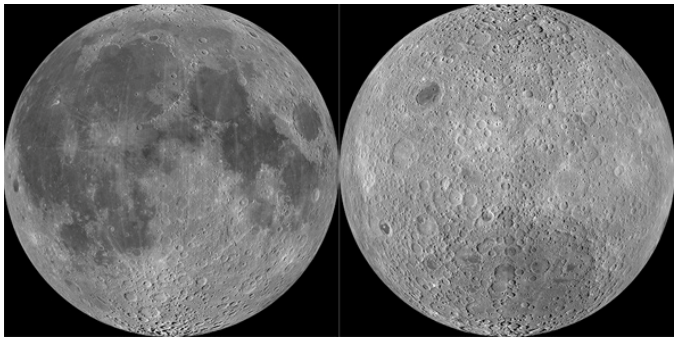
Grade 9 Science

Astronomy

Class 16

Rotation of the Moon

- Moon also rotates on its axis as it revolves around the Earth
- Result = the same side of the Moon faces the Earth at all times



Phases of the Moon

- The moon is illuminated by the Sun which means that we see different amounts of lits side as the Moon orbits the Earth; follows the lunar cycle

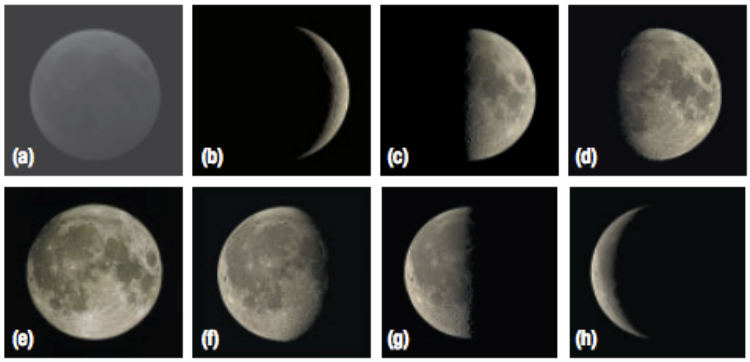
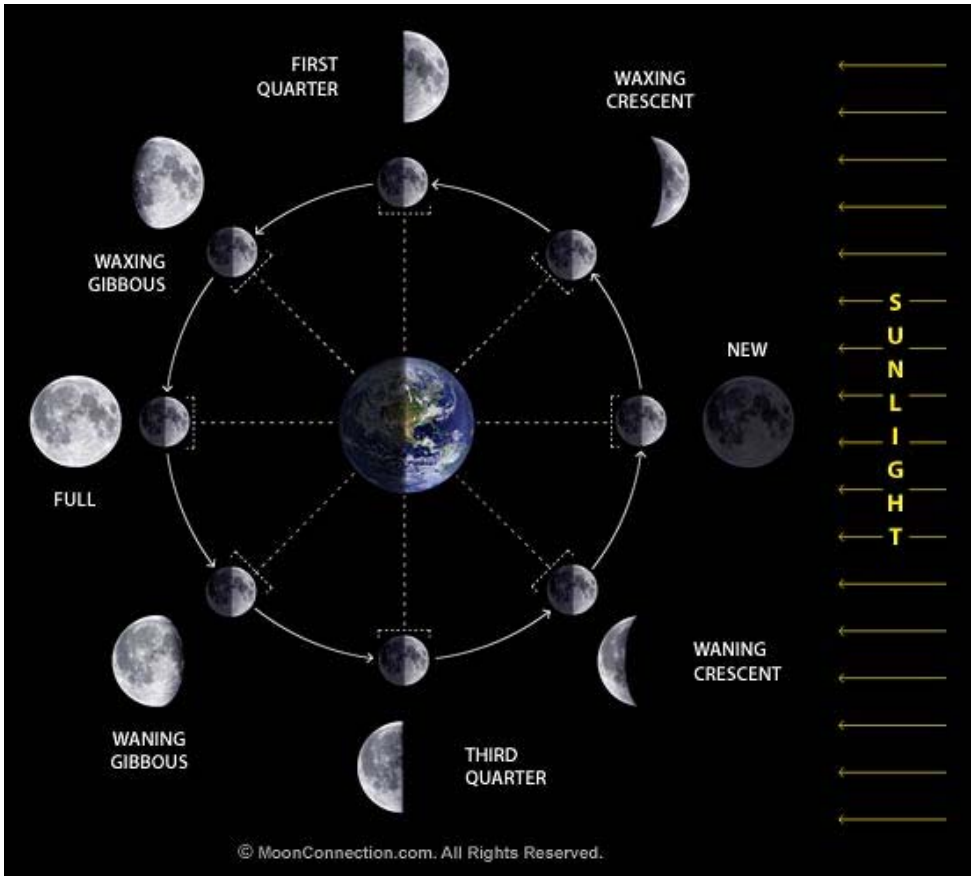
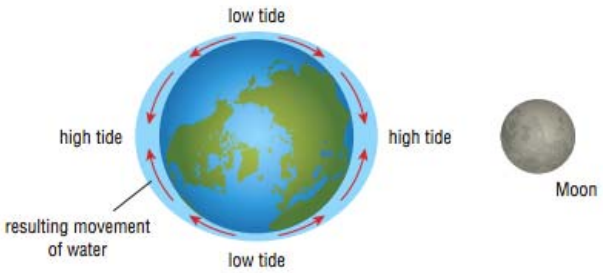


Figure 11 The phases of the Moon as seen from Earth.
(a) New moon (darkened image to represent the new moon, which we cannot see)
(b) Waxing crescent
(c) First quarter
(d) Waxing gibbous
(e) Full moon
(f) Waning gibbous
(g) Third quarter
(h) Waning crescent



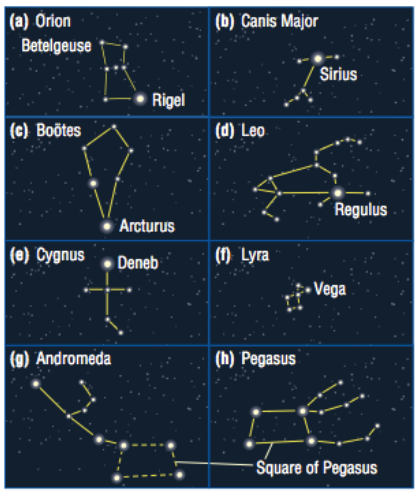
Tides

- The rising and falling of the surface of oceans, caused by the gravitational pull of the Moon and the Sun
  - Moon's gravitational force pulls Earth and its ocean toward it causing a bulge on the side facing the moon and on the opposite side where there is weak gravitational force



Constellations

- Constellation – are regions of the sky containing stars



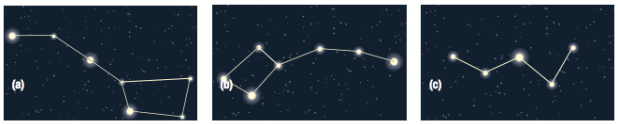
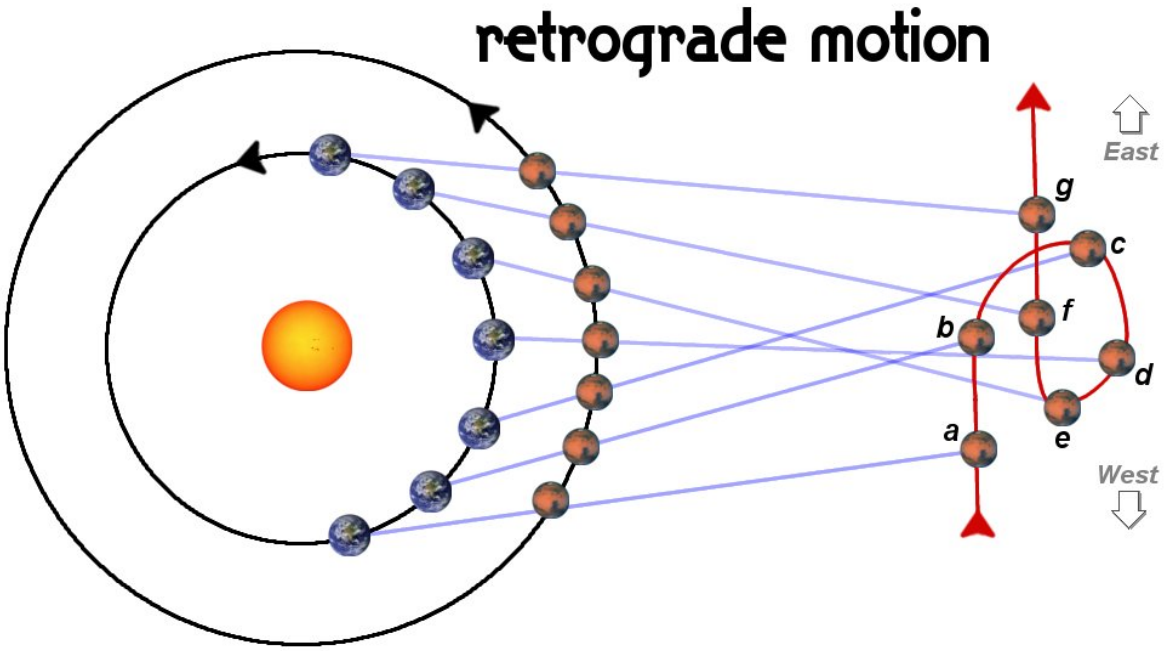


