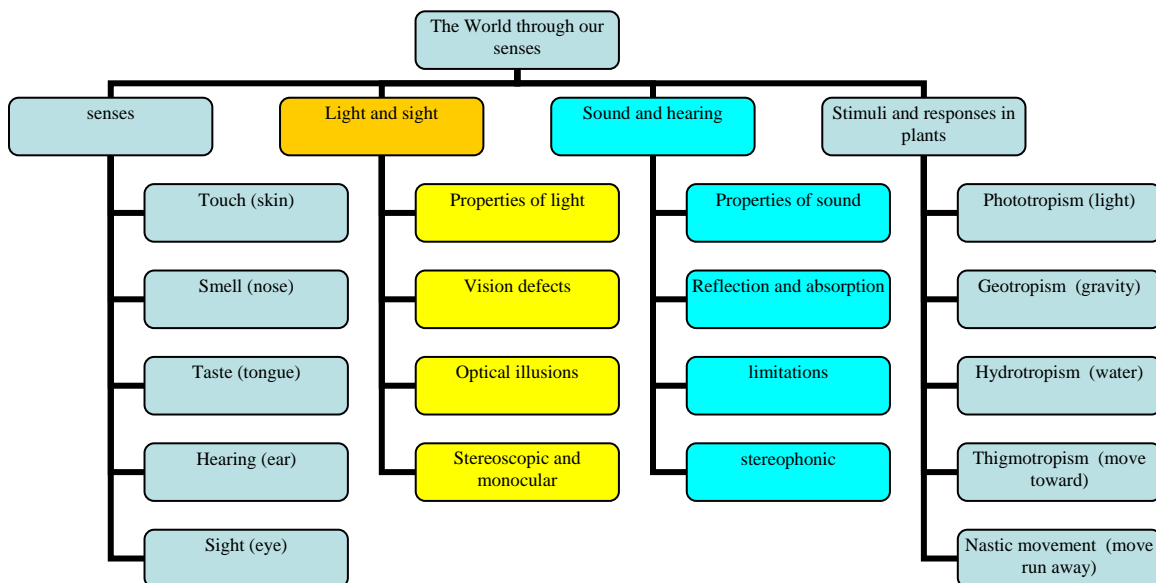


# CHAPTER 1: THE WORLD THROUGH OUR SENSES



## 1.1 Sensory Organs and Their Functions

### Sensory Organs and Their Stimuli

1. Humans being have five main sensory organ, which are skin, nose, tongue, ears and eyes.
2. Sense detects stimuli, that is changes in surroundings (around us).
3. Five senses:
  - i. sight
  - ii. hearing
  - iii. touch
  - iv. taste
  - v . smell
4. Senses are part of the body called sensory organs.
5. Changes or object that can detect by our senses are called stimuli.
6. The ability of the sensory organs to detect stimuli is called senses.
7. All the sensory organs are complete with sensory receptors, that is the nerve endings that can detect stimuli.

Stimuli	Sense	Sensory organ
Light(Brightness, colour)	Sight	Eye
Sound	Hearing	Ear
Touch, heat, cold, pain, pressure	Touch	Skin
Sweet, sour, bitter, salty	Taste	Tongue
Smell or odors	Smell	Nose

Laman web.

<http://freda.ayeung.net/5senses/see.htm>  
<http://freda.ayeung.net/5senses/touch.htm>  
<http://freda.ayeung.net/5senses/hear.htm>  
<http://freda.ayeung.net/5senses/taste.htm>  
<http://freda.ayeung.net/5senses/smell.htm>

