- **Fragrances and dyes:** appeals to the consumer.
- **Body soaps:** coats the skin in grease removing chemicals – the chemicals consists of a hydrocarbon chain that's hydrophobic (hates water) but is attracted to oil, grease and dirt; and a carboxylic acid that's hydrophilic (loves water). Soap is made by reacting sodium hydroxide with an animal/vegetable fat (e.g. coconut oil).
- **Cleansers:** common components of these include mineral oil, water and stearate (salt or ester of stearic acid). Cleansers dissolve sebum and loosen particles of grime and dirt trapped in the pores of the skin.
- **Shampoos:** extra chemicals in shampoo make the lather stay in the hair and remove oil, grease and dirt. Common components include coconut oil, some olive oil (coconut oil and olive oil = Palmolive), alcohol, glycerol and water, detergent or soap and perfume. Note: Stearate (stearic acid) is used in soap-less shampoo.

9.2.4 – the nature of a solvent plays an important role in the application of a mixture.

- **Identify water and alcohol (ethanol) as commonly used solvents.**
  - Water and alcohol (ethanol) are commonly used as solvents for products that are applied to the skin and/or ingested by people.
  - Water is a solvent because it is polar and can dissolve polar substances – however it can't dissolve non-polar substances.
  - Alcohol is a solvent that can dissolve both non-polar and polar substances because it is a polar and non-polar substance itself. It can dissolve things that water can't.
- **Explain the relationship between the properties of a solvent and their use in cosmetics and external medications.**
  - Alcohol is a solvent that is used in preparing some cosmetics and external preparations because it has the capacity to dissolve some organic substances due to one end being polar and the other being non-polar. Products such as antiseptic solutions used alcohol as a solvent because of its ability to dissolve some components that are insoluble or immiscible in water.
- **Identify cosmetics and external medications where water is the solvent.**

on the body. A drug must be stable enough to survive the body's digestive system. Absorption can also be affected by the presence of other substances and the nature of membranes through which the drug must be absorbed.
  - Drugs taken orally may be soluble in water, soluble in alcohol or not soluble in either.
  - When an acidic drug is given in the form of a salt, it may precipitate in the stomach initially but can be readily dissolved in the intestine and be absorbed.
  - Some drugs are prepared as sprays to act directly on the surface of the throat or nose, or to be absorbed through the lining. Some sprays are designed to be inhaled into the lungs. This type of administration can be very fast-acting. Nasal sprays are usually aqueous solutions. Some sprays are very fine particles of powder; others are a fine mist of dissolved particles.
  - Skin applications are usually intended to react at the skin surface or the lining of the sebaceous glands under the skin. They include creams (water-based) and ointments (oil-based) as well as gels, lotions (which may be water- or alcohol-based) and liniments (usually alcohol based). Many ingredients of skin applications are soluble in fats and oils, such as the type found in the layers of the skin.
  - Highly soluble drugs can be easily carried in the bloodstream and so can act more quickly on the body.
- **Identify that the manner of administration of a drug may relate to its solubility.**
  - Depending on the rate of solubility of different drugs, different means of administration are more appropriate. The rate of absorption of the drug however depends on the substance in which the drug had been dissolved or suspended in.
  - Different ways of administering a drug include:
    - By mouth: for absorption by the stomach or small intestine.
    - By inhalation: for absorption through the nasal passage and lungs.
    - As a skin or dermal patch: for absorption by the skin.
    - By creams or ointment: for protection of and absorption by the outer layers of the skin.

- In 1961, the first successful replacement for the human vitral valve was implanted. The valve was made from a steel cage enclosing a silicon rubber ball.

- **Cochlear implant:**
  - Cochlear implants are the result of research over the past two decades.
  - The development of implants followed attempts to produce hearing by stimulating different parts of the auditory system with electricity.

9.3.2 – the regular beating of the heart and continuity of blood flow through the heart and around the body is needed to maintain good health.

- **Explain the relationship between the structure and functioning of the following parts of the heart:**
  - **Valves**
  - **Atria**
  - **Ventricles**
  - **Major arteries and veins**

- **Valves:**
  - Structure present in the heart and in the veins that allow blood to flow in one direction and not go back where it came from. If the blood flow happens to go the wrong way, the valves will close.

- **Atria:**
  - Function is to receive blood from the veins before passing it on to the ventricles.
  - About 80% of the blood received in the atria flows into the ventricles while the heart is relaxed. The first beat of a heartbeat cycle is the contraction of the atria pushing the remaining 20% of the blood into the ventricles.

- **Ventricles:**
  - Ventricles receive blood from the atria.

