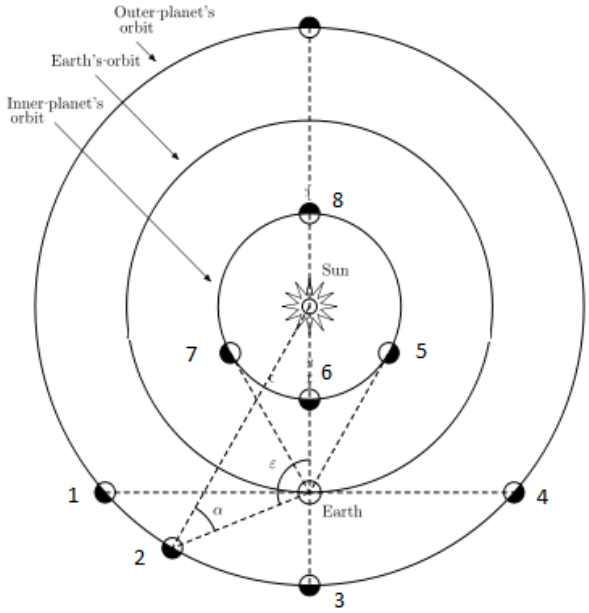
A.

i. M31 is NGC_. [3] – 224

ii. The effective temperature of the solar surface in Kelvin. (integer) [4] – 5778

iii. Sun's Absolute Visual Magnitude. (two decimals) [3] - 483

iv. Eastern quadrature, Superior conjunction [2] – 18



v. Hour angle of setting sun on the equinox day [1] – 6

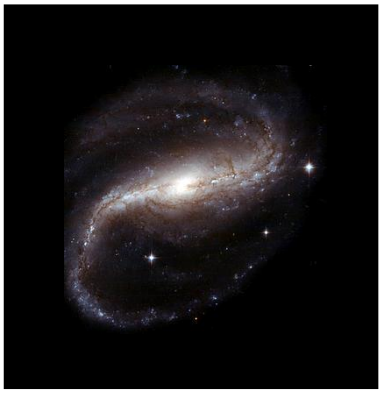
B.

i. The Trifid Nebula is M_. [2] – 20

ii. The temperature at an exoplanet's atmosphere is $336K$. The mean speed of the nitrogen molecules ($m=4.7x10^{-26}kg$) in the same temperature is $0.5km/s$. The mean speed (km/s) that the nitrogen molecules acquire when the temperature becomes four times greater is_. [1] – 1

iii. The emission spectral line H α is the result of the transition of an electron between energy levels _ to _. [2] – 32

iv. The morphological class of this galaxy. [1] – 3

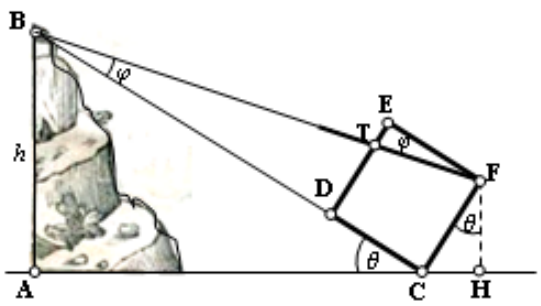


1. SBa
2. SBb
3. SBc
4. S0
5. SB0
6. Irr
7. Sa
8. Sb
9. Sc

v. Io, Europa and Ganymede revolve in a _:_:_ resonance. [3] – 124

vi. Vega's B-V Colour Index. [1] – 0

vii. Find the height of the mountain (metres). $FE/TE=800$ and $CH=0.4m$. EFCD is a square and FH is vertical to CH. [3] – 320



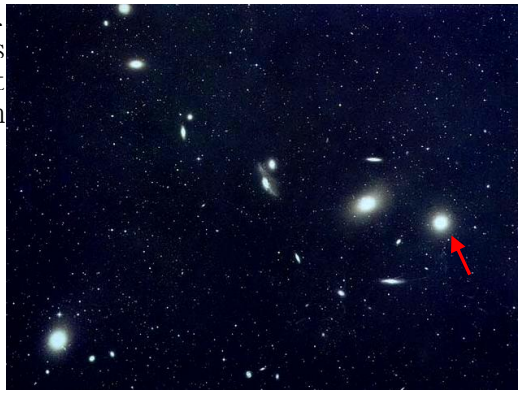
C.