## 1.2 The Pathway from Stimulus to Response **PMR 05**

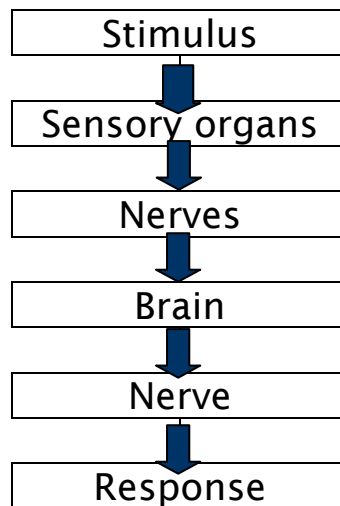
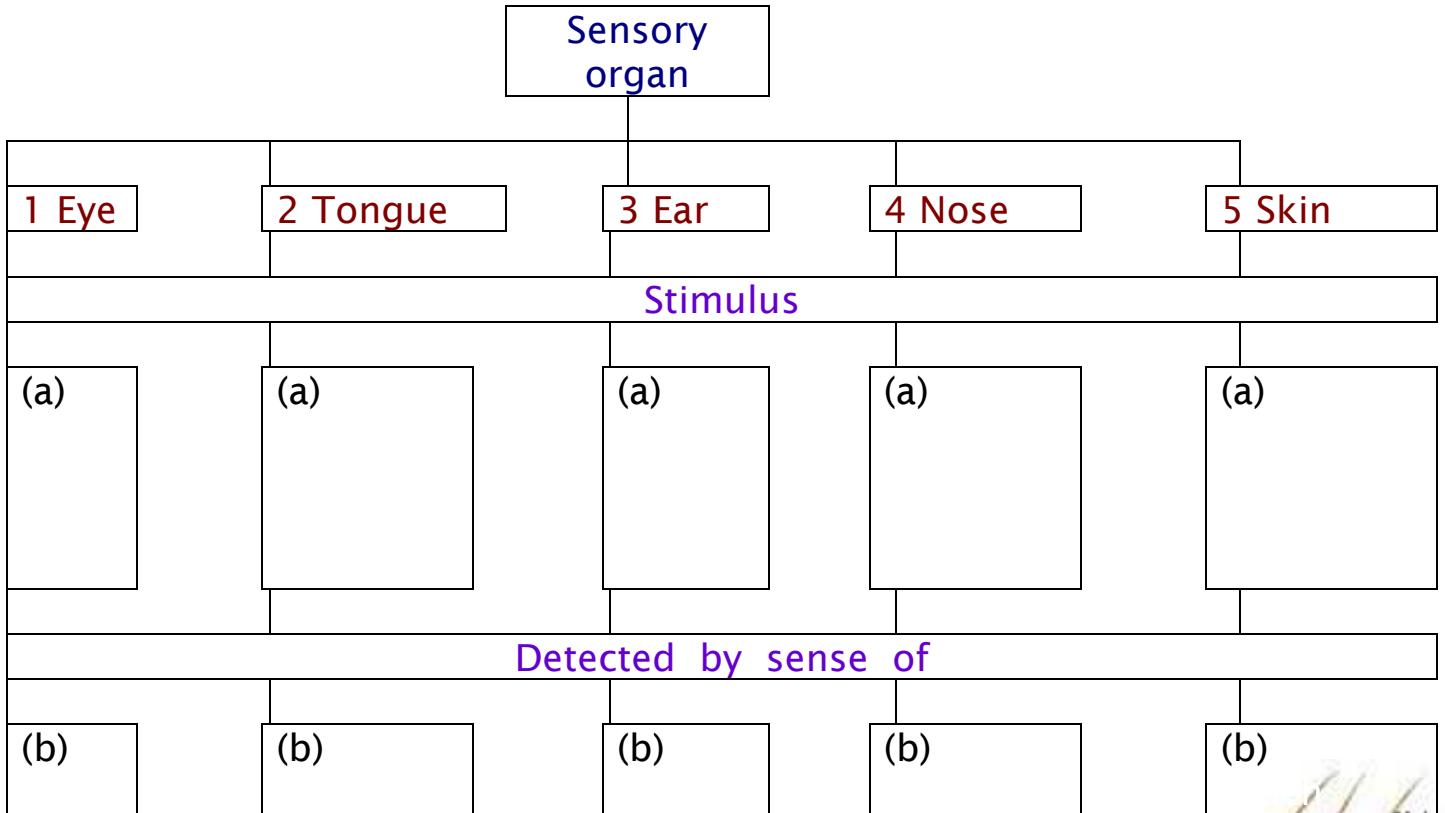