- **Identify where information systems cannot physically link the information that may be transmitted in a wave form through the atmosphere or space.**
    - Information systems may not be physically linked due to geographical location and/or economic viability.
    - However, this is where EM waves come into play.
- **Identify the properties of energy from the electromagnetic spectrum that make it useful in communication technologies, including its:**
    - **Speed of travel**
    - **Ability to travel in a straight line**
    - **Ability to be reflected**
    - Speed of travel: Electromagnetic waves transmit energy from one place to another at the speed of 300 million metres per second. The very high speed of electromagnetic radiation (EMR) means that the time between sending, receiving and decoding a signal is almost instantaneous for Earth-based systems.
    - Ability to travel in a straight line: Electromagnetic waves travel in a straight line unless there's a change in the medium through which they are travelling. This makes using them predictable.
    - Ability to be reflected:
        - Reflection is the change in direction of a wave due to its bouncing off a boundary between two media. This effect is used by shortwave AM radio frequencies. Signals are deliberately bounced off the ionosphere.
        - Scattering occurs when shorter wavelengths strike an object and are reflected in many directions, e.g. microwaves can be scattered by rain. Scattering weakens the signal.

- **Describe the individual properties of visible light, radio waves (AM, FM and TV waves) and microwaves and relate these to their use in communication systems.**

- A geostationary satellite is one that orbits the Earth at the same period as the period of rotation of the Earth (that is approximately every 24 hours) so that its position in the sky relative to any position on Earth is always the same. It must be in an equatorial orbit.
- The receiving dish on earth must be large as the signal is relatively weak, due to the satellite dish being quite distant at approximately 36,000 km. The satellite dish must face the same direction at all times to ensure that signals are received and retransmitted in the correct directions to the intended receivers.

- **Explain why the satellite must be at a height where its revolution period is the same as that of the Earth's period of rotation.**
  - In order for a satellite to remain in orbit over the same point on the Earth's surface at all times, it must be located 36,000 kilometres above the equator. In this orbit, the satellite travels at a speed that keeps it in the same position relative to the Earth's surface and so the signal can be sent directly to and from the dish antenna on the Earth to the satellite.
  - The Earth's gravitational pull keeps the satellite in orbit. Satellites don't fall towards the Earth because of their tremendous speed. Although they are pulled towards the Earth by gravity, their speed enables them to keep *falling* over the horizon. Thus, if they are travelling with exactly the correct speed they never actually get any closer to the Earth's surface. Tracking stations on Earth use radio signals to activate small rockets on the satellite to keep them in the correct orbit.

9.4.5 – Information can be transmitted in the form of electrical impulses.

- **Identify communication technologies that transform one type of energy into electrical energy.**

Communication technology	**Energy involved in using this device**
Microphone	Sound → Electrical → Sound
TV Camera	Light → Electrical

- **Describe the transmission of images using digital technologies in terms of scanning of the input image along very thin lines.**
    - Essential parts of scanning digital technologies are:
    - A transmitting device: this device translates visual matter (text and graphic) of the copy into electrical impulses according to a set pattern.
    - A synchronized receiving device: this device translates these impulses and prints an exact copy.
    - Digital technologies:
    - Uses a process called digitization (involves converting sound or light into computer language [a code], transmitting it and converting it back to its original form at the receiving end) → to input information into a computer, a keyboard, light pen, scanner, mouse, floppy disc, CD or drawing pad is used. Speech recognition technology is also available.
    - Output from the computer is via the screen, printer or modem (fax, telephone, and internet) → they could also provide input.
    - Faxes: light energy is transformed into electrical signals (digitalized) and transmitted through the telephone line where it is converted back to light.
    - Light energy → electrical energy → light energy
    - In a typical system, the scanner consists of a source projecting a narrow beam of light and a photoelectric cell. The copy to be transmitted is scanned by the light beam, which moves along the device, scanning it in a series of thin lines.
        - The output of the photoelectric cell is suitably amplified in a coupling device and used to modulate a carrier radio signal, or is transmitted directly over the telephone cables.
    - Analogue and digital systems:
    - Both systems involve coding information in order for it to be transmitted or stored.
    - In an analogue system – information is transmitted in the form of a wave.
    - In a digital system – information is represented as numbers (a series of on and offs).
- **Explain how the coding of the image into a series of zeros and ones allow its transmission and ultimate decoding.**

- Claiming the life of many humans and fauna.
- Involves the damage leading to large costs in repair and/or replacements.

