

SUPPLEMENTAL MATERIAL A - QUESTIONNAIRES USED IN THE STUDY

In the following we report the two versions of the conceptual test used in the study. Correct answers are marked in bold.

FORM 1
(5th and 6th grade students)

Q1 Which is the cause of a solar eclipse?

- (a) **The Earth-Moon-Sun alignment;**
- (b) The Moon passes through the shadow cone of the Earth;
- (c) The Moon's orbit intersects the Earth's orbit around the Sun;
- (d) A planet is aligned between the Earth and the Sun.

Q2 Which is the cause of a total Moon eclipse?

- (a) **The alignment of the Sun, Earth, and the Moon;**
- (b) The Earth's shadow;
- (c) The Sun that obscures the Moon;
- (d) The inclination of the Moon's orbit plane with respect to the Earth's one.

Q3 One night you observed that the Moon appeared as in the figure below on the left. How much time will pass before you could see it as shown in the figure below on the right?



- (a) About one day;
- (b) **About one week;**
- (c) About two weeks;
- (d) About one month.

Q4 During the New Moon phase, the Moon is not visible by an observer on Earth. This occurs because:

- (a) the Moon is between the Earth and a celestial body that prevents the sunlight from lighting up the Moon;
- (b) the Moon is on the same side of the Sun, whose brightness outshines the weak light of the Moon;
- (c) **the Moon is on the same side of the Sun that lights up the Moon hidden face;**
- (d) Earth's shadow covers the Moon, obscuring it.

Q5 The main factor for which summer and winter alternate is:

- (a) the distance between the Sun and the Earth changes during the year;
- (b) the rotation of the Earth around its own axis;
- (c) the variation in the length of daylight;
- (d) **the incidence of the solar rays on the Earth's surface varies.**

Q6 Why is it warmer in summer than in winter?

- (a) The inclination of Earth's axis is varied;
- (b) **The solar rays on the Earth's surface are less tilted;**
- (c) In summer, the Earth is further away from the Sun;
- (d) In summer, the Earth is closer to the Sun.

FORM 2
(8th and 9th grade students)

Q1 The main factor for which summer and winter alternate is:

- (a) the distance between Sun and Earth changes during the year, so the incidence of solar rays on the Earth's surface varies;
- (b) the inclination of the Earth's axis with respect to the orbit plane changes during the year, therefore the incidence of the solar rays on the Earth's surface varies;
- (c) the Earth's axis direction in space changes during the year, therefore the incidence of the solar rays on the Earth's surface varies;
- (d) **the Earth's position along its orbit changes during the year, therefore the incidence of the solar rays on the Earth's surface varies.**

Q2 During the New Moon phase, the Moon is not visible by an observer on Earth. This happens because:

- (a) the Moon is between the Earth and a celestial body that prevents the sunlight from lighting up the Moon;
- (b) with respect to the Earth, the Moon is on the same side of the Sun, whose brightness outshines the weak light of the Moon;
- (c) Earth's shadow covers the Moon, obscuring it;
- (d) **with respect to the Earth, the Moon is on the same side of the Sun that lights up the Moon hidden face.**

Q3 Which is the cause of a solar eclipse?

- (a) **The alignment of the Earth-Moon-Sun;**
- (b) The Moon crosses the cone of shadow cast by the Earth;
- (c) Moon's orbit intersects Earth's orbit around the Sun;
- (d) A planet is aligned in between the Earth and the Sun.

Q4 Which is the cause of the different Moon phases?

- (a) **The revolution of the Moon around the Earth and how solar rays hit the Moon's surface;**
- (b) The revolution of the Moon around the Earth and the revolution of the Earth around the Sun;
- (c) Earth's motion and how solar rays are reflected by the Moon surface;
- (d) The shadow of clouds and planets in between the Earth and the Moon and the revolution of the Earth around the Sun.

Q5 The reason why in Italy during summer is hotter than in winter is that during summer:

- (a) the Earth is closer to the Sun and the daylight lasts more than in winter;
- (b) the inclination of Earth's axis changes;
- (c) **solar rays are less inclined and, hence, the daylight is longer;**
- (d) the Sun produces more energy.

Q6 A total solar eclipse, visible from Italy,

- (a) is visible also from Brazil, if it is daytime;
- (b) **is not visible from Brazil, because the shadow cone cast by the Moon on the Earth is small;**
- (c) is visible also from Brazil, if the Moon is full;
- (d) is probably visible from Brazil, because in Brazil it is night.

Q7 Which is the Moon phase seen by a Canadian when, in Italy, you can see the Moon at its first quarter?

- (a) **The same because we are in the same day;**
- (b) A different one, because the lighting of the Sun changes, depending on where we are on the Earth's surface;

- (c) The same because we are in the same hemisphere;
- (d) A different one, because the lit up portion of the visible Moon face changes, depending on where we are on the Earth's surface.

Q8 Which of the following statements best explains the phenomenon of the different seasons? During the revolution

- (a) the distance between the Earth and the Sun changes so that, in a certain place of the Earth, solar rays do not always have the same incidence on the surface;
- (b) the direction of the Earth's axis changes so that, in a certain place of the Earth, solar rays do not always have the same incidence on the surface;
- (c) **Earth's axis remains parallel to itself so that, in a certain place of the Earth, solar rays do not always have the same incidence on the surface;**
- (d) Earth's axis is always perpendicular to the orbit plane so that, in a certain place of the Earth, solar rays do not always have the same incidence on the surface.

Q9 Which is the cause of a total Moon eclipse?

- (a) **The alignment of the Sun, the Earth, and the Moon;**
- (b) The Earth's shadow;
- (c) The Sun that obscures the Moon;
- (d) The inclination of the Moon's orbit plane with respect to the Earth's one.