The diagram below shows the Moon in different positions as it revolves around Earth, as observed from above the North Pole (NP).

Which image correctly represents the Moon at position 8, as observed from Earth?
Which diagram sequence correctly shows the order of Moon phases, as viewed from Earth, for a period of 1 month? [Note that some phases have been omitted.]

(1)  

(2)  

(3)  

(4)
What was the maximum altitude of the Moon on June 22?

46°

Which diagram best represents the Moon’s phase observed on June 11?

Which terms describe both the changes in the maximum altitude of the Moon and the changes in the Moon’s phases over a period of several years?

cyclic and predictable
Which diagram best represents visible light rays after striking a dark, rough surface?

(1)  (2)  (3)  (4)
Which graph best represents the relationship between the angle of insolation and the intensity of insolation?

(1)  
(2)  
(3)  
(4)
The diagram below represents a simple geocentric model. Which object is represented by the letter X?

(Not drawn to scale)

(1) Earth  (2) Sun  (3) Moon  (4) Polaris
The diagram below shows the types of electromagnetic energy given off by the Sun. The shaded part of the diagram shows the approximate amount of each type actually reaching Earth’s surface.

Which conclusion is best supported by the diagram?

(1) All types of electromagnetic energy reach Earth’s surface.
(2) Gamma rays and x-rays make up the greatest amount of electromagnetic energy reaching Earth’s surface.
(3) Visible light makes up the greatest amount of electromagnetic energy reaching Earth’s surface.
(4) Ultraviolet and infrared radiation make up the greatest amount of electromagnetic energy reaching Earth’s surface.
What is represented by the diagram below?

(1) changing phases of the Sun
(2) changing phases of the Moon
(3) stages in an eclipse of the Sun
(4) stages in an eclipse of the Moon
The diagram below shows the relative positions of the Sun, the Moon, and Earth when an eclipse was observed from Earth. Positions A and B are locations on Earth’s surface.

(Not drawn to scale)

Which statement correctly describes the type of eclipse that was occurring and the position on Earth where this eclipse was observed?

(1) A lunar eclipse was observed from position A.
(2) A lunar eclipse was observed from position B.
(3) A solar eclipse was observed from position A.
(4) A solar eclipse was observed from position B.
Base your answers to questions 64 through 66 on the diagram provided in your answer booklet and on your knowledge of Earth science. The diagram shows the Sun, Earth, and the Moon’s orbit around Earth as viewed from space.

64 On the diagram provided in your answer booklet, draw a circle of approximately this size $\bigcirc$ to represent the Moon’s position in its orbit when a solar eclipse is viewed from Earth.

![Diagram showing Sun, Earth, and Moon's orbit](image)

(Not drawn to scale)

65 Approximately how many complete revolutions does the Moon make around Earth each month?  

1 or 1.1 revolution.

66 Explain why solar eclipses do not occur every time the Moon revolves around Earth.

The Moon’s orbit around Earth is not always in the same plane as Earth’s orbit around the Sun.

The Moon usually passes above or below the Sun as seen from Earth.

The Sun, Moon, and Earth are only occasionally aligned in a straight line.
The table below shows gravitational data for a planet traveling in an elliptical orbit around a star. The table shows the relative gravitational force between the star and this planet at eight positions in the orbit (letters $A$ through $H$). Higher numbers indicate stronger gravitational attraction.

<table>
<thead>
<tr>
<th>Planet’s Position in the Orbit</th>
<th>$A$</th>
<th>$B$</th>
<th>$C$</th>
<th>$D$</th>
<th>$E$</th>
<th>$F$</th>
<th>$G$</th>
<th>$H$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Gravitational Force Between Star and Planet</td>
<td>52</td>
<td>42</td>
<td>25</td>
<td>12</td>
<td>10</td>
<td>12</td>
<td>25</td>
<td>42</td>
</tr>
</tbody>
</table>

Which diagram best represents the positions of the planet in its orbit that would produce the gravitational forces shown in the data table?
The diagram provided in your answer booklet represents the Sun and Earth as viewed from space on a certain date.

a Using a symbol for the Moon of approximately this size (○), draw the position of the Moon on the diagram provided in your answer booklet at the time when the full-Moon phase is observed from Earth.

b Draw an arrow on the diagram provided in your answer booklet that shows the Earth motion that causes surface ocean currents and surface winds to curve (Coriolis effect).

(Not drawn to scale)

ANSWER:

(Not drawn to scale)
Base your answers to questions 63 through 66 on the diagram below, which represents an exaggerated model of Earth's orbital shape. Earth is closest to the Sun at one time of year (perihelion) and farthest from the Sun at another time of year (aphelion).

63 State the actual geometric shape of Earth's orbit. 
   ellipse
   oval
   elliptical with the Sun at one focus

64 Identify the season in the Northern Hemisphere when Earth is at perihelion. 
   early winter
   winter

65 Describe the change that takes place in the apparent size of the Sun, as viewed from Earth, as Earth moves from perihelion to aphelion.

   As Earth moves from perihelion to aphelion, the apparent size decreases.
   The Sun appears smaller.

66 State the relationship between Earth's distance from the Sun and Earth's orbital velocity.

   As Earth moves from perihelion to aphelion, the orbital velocity decreases.
   As distance of Earth from the Sun increases, orbital velocity decreases.
   an inverse relationship
The photograph below shows an impact crater approximately 1 mile wide located in Diablo Canyon, Arizona. Describe the event that produced this crater.

Barringer Crater, Arizona, U.S.A. (photo courtesy of NASA)

Barringer Crater was caused by the impact of a meteorite (or meteor or comet or asteroid).
In the diagram below, the spectral lines of hydrogen gas from three galaxies, \(A\), \(B\), and \(C\), are compared to the spectral lines of hydrogen gas observed in a laboratory.

What is the best inference that can be made concerning the movement of galaxies \(A\), \(B\), and \(C\)?

1. Galaxy \(A\) is moving away from Earth, but galaxies \(B\) and \(C\) are moving toward Earth.
2. Galaxy \(B\) is moving away from Earth, but galaxies \(A\) and \(C\) are moving toward Earth.
3. Galaxies \(A\), \(B\), and \(C\) are all moving toward Earth.
4. Galaxies \(A\), \(B\), and \(C\) are all moving away from Earth.
Which graph best represents the relative periods of rotation of Mercury, Venus, Earth, and Mars?
Which graph best represents the change in gravitational attraction between the Sun and a comet as the distance between them increases?

(1)

(3)

(2)

(4)