i. The Julian century has _days. [5] – 36525

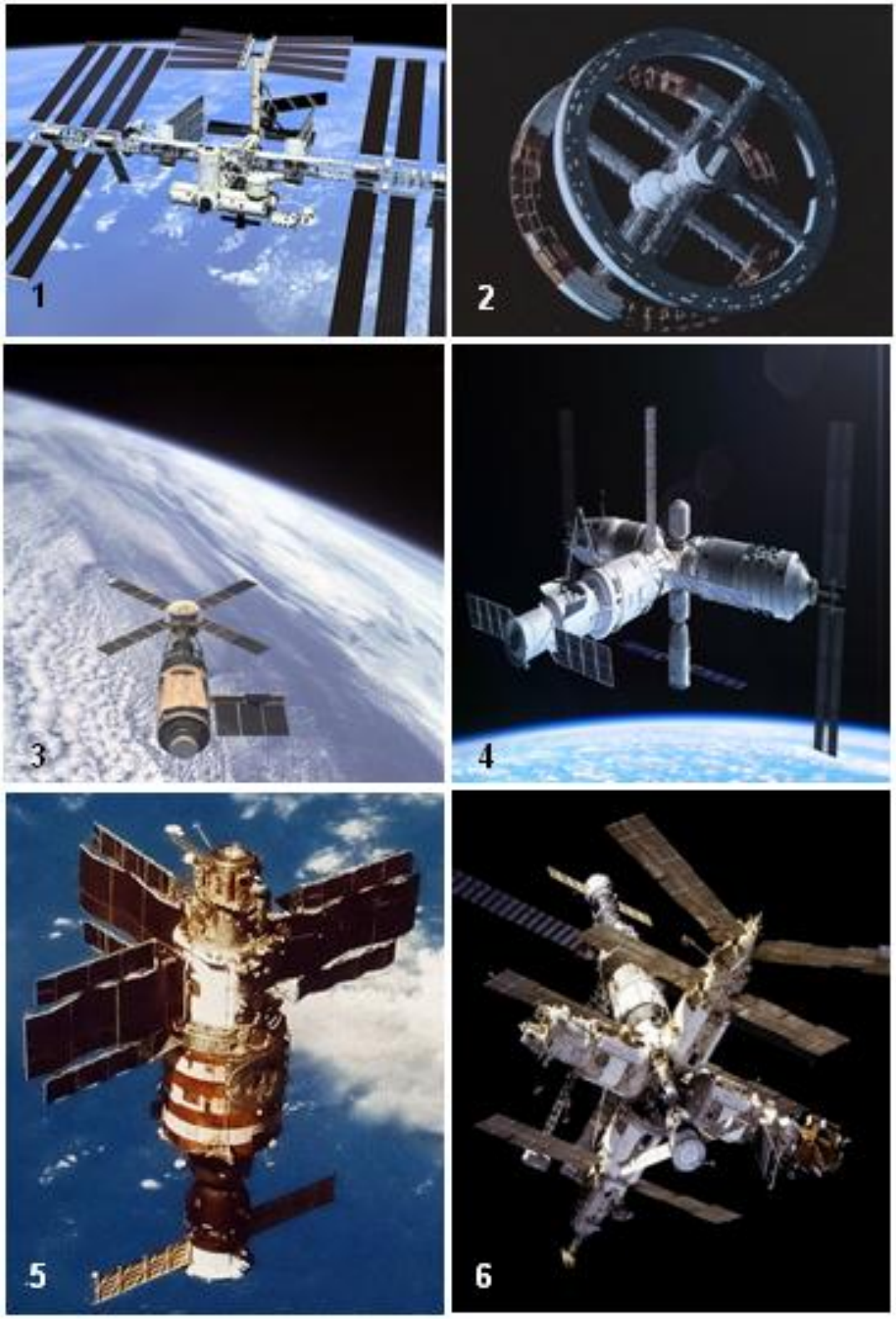
ii. The first to measure Earth's radius, only using data from a single location. [1] – 7

1.Posidonius
2.Picard
3.al-Ma'mun
4.Eratosthenes
5.al-Farghani
6.Snell
7.al-Biruni
8.Cassini
9.Gauss

iii. This image shows a part of the Virgo Galaxy Cluster. The long chain of galaxies is known as Markarian's Chain. At the bottom right, pointer shows a giant elliptical galaxy (also a powerful radio source) known as M_. [2] – 84



iv. A star cluster which lies between η and ζ Herculis is M_. [2] – 13


1
2
3
4
5
6

D.

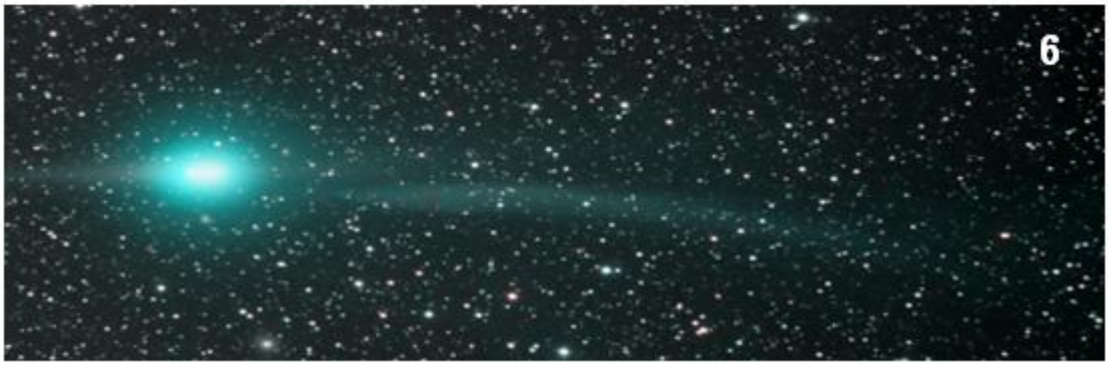
i. The Orion Nebula is M_. [2] – 42

ii. This year Galileo observed the sky with a telescope for the first time. [4] – 1609

iii. R

iv. N

v. C



E.

i. What would have been temperature of CMBR at z=8.63? (upto 1st decimal) [3] – 263

ii. The axial tilt of the Earth (integer) [2] – 23

iii. Number of planets of the Solar System that have moons. [1] – 6

iv. The wavelength used to chart the Milky Way (in cm). [2] – 21

v. Pleiades is M__. [2] – 45

vi. Write scientist number in correct sequence [3] – 148

- He confirmed the Big Bang Theory by observing the CMBR
- He coined the name "Big Bang Theory"
- He introduced Big Bang Nucleosynthesis

1. Robert Wilson
2. Alexander Friedmann
3. Edwin Hubble
4. Fred Hoyle
5. George Lemaitre
6. Fritz Zwicky
7. Arthur Walker
8. George Gamow

F.

i. Every _ years (integer), Halley's comet appears! [2] – 75

ı.