Figure 1.2 The summary of the pathway from stimulus to response

1. Our sensory organs are used to detect **stimuli** (Singular: stimulus). A stimulus is anything that causes a reaction in a living organism, e.g. Pain, heat, sound, chemicals.
2. When a stimulus is detected, receptor cells in the sensory organ will be triggered and generate impulses.
3. These impulses will be transmitted through the nerve and then to the brain.
4. The brain will further process and interpret the impulse signals as specific information that the organism has to respond to.
5. This information is then sent back to the sensory organ through the nerve to provide responses.

**Stimulus → Sensory organ → Nerves → Brain → Nerves → Response**

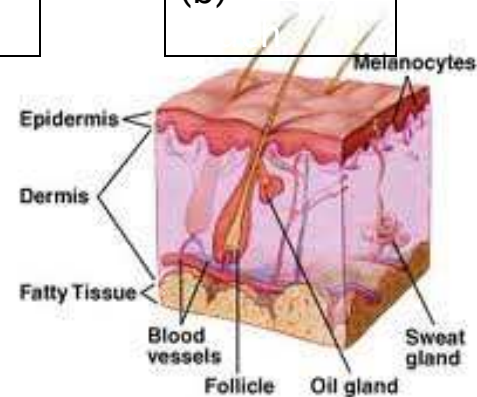
EXERCISE



**Sense of Touch PMR 07**

<http://freda.ayeung.net/5senses/touch.htm>

Go to [www.brainpop.com/health/integumentary/skin/index.wemf](http://www.brainpop.com/health/integumentary/skin/index.wemf)  
 Watch a movie on the skin. For easy access, go to [www.icd.com.my](http://www.icd.com.my)



1. The sense of touch is the sense that is sensitive towards the touch stimulus provided by specific objects.
2. Organ involve in the detection of touch stimulus is the skin.
3. Structure of human skin:
  - a) The skin divided into three layer epidermis, dermis, fat layer (subcutaneous layer @ adipose layer @ fat layer)
  - b) Receptors are cell in our body that detected stimuli.
  - c) Our body have different types of receptors. These are:
    - i. pain receptor
    - ii. touch receptor
    - iii. heat receptor
    - iv. cold receptor
    - v. pressure receptor

- d) The pain receptor is in the epidermis.
- e) The touch, heat and cold receptors are in the dermis. The pressure receptors are in the fat layer.
- f) Each type of receptor can detect only one particular stimulus.
- g) The part of our body that contain receptors are called **sensory organs**
- h) These receptors have nerves attached to them

Draw figure 1.3, page 6

4. The degree of sensitivity of the skin depends on the:
- a) **Thickness of the epidermis**
    - The thinner the epidermis, the more sensitive the skin is to the stimulus
  - b) **Number of receptors present** **PMR 05**
    - The more receptors found on the skin the more sensitive is that part of the skin.
5. The part of the body that have thin epidermis and many receptors sensitive to touch are
- a) lips
  - b) fingertips
  - c) behind the ears
  - d) armpit
  - e) the back of the neck
6. The part of the body that are not so sensitive to touch are the:
- a) elbow
  - b) knee
  - c) palm of the hand and sole of the foot
  - d) buttocks/hip
7. The parts of the body usually chosen by the doctor for injection are along the upper arm and the buttocks. This is because these parts have thick epidermis and fewer receptors.
8. Braille is a code made up of small raised dots on paper. Blind people use their sense of touch to read Braille.
9. Other functions of the human skin.
- i. *Water proof*
    - prevent water loss from skin.
  - ii. *Prevents entry of microorganisms that cause illnesses.*
  - iii. *Remove waste products*
    - excess water, urea and mineral salts.
  - iv. *Produces Vitamin D* in the presence of the sunlight.
  - v. *Stabilise body temperature*

- sweat glands produce more sweat to cool the body if body temperature rises.

## Quick check

Fill in the blank with the suitable terms given in the box.

Receptors	thickness	thinner	sense of touch	touch
more number				

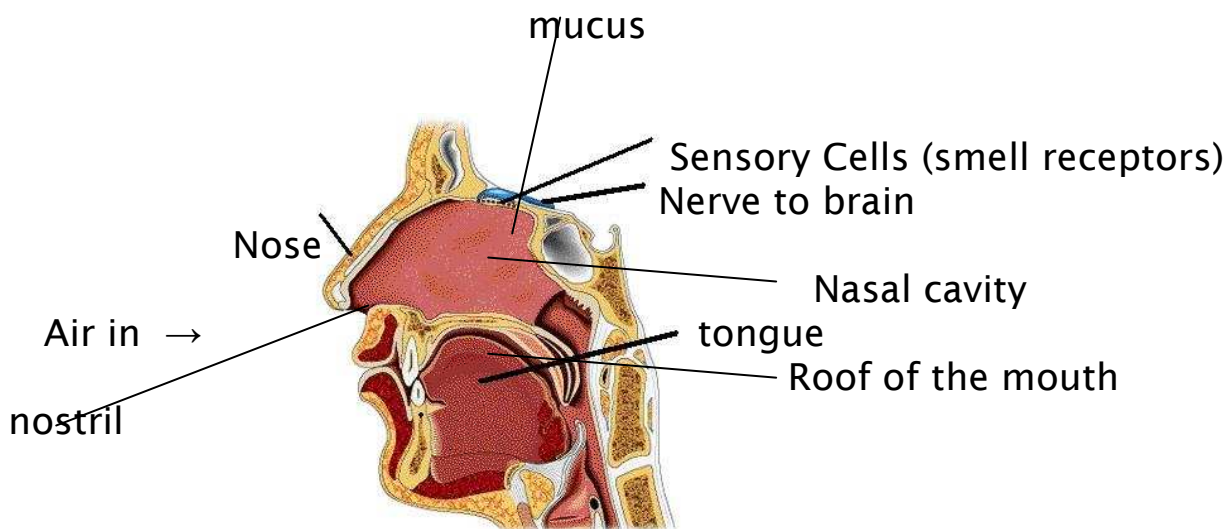
1. The skin is an organ of \_\_\_\_\_
2. There are five types of \_\_\_ \_\_\_ in the skin sensitive to various stimuli.
3. The sensitivity of the skin depends on the \_\_\_\_\_ of the epidermis and the \_\_\_\_\_ receptors on the skin.
4. The \_\_\_\_\_ the epidermis, the more sensitive it is to stimulus.
5. The \_\_\_\_\_ receptors there are on the skin, the more sensitive it is to stimulus.
6. Blind people use their \_\_\_\_ to help them read Braille

## THE SENSE OF SMELL

<http://freda.auyeung.net/5senses/smell.htm>

Go to [www.innerbody.com/htm/body/htm/](http://www.innerbody.com/htm/body/htm/). choose 'nervous system' and click on the 'nose' for detailed information.

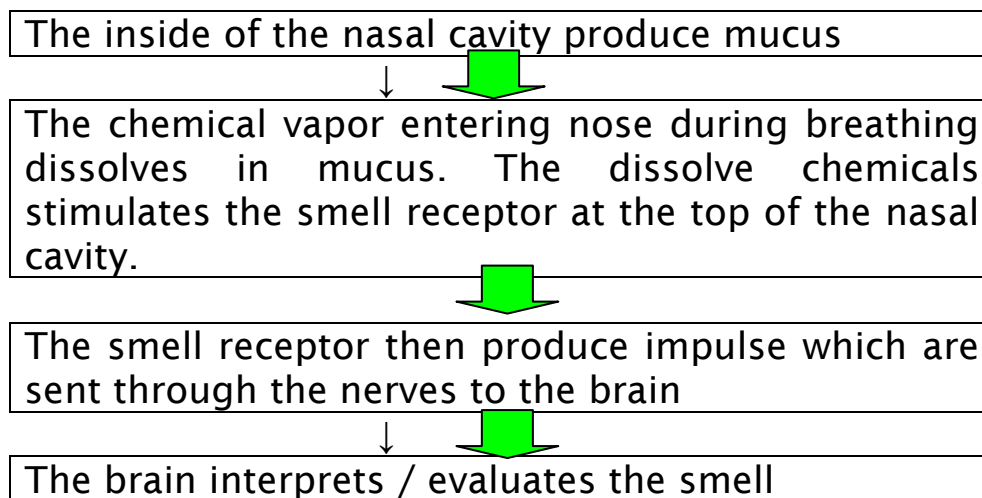
For easy access, go to [www.icd.com.my](http://www.icd.com.my)



1. The nose is sensory organ for smell.
2. Cells sensitive to smell (smell receptors) are found on the top of the nasal cavity.

Draw figure 1.8, page 9

3. Structure of the human nose.
  - a. The human nose has a cavity lined with epithelium tissue.
  - b. On the surface of the epithelium tissue are the sensory cells known as olfactory cells.
  - c. The surface of the nasal cavity is moist because of the mucus secreted by the cells of a gland.
  - d. The nasal cavity has a pair of external opening (nostrils) which have hair to filter dust from the air inhaled through the nose.
4. The nose detects smell in the following way.



5. When we have a cold or flu, a lot of mucus is produce. The smell receptors are surrounded by this thick layer of mucus and vary little of chemical vapor gets to the smell receptors. Therefore, the smell receptors do not get stimulated enough to effectively function as a sensory organ of smell.
6. The sensitivity of the nose towards stimuli is influenced by the following factors: **PMR 05**
  - i. **The strength of the smell.** A stronger smell will be detected by the nose easily compared with a weaker smell.
  - ii. The **presence of mucus** in the nose. A lot of mucus will reduce the sensitivity of the nose.

## Quick check 1.3

1. Where are the smells receptors found?
2. Explain why when we have cold or flu , the nose cannot function effectively as a sensory organ of smell

## THE SENSE OF TASTE

<http://freda.ayueung.net/5senses/taste.htm>

draw figure 1.10, page 11

1. The tongue is the sensory organ for taste.
2. The surface of the tongue has groups of cells known as **taste buds** which are sensitive to taste.
3. There are four types of taste buds on the tongue sensitive to sweet , bitter, sour and salty. **PMR 03**
4. The tongue detects taste in the following way:

Dissolved substance → taste receptors → message → brain → type of taste

5. The sense of smell helps the sense of taste .This explains why food dose not taste appetizing when we have a cold or flu because we cannot smell effectively

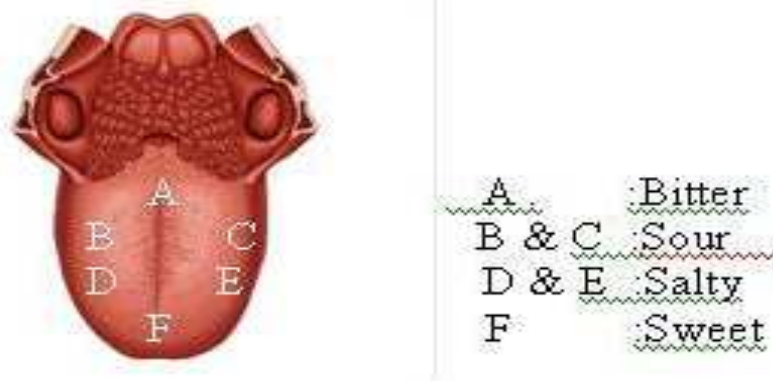


Figure 1.8 Structure of the human tongue and the areas of taste on the tongue

## The Sense of Taste and the Sense of Smell

Go to [www.brainpop.com/health/senses/taste/](http://www.brainpop.com/health/senses/taste/)

Watch a short movie on taste and try a quiz about taste.. For easy access, go to [www.icd.com.my](http://www.icd.com.my)

1. All our sense work together:- sense of smell and taste are special partner
2. When we eat, our tongue gives us the taste and our nose smell of the food.

## THE SENSES OF HEARING

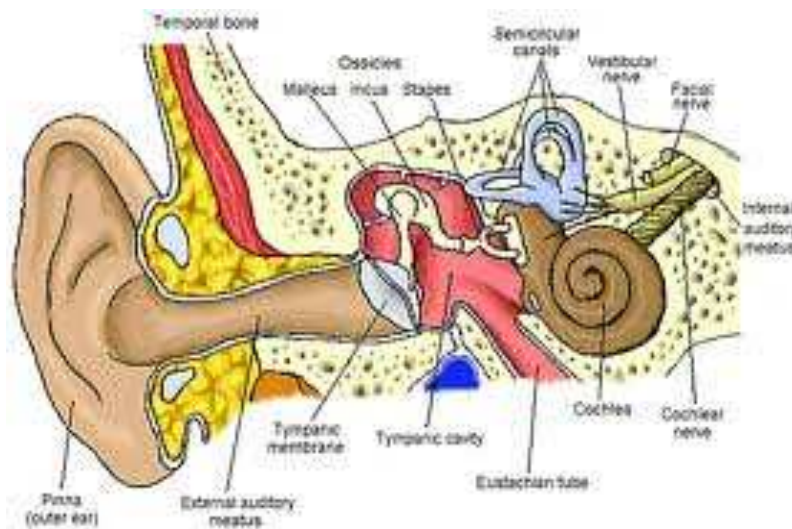
<http://freda.ayeung.net/5senses/hear.htm>

1. The ear is the sense organ that is sensitive to sound stimuli produced by vibrating object.
2. A human ear has three main part.
  - i. the outer ear, filled with air.
  - ii. The middle ear, filled with air.
  - iii. The inner ear, filled with liquid

Draw figure 1.15, page 14

3. Function of the different parts of the human ear.

Salin table 1.4, page 15





## The Hearing Mechanism

Lukis/Photostat figure 1.16 m/s 15

### FUNCTIONS OF DIFFERENT PARTS OF THE HUMAN EAR

Part	function
<b>OUTER EAR</b> Pinna	collects and directs sound waves into the ear canal.
ear canal / auditory canal	transmits sound waves to the eardrum.
Eardrum	vibrates and transmits sound waves to the ossicles.
<b>MIDDLE EAR</b> Ossicles	intensify the vibrations of the sound waves by 22 times before transmitting to the oval window.
<b>Eustachian tube</b>	<b>balances the air pressure at both side of the eardrum.</b>
oval window	transmits sound vibrations from the middle ear to the inner ear.
<b>INNER EAR</b> Cochlea	transforms sound vibrations into impulses.
<b>semicircular canals</b>	<b>balance the body position.</b>
auditory nerves	send messages to the brain which interprets the messages as sound.

### Limitations of hearing.

1. We cannot hear all the sounds around us.
2. The range of frequencies of hearing in man is 20 Hz until 20 000 Hz. The following table shows the range of frequencies of hearing of several animals:

ANIMAL	RANGE of FREQUENCIES
snake	100-800Hz
frog	50-10 000Hz
dog	10-50 000Hz
cat	60-60 000Hz
bat	1000-120 000Hz
grasshopper	100-15 000Hz
whale	10-50Hz

3. Different people have different limitations of hearing.
4. For example, old people generally cannot hear as well as young people.
5. Our ear drum become less sensitive to sound as we grow older.
6. To overcome the limitations of hearing, we use
  - i. the stethoscope – enables doctor to detect the soft heartbeats of patients.
  - ii. hearing aids – collects sound signals before being sent to the middle ear.
  - iii. amplifier – boosts weak sound signals.

