

## JAF01 Lesson 10 The Universe

### I. Discuss in pairs:

1. Are you interested in the universe? If yes, what would you like to know about it?
2. Do you know about any recent discoveries in astronomy? What do you think the edge of the universe looks like?
3. What is the shape and colour of the universe?
4. How did the universe start?
5. What three adjectives would you use to describe the universe?
6. Read the quotations below. Which do you like best and why?

**Dyer** said: "Everything is perfect in the universe."

**Einstein** said: "Two things are infinite: the universe and human stupidity; and I'm not sure about the universe."

**Stephen Hawking** said: "We are just an advanced breed of monkeys on a minor planet of a very average star. But we can understand the Universe. That makes us something very special."

### II. The Solar System

Read the text and fill in the gaps with suitable words.

The Solar System comprises the Sun and its planetary system of eight planets, as well as a number of dwarf planets, satellites, and other objects that orbit the Sun. It formed 4.6 billion years ago from the gravitational collapse of a giant \_\_\_\_\_. The vast majority of the system's mass is in the \_\_\_\_\_, with most of the remaining mass contained in \_\_\_\_\_. The four smaller inner planets, Mercury, Venus, Earth and Mars, also called the terrestrial planets, are primarily composed of \_\_\_\_\_ and metal. The four outer planets, called the \_\_\_\_\_, are substantially more massive than the terrestrials. The two largest, Jupiter and Saturn, are composed mainly of \_\_\_\_\_ and helium; the two \_\_\_\_\_ planets, Uranus and Neptune, are composed largely of substances with relatively high melting points, called ices, such as water, ammonia and methane, and are often referred to separately as "ice giants". All planets have almost circular orbits that lie within a nearly flat disc called the \_\_\_\_\_.

The Solar System also contains a number of regions populated by smaller objects. The \_\_\_\_\_, which lies between Mars and Jupiter, is similar to the terrestrial planets as it mostly contains objects composed of rock and metal. Beyond Neptune's orbit lie the Kuiper belt and scattered disc, linked populations of trans-Neptunian objects composed mostly of ices. Within these populations are several dozen to more than ten thousand objects that may be large enough to have been rounded by their own \_\_\_\_\_. Such objects are referred to as dwarf planets. Identified dwarf planets include the asteroid Ceres and the trans-Neptunian objects \_\_\_\_\_, Eris, Haumea, and Makemake. In addition to these two regions, various other small-body populations including comets, centaurs and interplanetary dust freely travel between regions. Six of the planets, at least three of the dwarf planets, and many of the smaller bodies are orbited by \_\_\_\_\_, usually termed "moons" after Earth's Moon. Each of the outer planets is encircled by planetary rings of \_\_\_\_\_ and other small objects.

([http://en.wikipedia.org/wiki/Solar\\_System](http://en.wikipedia.org/wiki/Solar_System))

### III. Match terms with their definitions

1. Astronomy
  2. Solar system
  3. Geocentric model
  4. Astronomical unit
  5. Conjunction
  6. Rotation
  7. Revolution
  8. Foucault pendulum
  9. Solar nebula
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- a) Spinning on an internal axis
  - b) Proves that the Earth rotates
  - c) Considers the Earth to be the centre of the universe
  - d) The study of the totality of all matter, energy, space, and time
  - e) A flattened, rotating disk of gas and dust
  - f) Contains eight planets
  - g) Average distance between the Earth and the Sun
  - h) Two planets lined up on the same side of the Sun
  - i) Movement of one object around another
- (Shipman, Wilson, Todd. *An Introduction to Physical Science*. Houghton Mifflin:2006)

### IV. Video: Planets explained

(<http://www.videojug.com/film/the-planets-explained?sourcelink=verticalrecommendaation>)

**Listen and answer the questions:**

1. What are the dark areas on the Sun called?
2. Is the Sun burning?
3. How hot is the surface of Mercury?
4. What's Venus's nickname?
5. What is the distance of the Earth from the Sun?
6. What is the distance from the Earth to the Moon?
7. What is on the surface of the Moon?
8. What are the polar ice caps on Mars made from?
9. How big is Jupiter?
10. How long is a day on Jupiter?
11. What is the great red spot on Jupiter?
12. What is the size of Jupiter compared to Earth?
13. What is the surface of Saturn?
14. How thick are Saturn's rings?
15. What is odd about Uranus?
16. What is the recent discovery about Uranus?
17. What is Neptune's distance from the Sun?
18. When was Neptune visited by a NASA spacecraft?
19. What happened to Pluto in 2006?
20. What is Pluto called now?

## V. Reading: The Moon – A Nice Place to Visit?

The moon has been described by songwriters and poets as a place for a romantic escape. We know of course that the moon is actually a very hostile environment for human beings.

The moon is completely devoid of water because the force of gravity on the moon is much less than on the earth. (The moon is much smaller; its surface is about as large as Africa.) The lack of a strong gravitational pull has caused any water the moon may have had to leak out into space over the 4.6 billion years that it has been in existence. Of course, since there is no water, there is also no vegetation.

There is no air on the moon because its gravity is insufficient to retain an atmosphere. Accordingly, travellers to the moon require not only oxygen and water but also protection against cosmic rays that are unfiltered by an atmosphere. No atmosphere also means no weather – no wind, no rain, no clouds.

Temperatures on the moon are quite extreme, ranging from 110°C to -173°C. This occurs because there is no atmosphere to filter the sun's rays when it is shining and then to blanket in warm air when the sun goes down. These extremes of temperatures are particularly striking during a solar eclipse, when the earth passes directly between the sun and the moon, temporarily blotting out the sun's light. At such times the temperature on the moon dips very rapidly and then rises immediately as the sun emerges from the earth's shadow. The change in temperature may be as much as 200°C in one hour! This sudden change can cause rocks to shatter due to the alternate expanding and contracting.

There is no twilight or dawn on the moon. Like the earth, the moon does not shine its own light: it reflects the light of the sun. Unlike the earth, however, there is no atmosphere to diffuse the light as day becomes night and night turns into day. Changes from light to dark and from dark to light occur suddenly.

The lunar sky is black. On the moon stars are visible in the daytime, but you would have to shield your eyes from the unfiltered sunlight to view them.

There is no sound on the moon. Sound travels on waves of air molecules and since there is no air, there is nothing to transmit sound.

The moon is a satellite of the earth, revolving around the earth once every twenty-nine and a half days. The moon itself rotates, but it does so very slowly. Therefore the same side of the moon is always visible to us. To get to the moon, you would have to travel 240,000 miles, a distance that is about the same as circling the earth at the equator ten times.

It is clear that if you were making a trip to the moon, you would need to pack more than a toothbrush and a change of underwear. Its adverse conditions would make it very difficult for a visitor from the earth.

### **Making inferences.**

**Indicate whether each of the following statements is stated in the passage (S), implied by other information (I) or neither stated nor implied (N).**

1. The force of gravity on the moon is less than that on the earth.
2. The tides on the earth are caused by the moon.
3. A person would weigh less on the moon than on the earth.
4. It would be difficult to have a chat with someone on the moon.
5. The moon orbits the earth about once a month.
6. The temperature on the moon goes up to 200°C.
7. The moon has more extremes of temperatures than the earth has.
8. Human beings could not live on the moon.

(adapted from Zimmerman, F. *English for Science*. Prentice-Hall, 1989.)

**VI. Study the phrases below. Then compare the planets of the solar system and/or the Moon and the Earth.**

The following words and phrases that can be used to make a comparison more precise (Jordan 1999) :

X is	considerably a great deal (very) much rather somewhat a little slightly scarcely hardly only just	smaller bigger closer  <i>etc</i>	than...
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X is	exactly precisely just virtually practically more or less almost nearly approximately about	the same as ...
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X is not	exactly entirely quite	the same as ...
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X is	totally completely entirely quite	different from Y.	X is not quite so/as	big expensive  <i>etc</i>	as...
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X and Y are	different dissimilar	in every way/respect.
	totally completely entirely quite	different.

**VII. Video: How realistic is “Gravity”?**

<http://edition.cnn.com/2013/10/07/showbiz/movies/gravity-scientists/>

**Gravity** is a 2013 3D science fiction thriller and space drama film directed, co-written, co-produced and co-edited by Alfonso Cuarón. The film stars Sandra Bullock and George Clooney as astronauts who survive the mid-orbit destruction of a Space Shuttle and attempt to return to Earth.

Watch the video to find out a physicist’s comments on scientific accuracy of the film. What did the filmmakers get right and what is wrong according to the physicist?