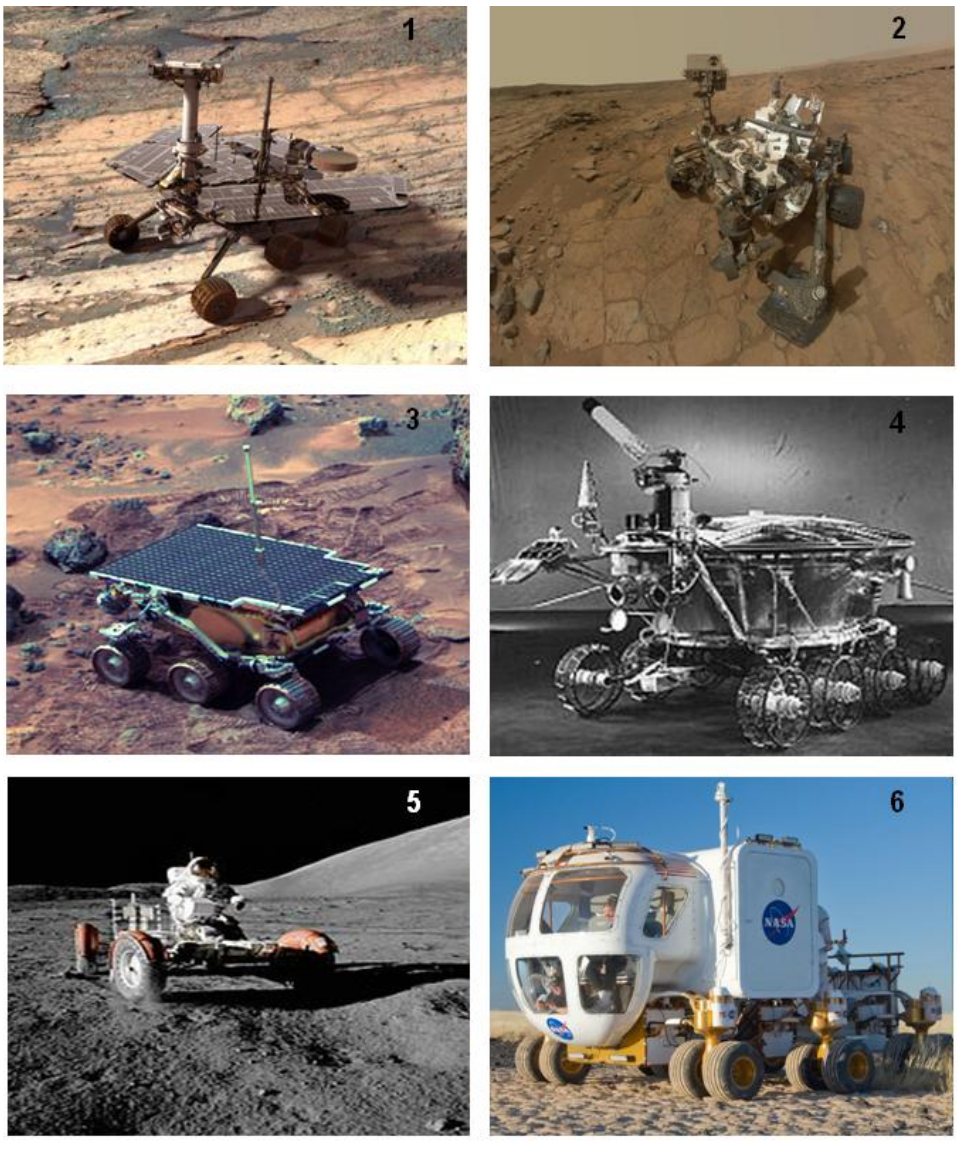
ii. The relative error of the spectroscopic parallax is *15%* and the absolute error of the trigonometric parallax is *0.005″* . Over which distance (pc) the spectroscopic parallax becomes more accurate than the trigonometric? (integer) [2] – 30

iii. The molecular weight (in a.m.u.) of the main constituent of Titan's oceans [2] – 16

iv. 189.08 light years in parsec (integer) [2] – 58

v. In the beginning of July this planet stopped its retrograde motion. How many AU is its mean orbital radius? (one decimal) [2] – 96

vi. Sojourner, Lunokhold 1, Curiosity [3] – 342

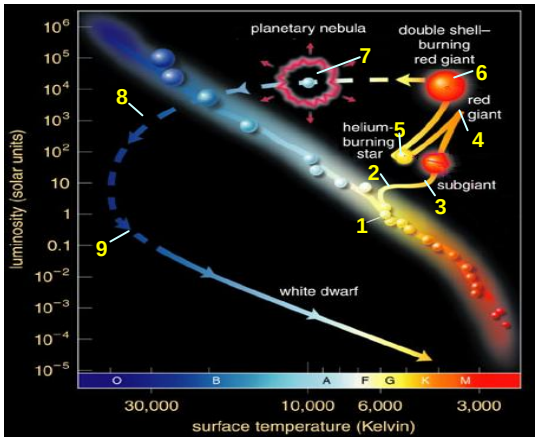


G.

i. The four greatest celestial objects in descending order of size: [4] – 3657

1.Moon
2.Europa
3.Ganymede
4.Io
5.Mercury
6.Titan
7.Callisto
8.Triton
9.Titania

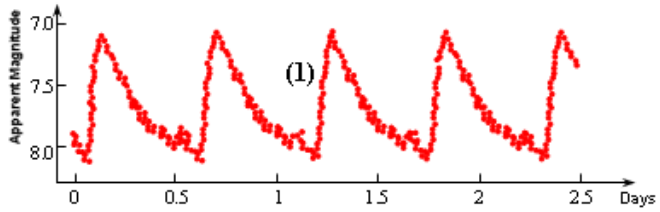
ii. At which point does the Helium Flash occur? [1] – 4



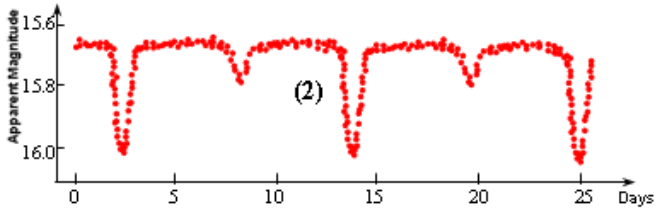
iii. The polarity of the solar magnetic field is reversed every _years. (integer) [2] – 11

iv.RR Lyrae, Mira, Classical Cepheid, Eclipsing Binary [4] – 1432

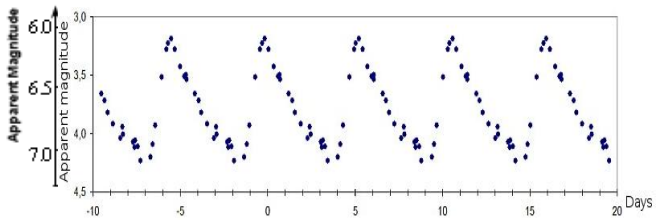
1



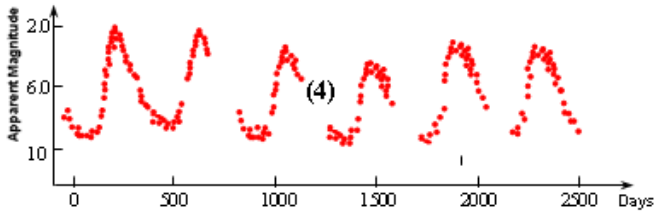
2



3



4



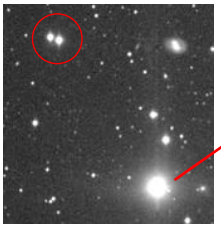
v. Days between the longest day in southern hemisphere and the next equinox. [2] – 89

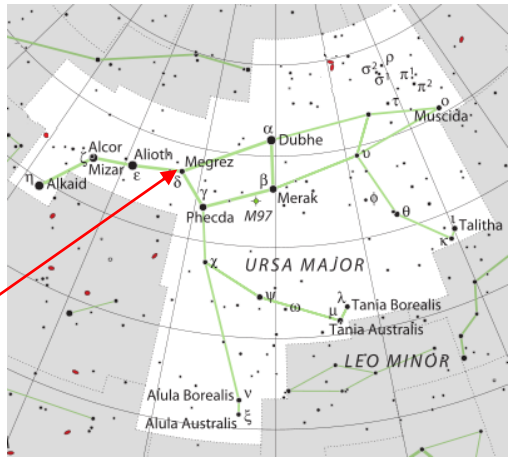
H.

i. Sombrero galaxy is M__. [3] – 104

ii. Number of martian satellites. [1] – 2

iii. The circle marks is M__. [2]
– 40





iv. Arrange the following in the increasing order of masses [6] – 213546

1. Hyades Cluster
2. Eta Carinae
3. Omega Centauri
4. M31
5. LMC
6. Virgo Cluster

v. Number of crew members who perished in challenger space shuttle disaster. [1] – 7

I.

i. Assuming you are seeing the moon in the sky from Greece, how many days have passed since the last New Moon? (integer). [2] – 25

ii. Difference between the solar day and the sidereal day in minutes. [1] – 4

iii. The number of constellations [2] – 88

iv. The Whirlpool Galaxy is M_. [2] – 51

v. The four closest galaxies to the Milky Way in ascending order: [4] – 3491

1.SMC
2.Andromeda
3.Canis Major Irregular Dwarf
4.Saggitarius dwarf irregular galaxy
5.Triangulum galaxy
6.Fornax Dwarf Spheroidal
7.Barnard's galaxy
8.Maffei I
9.LMC

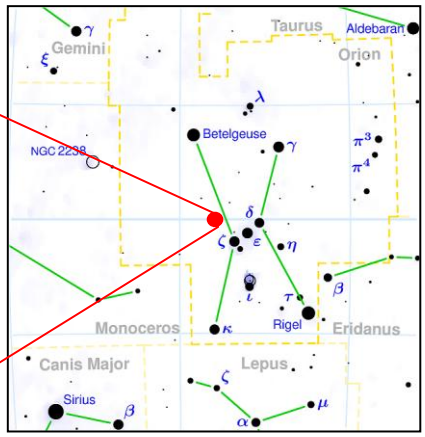
vi. Number of Van Allen Radiation Belts. [1] – 2

vii. The L point through which matter from one star of a binary system escapes to the other. [1] – 1

J.

i. The CMBR has a thermal black body spectrum at a temperature of _Kelvin. (two decimals) [3] – 273

