moon
 - (4) four times the diameter of the Moon

Base your answers to **questions 12 and 13** on the data table below. The data table provides information about the Moon, based on current scientific theories.

Subject	Current Scientific Theories		
Origin of the Moon	Formed from material thrown from a still-liquid Earth following the impact of a giant object 4.5 billion years ago		
Craters	Largest craters resulted from an intense bombardment by rock objects around 3.9 billion years ago		
Presence of water	Mostly dry, but water brought in by the impact of comets may be trapped in very cold places at the poles		
Age of rocks in terrae highlands	Most are older than 4.1 billion years; highland anorthosites (igneous rocks composed almost totally of feldspar) are dated at 4.4 billion years		
Age of rocks in maria plains	Varies widely from 2 billion to 4.3 billion years		
Composition of terrae highlands	Wide variety of rock types, but all contain more aluminum than rocks of maria plains		
Composition of maria plains	Wide variety of basalts		
Composition of mantle	Varying amounts of mostly olivine and pyroxene		

Information About the Moon

- 12. Which statement is supported by the information in the table?
 - (1) The Moon was once a comet.
 - (2) The Moon once had saltwater oceans.
- (3) Earth is 4.5 billion years older than the Moon.
- (4) Earth was liquid rock when the Moon was formed.
- 13. Which Moon feature is formed by meteorite impacts?
 - (1) crater
- (2) maria plain

- (3) terrae highland
- (4) mantle

Data Table

Characteristics of Stars: The H-R Diagram

(ESRT page 15)

Directions: Use the HR diagram on from page 15 of the ESRT to answer the questions about stars in our GALAXY.

1. Fill in the spaces below to describe certain characteristics of our Sun.

	Color: Temperature: Size (S,M,L): Class:				
2.	What type of star would Procyc	n B be classified as?			
3.	According to the diagram, what i definition of "luminosity"?	s the		 	
4.	Of the stars given on the HR dia is the name of the star that is the	gram, what hottest?			
5.	Give two properties of a White D	warf star.			
6	6. How many times brighter is Be	telgeuse than our Sun			
7	 List the color of the stars in c increasing temperature. 	rder of			
8	8. What is the approximate tem	perature of Barnard's Star?			
9.	Compared to the Sun, Aldeba	aran is: (circle all that apply)			
	hotter	cooler	brighter		
	larger	smaller	dimmer		
10). What property of a star can be	inferred based on its color?			
11	 Which property of a star is rela (1) color (2) temperature 	ted to its luminosity? (3) size (4) shape			



MODERN ASTRONOMY EXAM REVIEW

1. The planet that has liquid water and supports life is	
2. The planet that has a rotation period longer than its revolution period is	
3. Rocks that orbit the Sun between Mars and Jupiter are called	
4. The planet that has a thick atmosphere of CO ₂ is	
5. The names of the Jovian planets are,,,	, &,
6. Which planet has the longest period of revolution?	
7. How are galaxies classified?	
8. Which planet's density is less than the density of liquid water?	
9. Large chunks of rock, ice, and gas that travel in elliptical orbits around the Sun are known as	
10. According to theory, how long ago did the Sun, Earth, and Solar System form?	
11. Which process produces the energy that allows the stars of the universe to radiate visible light?(1) convection(3) insolation(2) nuclear fusion(4) radioactive decay	
12. The diagram below shows the spectral lines for an element.	
Violet Red	
Which diagram best represents the spectral lines of this element when its light is observed coming from a star that is moving away from Earth?	
Violet Red	
(2) Violet Red	
(3) Violet Red	

(4) Violet Red

13. Which pair of shaded circles best represents the relative sizes of Earth and Venus when drawn to scale?



- 14. The vertical axis of the H-R diagram relates to the
 - (1) color of the star
 - (2) temperature of the star
 - (3) brightness of the star compared to our Sun
 - (4) speed of the star

Base your answers to questions 15 through 17 on the diagram below, which shows two possible sequences in the life cycle of stars, beginning with their formation from nebular gas clouds in space.

The Life Cycles of Stars



- 15. According to the diagram, the life-cycle path followed by a star is determined by the star's initial
 - (1) mass and size
- (3) luminosity and color
- (2) temperature and origin (4) luminosity and structure
- 16. Stars like Earth's Sun most likely formed directly from a
 - (1) nebula

(3) red giant

(2) supernova

- (4) black dwarf
- 17. According to the diagram, a star like Earth's Sun will eventually
 - (1) explode in a supernova
- (2) become a black hole
- (3) change into a white dwarf
- (4) become a neutron star
- 18. Which of the following stars is the hottest?
 - (1) a red giant

(3) the Sun

(4) moon

- (2) a white dwarf (4) a red dwarf
- 19. Which object forms by the contraction of a large sphere of gases causing the nuclear fusion of lighter elements into heavier elements? (1) comet (3) star
 - (2) planet

- 20. The region of the H-R diagram occupied by most stars is the
 - (1) main sequence region (3) white dwarf region
 - (2) red giant region (4) quasar region
- 21. What factor usually determines whether a star will be on the main sequence?
 - (1) age (3) size
 - (2) mass

- (4) distance from our Sun
- 22. Which off the following diagrams correctly shows the life cycle of a star?



- 23. Which evidence best supports the theory that the universe was created by an explosion called the Big Bang?
 - (1) impact craters found on Earth
 - (2) cosmic background radiation

- (3) the different compositions of terrestrial and Jovian planets(4) the blue shift of light from distant galaxies
- 24. Compared to the Sun, a white dwarf star is
 - (1) hotter and larger
 - (2) hotter and smaller

- (3) cooler and larger
- (4) cooler and smaller
- 25. Compared to our Sun, the star Pollux is
 - (1) smaller, hotter, and less luminous
 - (2) smaller, cooler, and more luminous
- (3) larger, hotter, and less luminous
- (4) larger, cooler, and more luminous
- 26. Astronomers viewing light from distant galaxies observe a shift of spectral lines toward the red end of the visible spectrum. This shift provides evidence that
 - (1) orbital velocities of stars are decreasing
 - (2) the Sun is cooling

- (3) Earth' atmosphere is warming(4) the Universe is expanding
- 27. The diagram below represents the development of our universe from the time of the Big Bang until the present. Letter *A* indicates two celestial objects.

The present-day celestial objects labeled *A* are best identified as

- (1) asteroid belts
- (2) terrestrial planets

(3) spiral galaxies(4) eccentric comets



Base your answers to **questions 28 and 29** on the diagram below, which shows an inferred sequence in which our solar system formed from a giant interstellar cloud of gas and debris. Stage *A* shows the collapse of the gas cloud, stage *B* shows its flattening, and stage *C* shows the sequence that led to the formation of planets.



- 28. From stage *B* to stage *C*, the young Sun was created
 - (1) when gravity caused the center of the cloud to contract
 - (2) when gravity caused heavy dust particles to split apart
- (3) by outgassing from the spinning interstellar cloud
- (4) by outgassing from Earth's interior
- 29. After the young Sun formed, the disk of gas and dust
 - (1) became spherical in shape
 - (2) formed a central bulge

- (3) became larger in diameter
- (4) eventually formed into planets
- 30. Which sequence correctly shows the relative size of the nine planets of our Solar System?