- **Identify a range of natural disasters associated with human activity using specific Australian examples.**

Types of natural disasters	Specific Australian examples	Comments
bushfires	Ash Wednesday fires in Victoria and South Australia, Feb 16 1983.	The highest recorded bushfire death toll in Australia. The terrible fires that blazed from 16 February (Ash Wednesday) to 18 February throughout Victoria and South Australia killed 72 people, including 15 fire fighters, and destroyed more than 2000 homes and huge areas of forest and farmland.
drought	Droughts in parts of south-eastern Australia 2003 to 2007 and still ongoing in many areas.	Our country relies on farming for a considerable part of its income. Much of the land used for farming receives unreliable rain. Lack of rain can quickly lead to destruction of crops, food and water running out and stock dying.
flood	Flooding in Nyngan in 1990	Although our continent is very arid, one major cause of natural disasters is flooding. Many river systems traverse a large portion of the continent from South Queensland to South Australia. Some areas may not have rain for years and then experience a prolonged period of heavy rain. The flat nature of the Western plains in New South Wales allows flood waters to spread far and wide across the countryside, isolating farms, stations and towns.
cyclones	Cyclone Tracy in Darwin in December, 1974 and cyclone damage to Karratha north of Port Hedland, WA, caused by Cyclone Steve in March 2000.	Cyclones are common in tropical northern Australia but deaths only occur rarely as they mostly pass over country that is sparsely inhabited and over the ocean.
hailstorms	During 1999, a freak hailstorm moved across Sydney. It was so intense and the hailstones so large, that hundreds of homes had holes knocked in their roofs. There was extensive damage done to hundreds of cars, costing millions of dollars to repair.	More than a year later, many homes still did not have their roofs fixed. The same storm occurring out to sea would not be a disaster.
earthquakes	The earthquake in New South Wales in December, 1989 damaged parts of Newcastle, destroying several buildings and killing thirteen people. The earthquake measured 5.6 on the Richter scale.	The earth tremors felt in Australia are usually quite minor and do not cause major damage.

- **Identify a range of disasters associated with human activity using specific Australian examples.**

Types of disasters associated with human activity	Specific Australian examples	Comments
landslide	Thredbo, July 1997	The road, the Alpine Way, above the lodge that slid down, appears not to have been maintained properly.
transport accidents	the train crash near Glenbrook in December 1999	An enquiry into the disaster found there was inadequate training of personnel, not clear procedures for trains passing a 'stop' signal, inadequate signalling and communications equipment, and lack of a sufficiently strong 'safety culture', with greater priority being given to 'on-time running' than safety.
salinity	salinity in the Murray Valley	Salinity is natural in parts of Australia but the salinity problems in the Murray Valley and other parts of Australia have been exacerbated by overwatering by irrigators, resulting the raising of the watertable that contains saline water.
bridge collapse	the collapse of one span of the Tasman bridge over the Derwent River in Tasmania in January 1975.	The ship, Lake Illawarra, hit a pylon of the bridge, causing one span to collapse. Twelve people died, seven of whom were crewmen on the ship.

- **Identify specific Australian examples where nature and human activity have combined to produce disasters such as dust storms, shipwrecks, landslides and accidents.**
    - A dust storm in Melbourne (1983) resulted from a change in conditions. The farmland around Melbourne had been farmed and managed well. After a dry period, a freak storm built up which carried millions of tonnes of topsoil off the farms into the centre of Melbourne. It caused damage in the city. At the same time, the farms lost their topsoil that is essential to provide nutrients for crops to grow.
    - The Thredbo landslide occurred in 1997 and 18 people died. Although it could be called a natural disaster human error certainly contributed to it.

- *Richter Scale:* A formula based on amplitude of the largest wave recorded on a specific type of seismometer and the distance between the seismometer and the earthquake → invented in 1930s by Charles F. Richter → typically used to measure Californian based earthquakes so not really accurate.
- *Mercalli Scale:* This scale measures the intensity of an Earthquake by how much damage has been caused → intensity ranges from 1 – 10, with 1 being extremely weak/no effect and 10 being extreme/damages + lives lost.

- **Explain how the difference in time of arrival of P and S waves can be used to locate an earthquake's epicenter.**
  - The speed of the two waves is well known and so the P-S time can be used to calculate how far the centre of the earthquake was from the observatory,
    - Imagine two cars leave a spot and travel towards you with different speeds.
    - You do not know how far away they were when they started, but you do know that one travelled at 10 metres per second (m/s) and the other travelled at 15 m/s. If one car arrives 3 seconds after the other, how far away from you were they when they started?

  1. Let the distance be 's' metres, then the time taken by the two cars will be s/10 and s/15 respectively using the equation time = distance/velocity
  2. The difference in times will be s/10 -s/15
  3. We know this difference is 3 seconds
  4. Therefore s/10 - s/15 = 3
  5. Multiply both sides by 150 (10 x 15) to get 15 x s - 10 x s = 3 x 150
  6. 5s = 450
  7. s = 90 metres

Figure 1 - Taken from HSC Online.

- **Describe the difficulties of monitoring and predicting earthquakes.**
  - Earthquakes usually happen deep underground and can rarely be monitored or predicted until an extreme one occurs.
  - We are trying to monitor the movement of the ground we stand on and it's difficult to do that when we also move with the ground.
  - In order to predict where an earthquake may strike, people monitor all the parts of the Earth that are on Plate Margins.
- **Identify some of the conditions that can combine to trigger a bushfire including dry weather, high temperatures and flammable vegetation.**
  - Some of the conditions in Australia that contribute to triggering a bushfire include: