6. Space physics

Starter Quiz · 课前小测

IGCSE Physics Name: _____ Score: _____

1. What causes day and night?

   ☐ the Moon orbiting the Earth

   ☐ the Sun switching off

   ☐ the Earth orbiting the Sun

   ☐ the Earth spinning on its axis

2. How do the inner and outer planets differ?

   ☐ the inner four are small and rocky; the outer four are large and gaseous

   ☐ they are all the same

   ☐ the inner four are gaseous; the outer four are rocky

   ☐ the inner planets have no Sun

3. What powers the Sun?

   ☐ nuclear fusion of hydrogen into helium

   ☐ friction

   ☐ nuclear fission of uranium

   ☐ burning hydrogen like a fire

4. Light from a distant galaxy is redshifted. This means the galaxy is:

   ☐ standing still, so its light is unchanged

   ☐ getting hotter, so its light shifts to longer wavelengths

   ☐ moving toward us, so its light is squeezed to a shorter wavelength

   ☐ moving away from us, so its light is stretched to a longer wavelength

5. What causes the seasons?

   ☐ the Sun changing brightness

   ☐ the Earth getting closer to and further from the Sun

   ☐ the Moon blocking the Sun

   ☐ the tilt of the Earth's axis as it orbits the Sun

6. The Sun is about 1.5×10^{11} m away. How long does its light take to reach Earth, in seconds? (light speed 3.0×10^{8} m/s)

   _____ s

7. The cosmic microwave background radiation (CMBR) is found coming from every direction in space.

   ☐ True ☐ False

8. The phases of the Moon happen because we see different amounts of its lit side as it orbits.

   ☐ True ☐ False

9. The Hubble constant is about $H_0 = 2.0 \times 10^{-18}$ per second. Estimate the age of the Universe $(1/H_0)$, in seconds.

   _____ s

10. A satellite orbits at radius $r = 7.0 \times 10^6$ m with a period $T = 5800$ s. What is its orbital speed, in m/s?

    _____ m/s

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Answers · 答案

IGCSE Physics

1. **the Earth spinning on its axis**

   The Earth rotates once in about 24 hours, so each place faces the Sun (day) then faces away (night).

2. **the inner four are small and rocky; the outer four are large and gaseous**

   The four inner planets are small and rocky; the four outer planets are large and gaseous (gas giants and ice giants).

3. **nuclear fusion of hydrogen into helium**

   In a stable star, hydrogen nuclei fuse into helium in the core, releasing huge amounts of energy.

4. **moving away from us, so its light is stretched to a longer wavelength**

   A receding source stretches the light to a longer wavelength – toward the red end of the spectrum.

5. **the tilt of the Earth's axis as it orbits the Sun**

   The tilted axis means each hemisphere leans toward the Sun for half the year (summer) and away for the other half (winter).

6. **500 s**

   $\text{time} = \dfrac{d}{v} = \dfrac{1.5 \times 10^{11}}{3.0 \times 10^{8}} = 500$ s (about 8 minutes).

7. **True**

   The CMBR fills all of space, coming from every direction – it is early radiation stretched into microwaves as the Universe expanded.

8. **True**

   As the Moon orbits Earth, the fraction of its sunlit side that we can see changes, giving new, half and full moon.

9. **5e+17 s**

   $\text{Age} \approx \dfrac{1}{H_0} = \dfrac{1}{2.0 \times 10^{-18}} = 5.0 \times 10^{17}$ s (roughly 16 billion years).

10. **7600 m/s**

    $v = \dfrac{2\pi r}{T} = \dfrac{2\pi \times 7.0 \times 10^{6}}{5800} \approx 7600$ m/s.