Figure 1 (a) The Big Dipper (b) The Little Dipper (c) Cassiopeia

http://neave.com/planetarium/

Retrograde Motion

- The apparent motion of an object in the sky, usually a planet, from east to west, rather than in its normal motion from west to east
- Occurs because Earth travels faster around the Sun than the other planets



Azimuth and Altitude

- Azimuth – distance measured from north along a horizon to a point directly below the celestial object
  - North = 0°; East = 90°; South = 180°; West = 270°
- Altitude – angular height of a celestial object measured from the horizon

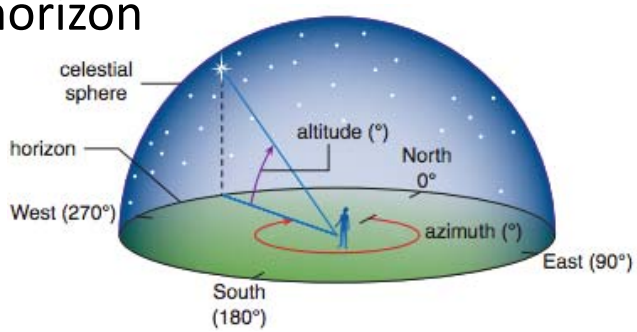


Figure 9 The width of a finger measures approximately one degree.

Figure 10 The width of a closed fist measures approximately ten degrees.

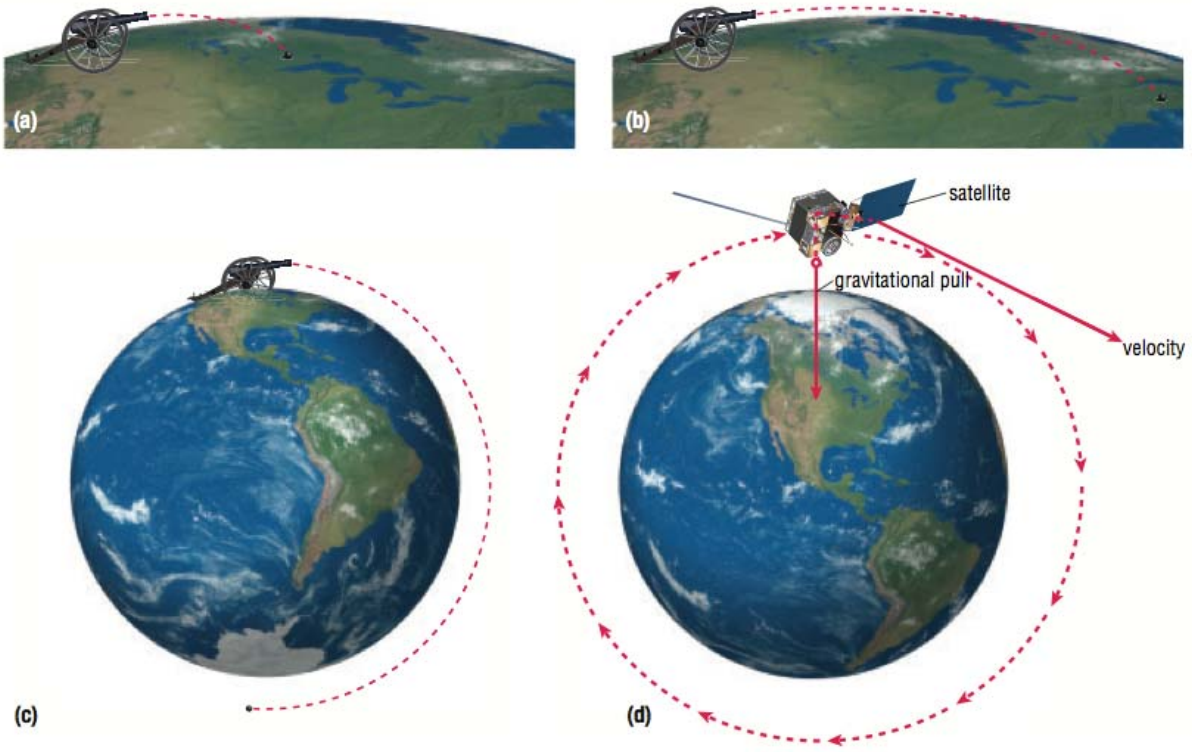
Figure 11 The width of an outstretched hand measures approximately twenty degrees.

