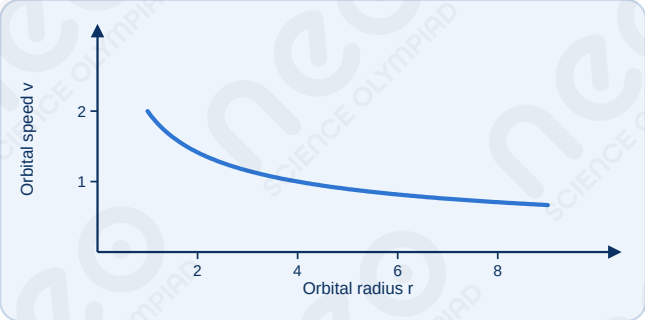
01



The graph plots orbital speed against orbital radius for circular orbits around the same planet. Which relationship best describes the curve?

A) v is proportional to r

B) v is proportional to $1/\sqrt{r}$

C) v is proportional to r^2

D) v is independent of r

02

A satellite moves from one circular orbit around Earth to another. The radius of the new orbit is four times the radius of the original orbit.

How does the satellite's speed in the new orbit compare with its original speed?

A) It is four times its original speed.

B) It is twice its original speed.

C) It is one-quarter of its original speed.

D) It is half its original speed.

03

A star emits light with a peak wavelength of approximately 500 nm. Using Wien's displacement law ($b = 2.9 \times 10^{-3}$ m·K), what is its approximate surface temperature?

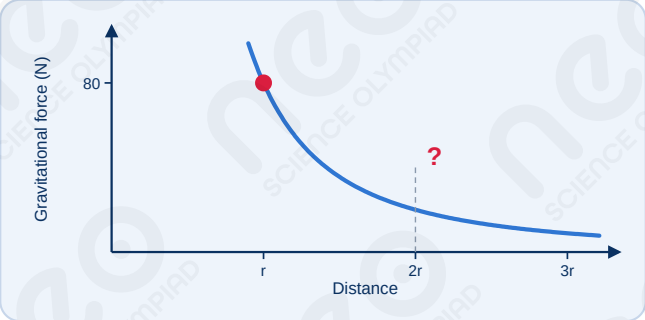
A) 2,900 K

B) 5,800 K

C) 11,600 K

D) 500 K

04



The gravitational force is 80 N at distance r. What is the force at distance 2r?

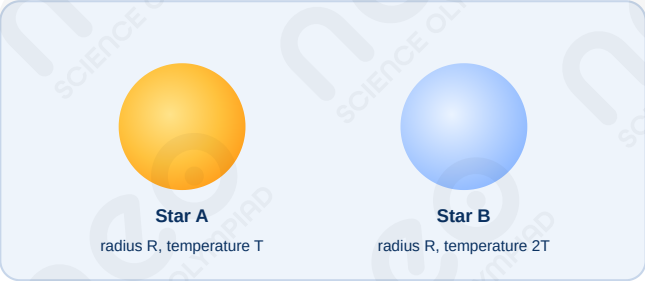
A) 160 N
B) 40 N
C) 20 N
D) 10 N

05

Astronomers detect periodic decreases in a star's brightness. Which explanation best supports the possible presence of an exoplanet?

A) A planet repeatedly passes in front of the star.
B) The star periodically stops nuclear fusion.
C) The star changes its distance from Earth by several light-years.
D) The star's gravity disappears at regular intervals.

06



Two stars have the same radius, but Star B's surface temperature is twice that of Star A. What is the ratio of Star B's luminosity to Star A's luminosity?

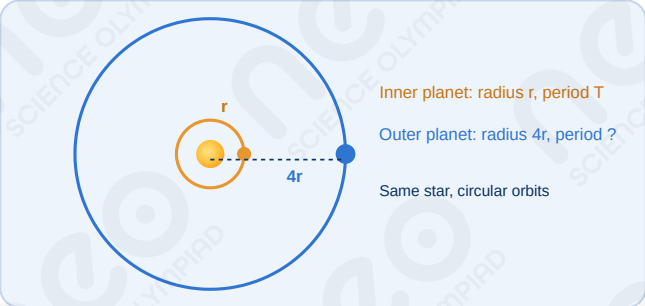
A) 2 times
B) 4 times
C) 16 times
D) 8 times

07

Why are heavy elements such as gold associated with extreme astrophysical events?

A) They can form only on the surfaces of ordinary planets.
B) They are produced mainly by sunlight interacting with dust.
C) They form by rapid neutron capture during neutron-star mergers.
D) They are created when comets melt as they pass near the Sun.

08



Two planets orbit the same star in circular orbits. The outer planet's orbital radius is 4 times that of the inner planet. What is the ratio of the outer planet's orbital period to the inner planet's orbital period?

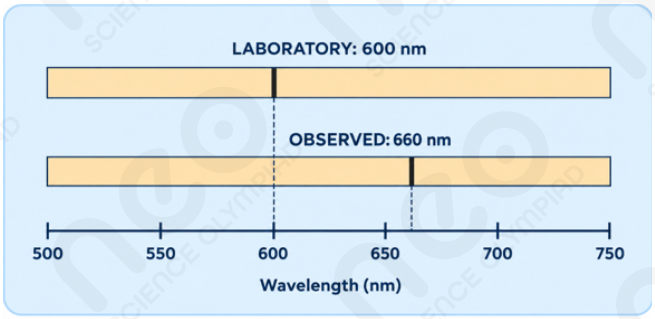
A) 4:1
B) 8:1
C) 16:1
D) 64:1

09

According to Hubble's law, a galaxy located 200 Mpc away has what approximate recession speed if H_0 = 70 km/s/Mpc?

A) 350 km/s
B) 1,400 km/s
C) 7,000 km/s
D) 14,000 km/s

10



A spectral line is observed at 660 nm but has a laboratory wavelength of 600 nm. What is its approximate redshift z?

A) 0.10
B) 0.01
C) 1.10
D) 10

11

What is the main reason that a Hohmann transfer orbit is commonly used for spacecraft moving between two circular, coplanar orbits?

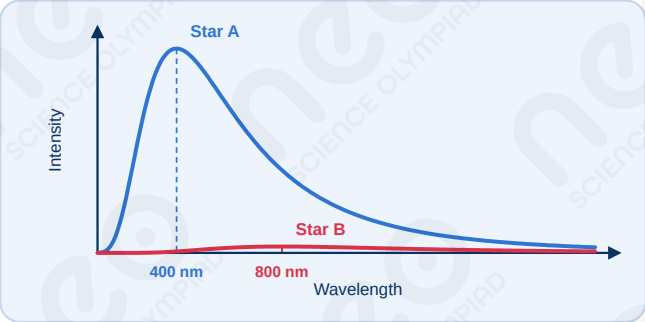
A) It removes the central body's gravitational pull.

B) It minimizes the total velocity change needed.

C) It lets spacecraft move between orbits instantly.

D) It needs no propulsion system during the transfer.

12



Star A's spectrum peaks at 400 nm and Star B's peaks at 800 nm. Approximately what is T_A/T_B?

A) 1/2

B) 1

C) 2

D) 4

13

A star has the same surface temperature as the Sun but twice its radius. Approximately how does its luminosity compare with the Sun's?

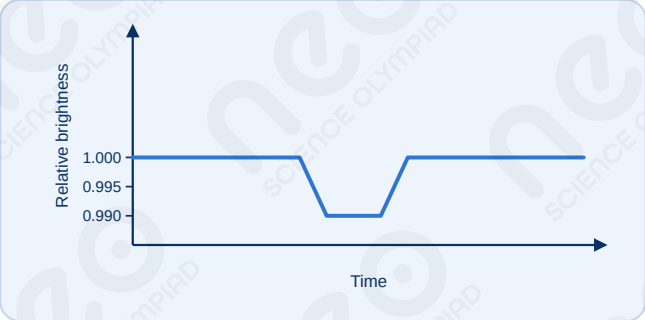
A) Four times the Sun's luminosity

B) Twice the Sun's luminosity

C) Eight times the Sun's luminosity

D) Equal to the Sun's luminosity

14



The light curve shows a planet blocking 1% of its star's light. Approximately what is the ratio of the planet's radius to the star's radius?

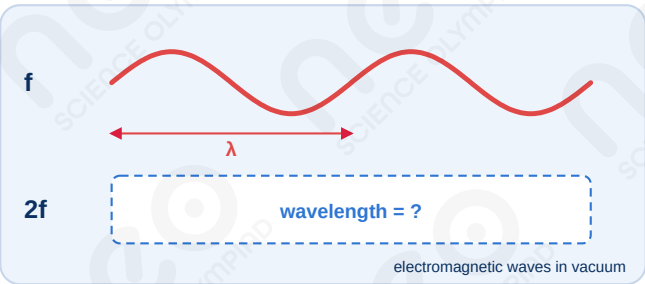
A) 0.01
B) 0.50
C) 1.00
D) 0.10

15

Which observation provides strong evidence supporting the Big Bang model?

A) The existence of rings around Saturn
B) The changing phases of the Moon
C) The cosmic microwave background radiation
D) The rotation of Earth around its axis

16



For electromagnetic waves in a vacuum, if the frequency doubles, the wavelength becomes...

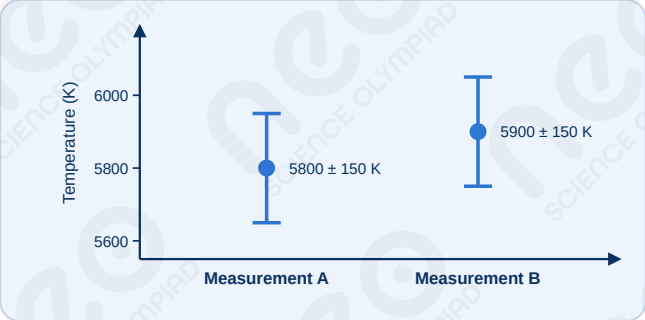
A) double
B) half
C) four times as long
D) unchanged

17

A spacecraft travels from Earth toward Mars. Why must mission planners consider the orbital motion of both planets when selecting a launch window?

A) Because Mars remains stationary while Earth moves around the Sun
B) Because rockets cannot operate once they leave Earth's atmosphere
C) Because Earth's gravity disappears once the spacecraft has launched
D) Because the relative positions of the planets affect transfer energy

18



Two measurements of a star's temperature are shown with their uncertainty ranges. Which conclusion is justified?

A) Both measurements are certainly wrong.

B) Their ranges overlap, so the values may agree.

C) The star has two temperatures simultaneously.

D) The higher value must always be correct.

19

Two independent measurements of an exoplanet's radius are (1.8 ± 0.15) Earth radii and (2.0 ± 0.15) Earth radii. Which conclusion is most scientifically appropriate?

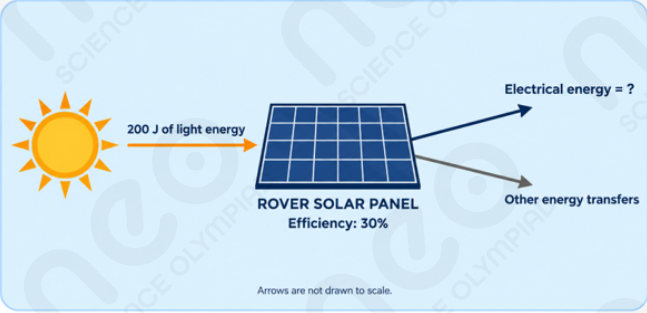
A) The planet's radius must be changing every day.

B) The ranges overlap, so the results are compatible.

C) Both must be rejected because they are not identical.

D) The true radius must be exactly 1.9 Earth radii.

20



A rover's solar panel receives 200 J of light energy and converts 30% of it into electricity. How much electrical energy is produced?

A) 30 J

B) 60 J

C) 140 J

D) 200 J

Answer Key

1	B
2	D
3	B
4	C
5	A
6	C
7	C
8	B
9	D
10	A
11	B
12	C
13	A
14	D
15	C
16	B
17	D
18	B
19	B
20	B