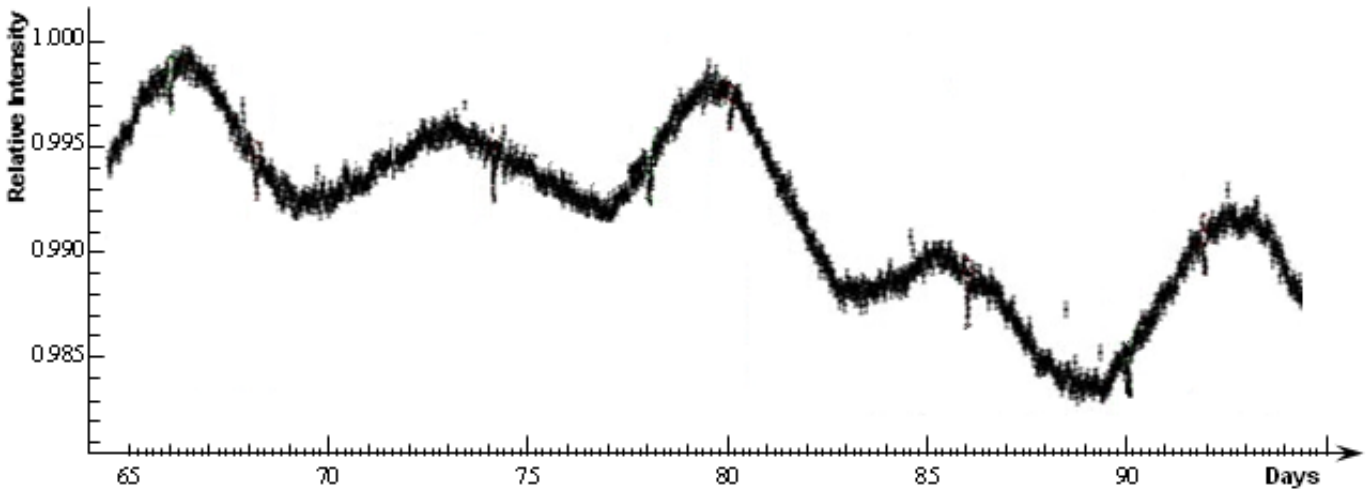
ii. This nebula is M_. [2] – 78



iii. Radiation with an energy of 2.5eV. [1] – 4

1.gamma-ray
2.X-ray
3.Ultraviolet
4.Visible
5.Infrared
6.Far Infrared
7.Microwave
8.Radio
9.Super Low Frequency

iv. Two exoplanets with a radius five times the radius of Earth rotate around a star (radius equal to this of the Sun). Find the shortest orbital period (days). (two decimals) [3] – 595

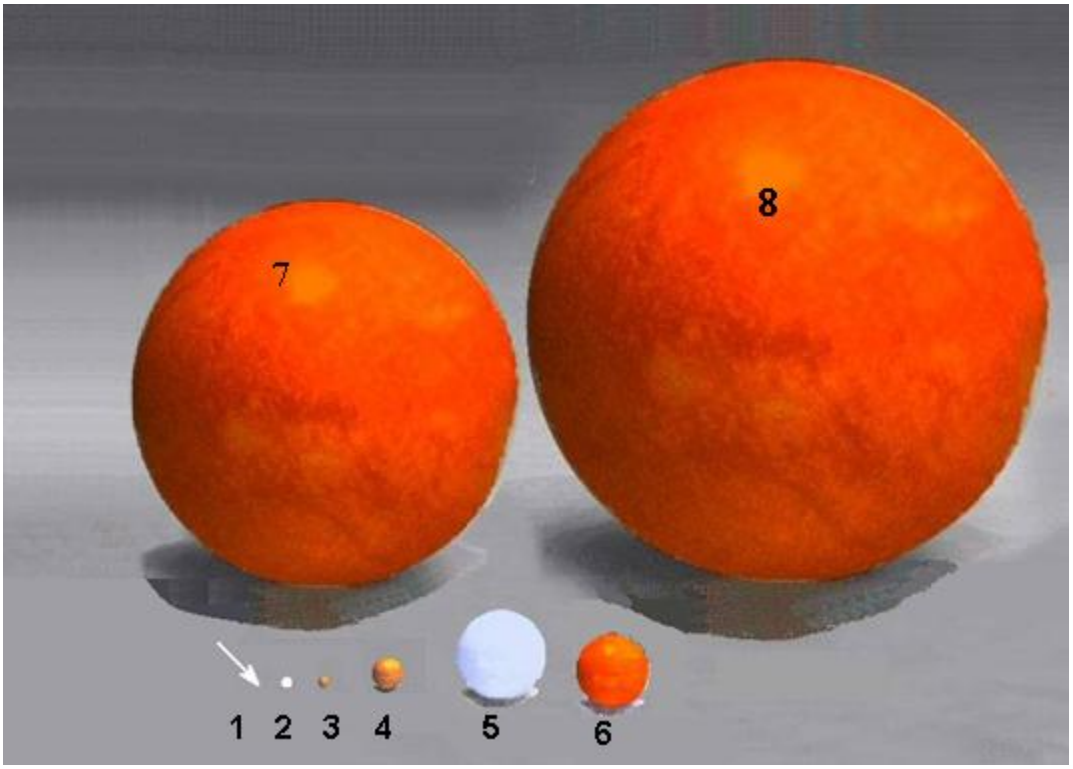


v. The first to calculate the AU by measuring the parallax of a planet: [1] – 1

1.Cassini
2.Aristachus
3.Hipparchus
4.Horrocks
5.Halley
6.Bayly
7.Euler
8.Lomonosov
9.Newcomb

vi. The diameters of the stars (Sirius, Betlegeuse, Aldebaran, Antares, Rigel, Pollux, Arcturus, Sun) are to scale. [3] – 875

Betlegeuse, Antares, Rigel

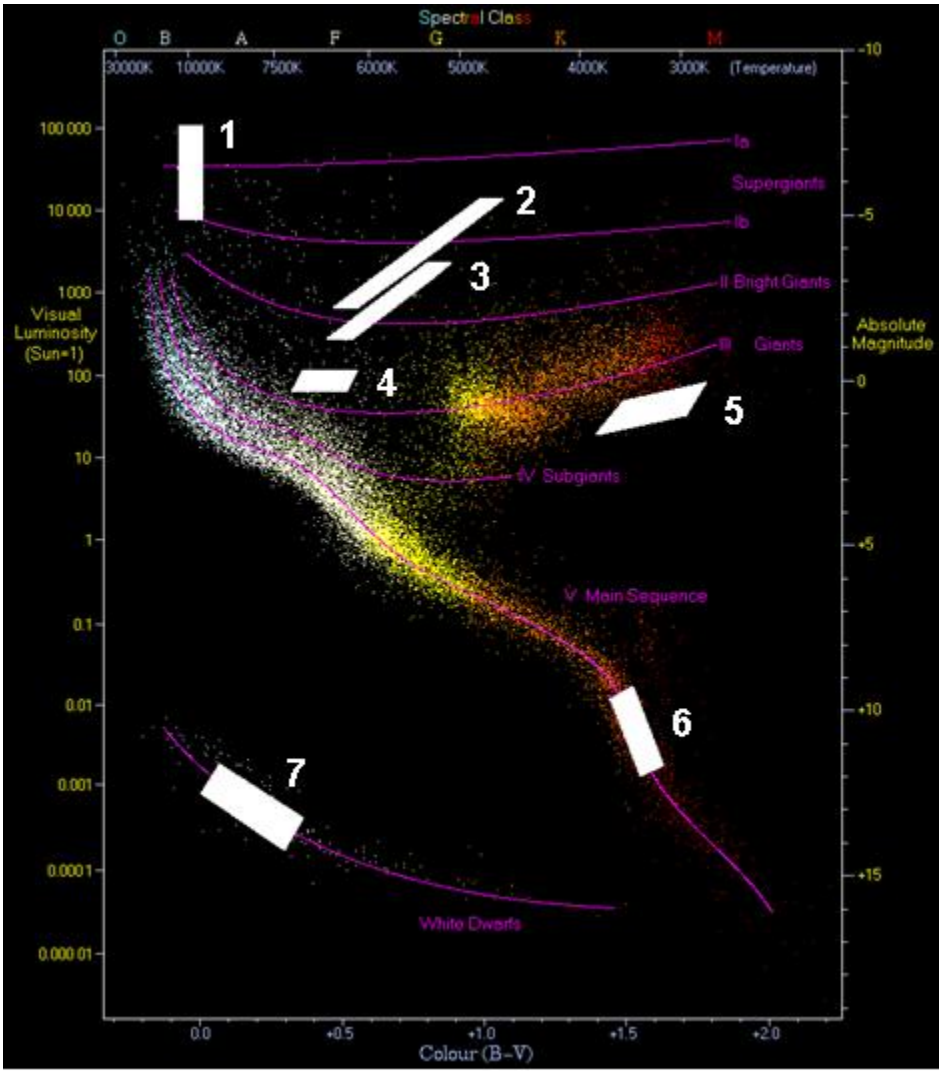


K.

i. Every that many years, the orientation of Earth's axial tilt shifts by 1°. (two decimals) [4] – 7159

ii. When we swim in the sea, the height of our eyes from its level is *20cm*. How many kilometres away can we look on the surface of the Earth? (one decimal) [2] – 16

iii. Flare Stars, Type I Cepheids, RR Lyrae Variables [3] – 624



iv. The first Pulsar discovered was nicknamed LGM-1. Its official name is now PSR J1921 +2153. Its declination is _ °_'. [4] – 2153

L.

i. What is the L.S.T. (hh:mm) at the culmination of the Sun on 53rd day after the longest day in the northern hemisphere? [4] – 0848

ii. The axial tilt of Mars. (integer) [2] – 25

iii. How many images of the same distant quasar appear at the Einstein Cross? [1] – 4

iv. mass of the Pluto in kg (exponent of 10 only) [2] – 22

v. Put in the right order the meteor showers according to when their peak occurs, starting from the earlier one: [4] – 4312

1.Perseids
2.Orionids
3.Eta Aquarids
4.Quadrantids

M.

i. Two white dwarfs have the same effective temperature. The one dwarf has an Absolute Bolometric Magnitude of $M_{bolA}=10.5mag$ and a mass $m_A=1\ solar\ mass$, while the other has $M_{bol\,B}=10mag$. What is the second dwarf's mass in solar masses? The mass-radius relationship of a white dwarf is $R^{3}\sim 1/M$. (one decimal) **[2] - 05**

ii. The value of the Constant of Aberration (arcseconds). (one decimal) **[3] - 205**

iii. Because of the solar parallax, the time the Sun stays below the horizon of the North Pole is longer. How many minutes is this increase in time? (integer) **[2] - 18**

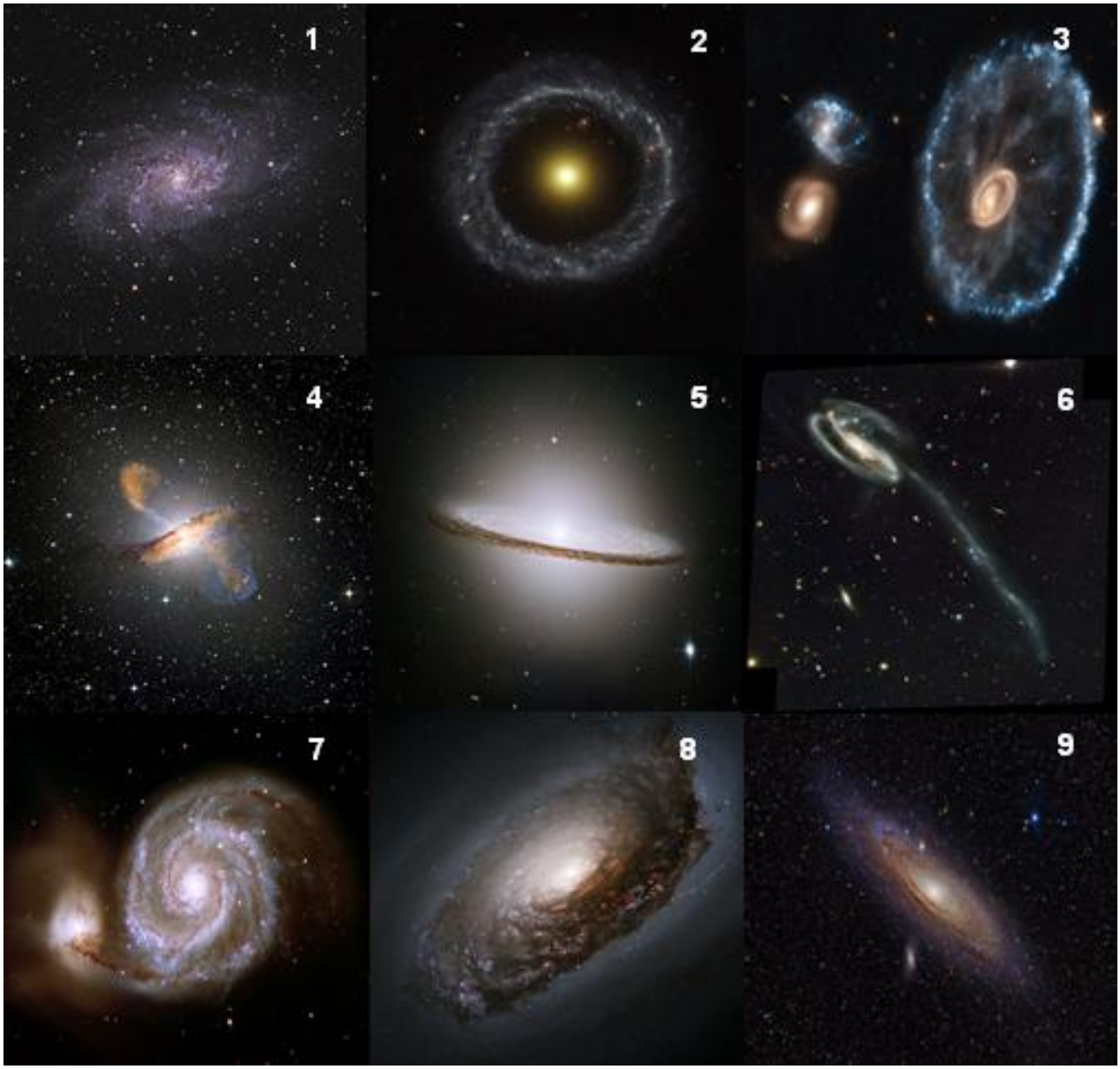
iv. How many billions of years is the age of the Universe? (one decimal) **[3] - 138**

v. What is the maximum ecliptic latitude that can be acquired by Pluto? Pluto's aphelion is *49.30AU*, its perihelion is *29.58AU* and its orbital inclination is 17.17^{o}. Earth's aphelion is *1.017AU* and its perihelion is *0.983AU*. (one decimal) **[3] - 178**

N.

i. By how many magnitudes will the magnitude of the faintest stars that can be detected by a CCD increase, if the exposure time is doubled? (up to two decimals) [3] – 075

ii. Sombrero Galaxy, Tadpole Galaxy, Black Eye Galaxy, Hoag's Object [4] – 5682



iii. How many flavours do the quarks have? [1] – 6

iv. How many colours do the quarks have? [1] – 3

v. A star with R.A. = $17^h\ 8^m$ rises in the sky at L.S.T. = $5^h\ 31^m$. How long the star will stay above the horizon (hh:mm)? [4] – 2314

O.