Measuring Azimuth

Measuring Altitude

Satellites

- Artificial satellites help forecast weather, monitor agriculture, aid in telecommunication or navigation, assist military activities and explore the Universe
- Forward motion of the satellite and the curvature of the Earth prevent the satellite from plunging back to Earth

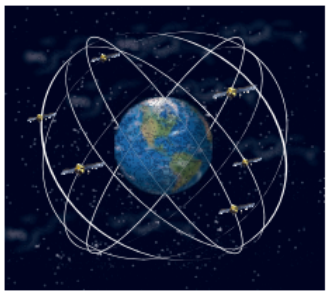


Low Earth Orbit Satellites

- Altitudes up to 2000 km for best global coverage

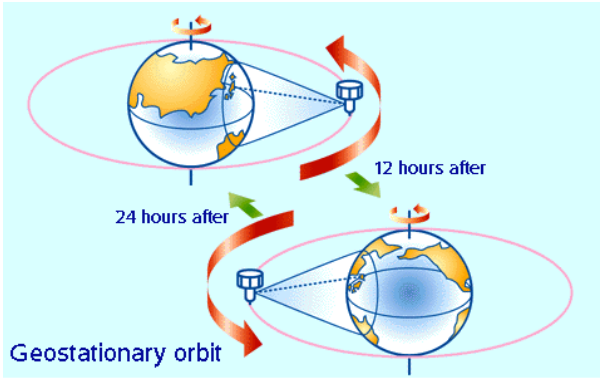
Medium Earth Orbit Satellites

- Altitudes up to 35 000 km
- Forms the GPS system so that at least 3 satellites can provide your location at any time



Geostationary Orbit Satellites

- Altitude = 35,790km to produce an orbit equal to the period of the rotation of Earth and appear motionless
- Useful for communications (i.e. satellite dishes, weather satellites)



The Light Year

- AU is used to measure distances within our solar system
- Light Year is used to measure the distance outside of the solar system
  - **Light Year** – the distance that light travels in a vacuum in 1 year (9.46×10^{12} km)
- Vega is 25 ly from Earth, which means it takes light 25 years to get to Earth – you see the star that was there 25 years ago

Checkpoint

If Proxima Centauri is 4.01×10^{13} km from Earth, what is its distance from Earth in light years?

(1 ly = 9.46×10^{12} km)

Checkpoint

If 9.46×10^{12}km = 1 ly, how many km are there in 1s?

Characteristics of Stars

Brightness

- Luminosity – total amount of energy produced by the star per second; measured in comparison to the Sun with a luminosity of 1
  - Sirius has a luminosity of 22
  - Need to compare luminosity at the same distances
- Magnitude – brightness
  - Apparent magnitude – brightness as it appears on Earth
  - Absolute magnitude – brightness of the star as if they were all located 33 ly from Earth

Table 1 Apparent and Absolute Magnitudes of Some Stars

Star	Apparent magnitude	Absolute magnitude
Sun	–26.8	4.83
Sirius	–1.45	1.5
Vega	0.04	0.5
Betelgeuse	0.41	–5.6
Deneb	1.99	–7.5

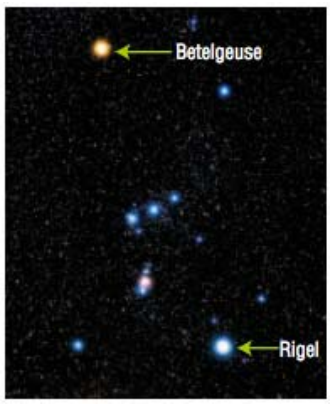
- The smaller the magnitude, the brighter the celestial object appears to the observer

Colour and Temperature

- Relatively hot star appears bluish; relatively cool star appears reddish

Table 2 Colour and Temperature Ranges of Some Stars

Colour	Temperature range (°C)	Example(s)
bluish	25 000–50 000	Zeta Orionis
bluish-white	11 000–25 000	Rigel, Spica
whitish	7500–11 000	Vega, Sirius
yellowish-white	6000–7500	Polaris, Procyon
yellowish	5000–6000	Sun, Alpha Centauri
orangish	3500–5000	Arcturus, Aldebaran
reddish	2000–3500	Betelgeuse, Antares



Composition

- To determine the chemical composition of stars, scientists use spectrographs
- Each chemical element has a signature spectrum
  - Compare the star's spectrum with known spectra of elements

Mass

- Solar mass = mass of our Sun which is $2x10^{30}$ kg
- All other masses are compared in solar masses
- Star masses can vary between 0.1 to 120
  - A1 has a solar mass of 118