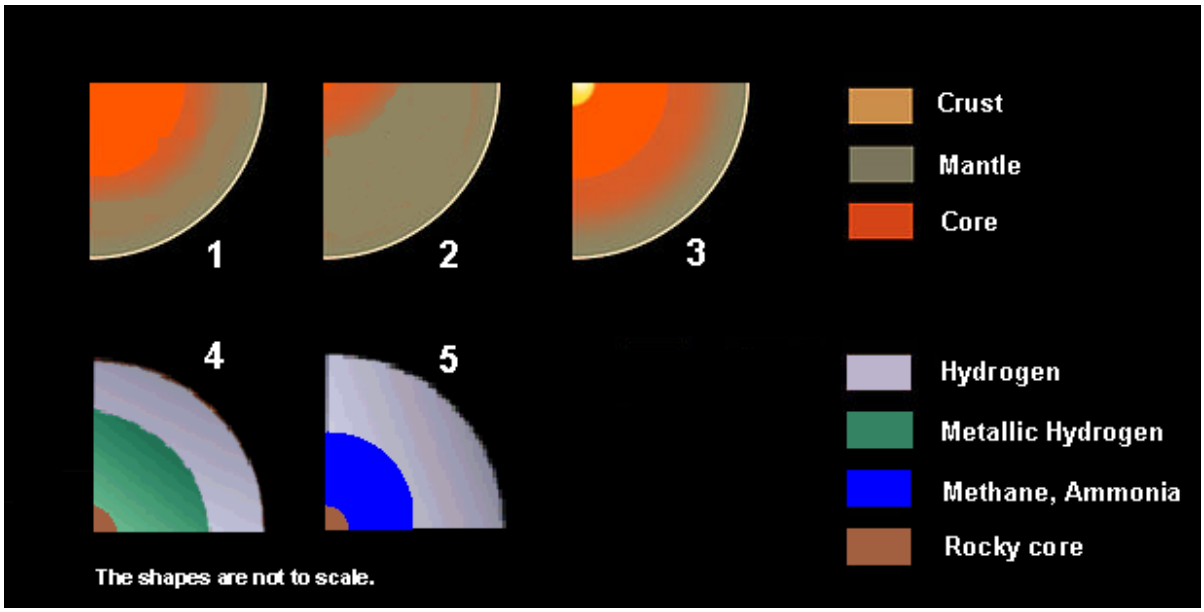
i. The maximum effective temperature of the surface of a Cepheid is $9{,}000K$ and the minimum is $7{,}000K$. The difference between its brightness maximum and minimum is 2.0 Absolute Bolometric Magnitudes. How many times bigger is the maximum radius of the Cepheid than its minimum radius? (one decimal) [2] – 15

ii. In 2013, after how many days after the Summer Solstice did the Earth reach Aphelion? (integer) [2] – 14

iii. The Sun belongs to the Population _ stars. [1] – 1

iv. The comet LINEAR is a periodic comet with aphelion distance of 5.29 A.U. And aphelion velocity as 10.45km/s. What is the semi-major axis of its orbit in A.U.? (up to 1st decimal) [2] – 39

v. Identify the following planets by recognizing their internal structure: Jupiter, Neptune, Mercury [3] – 451



vi. A main sequence star "fuses" Hydrogen at a rate of 1.178 x 10^{12} kg/s. Its luminosity (in 10^{24} W) if mass-defect is only 0.007. (integer) [3] – 742

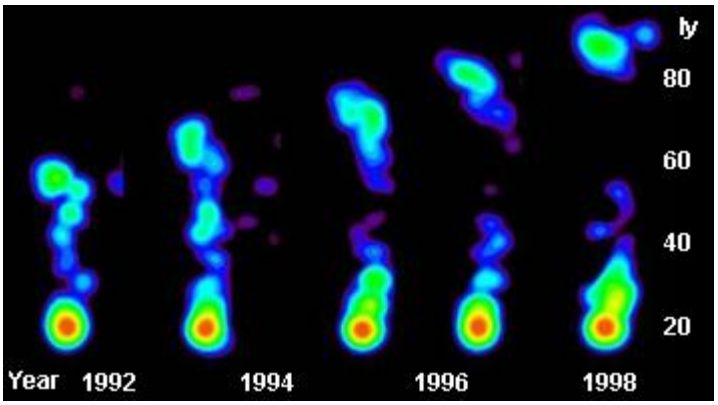
P.

i. What is the Azimuth of the point ♈ (degrees) at the 18th Sidereal Hour? (integer) [2] – 90

ii. Shape of Analemma of the Sun as seen from the Earth [1] – 8

iii. What is the distance of a galaxy (in Mpc) with recession velocity of 13966.8km/s? [3] – 206

iv. The apparent speed of this active galaxy's jet is *3.6c*! If the angle of the jet with the line of sight is 1.5°, what is the true speed of the jet? (up to 3rd decimal) [4] – 0993

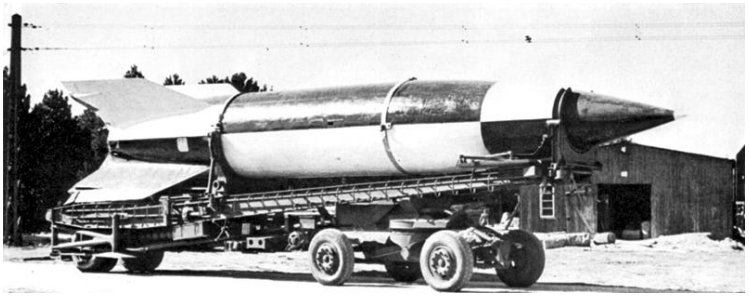


v. On the 21st of March, at a place with latitude $\phi = 35^{o}$, during the sunset, a star on the ecliptic is at its upper culmination. What is its zenith distance in degrees? (one decimal) [3] – 115

Q.

i. 294° 30’ in radians [3] – 514

ii. The first photo from space was taken from a V–_. [1] – 2



iii, A mission is sent to Mars by following a Hohmann–Vetchinkin orbit. How many days is the minimum time interval that the mission’s members will have to stay on Mars before they find the first opportunity to come back to Earth by following once more a Hohmann–Vetchinkin orbit? Consider that the orbits of Earth and Mars are circular and coplanar and that the distance of Mars from the Sun is *1.52AU*. (one decimal) [4] – 4586

iv. Mass of the supermassive black hole at the galactic centre in kg (exponent of 10 only) [2] – 37

v. distance of globular cluster M68 (in kpc) given its parallax = 97.2 μarcsec [3] – 103