### Stereophonic hearing

Go to : [http://www.wardless.co.uk/hearing\\_aids/twoEarsBetter.shtml](http://www.wardless.co.uk/hearing_aids/twoEarsBetter.shtml)

Find out more about stereophonic hearing from this website or other websites. . For easy access, go to [www.icd.com.my](http://www.icd.com.my)

1. Stereophonic hearing is hearing using both ears.
2. The advantages of stereophonic hearing:
  - i. enables the direction of the source of hearing to be detected more accurately.
  - ii. This is because the ear nearer the source of sound receives sound louder and earlier than the other ear.
  - iii. Animals that have stereophonic sound can detect the presence of preys and predators more quickly.

### Properties of sound (see page 16 science volume 1)

1. The transfer of sound requires a medium.
2. sound can transferred through;
  - b. solids
  - c. liquids
  - d. gases
  - e. cannot be transferred through in vacuum.
3. Sound can be transferred fastest in solids and slowest in gases.
4. This is because the particles in solids and liquids are closer each other compared to the molecules in gases.
5. Vacuum is space that does not have any particles.

6. Speed of sound transferred in various media.

MEDIUM	SPEED of SOUND (m/s)
Air	340
Water	1500
Wood	3600
Iron	5000
Steel	6000

Reflection and absorption of sound

1. Sound can be reflected or absorbed by the surface of an object.
2. The sound reflected repeatedly from one surface is known as echo.
3. Surfaces that are smooth, even and hard are good sound reflectors and produce loud echo. For examples, concrete, plank, metal and mirror
4. Surfaces that are rough, hollow and soft are good sound absorbers and produce weak echo. For examples cloth, sponge, cork, rubber, carpet and cushion.

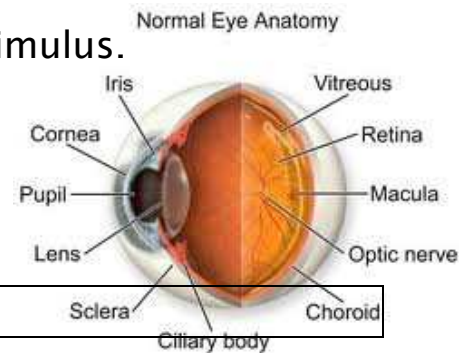
**SENSE OF SIGHT**

<http://freda.ayeung.net/5senses/see.htm>

1. The sense of sight is the sense that can detect light stimulus.

2. Structure of the human eye: **PMR 04**

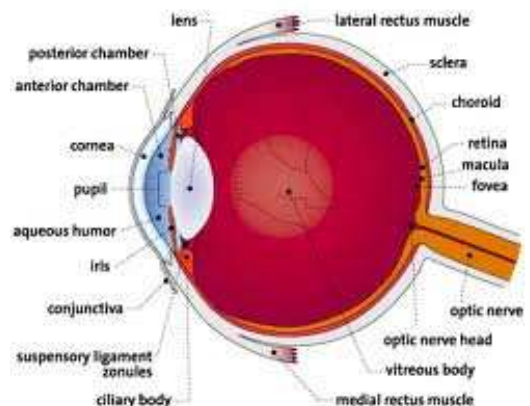
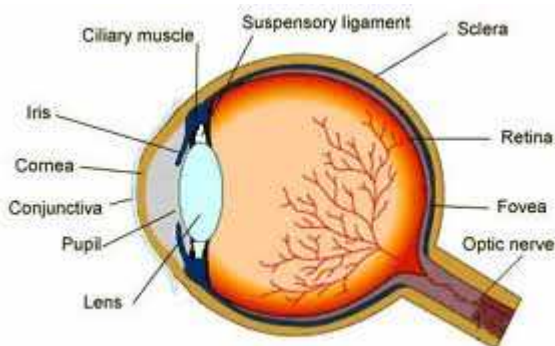
- i. the sclera (outermost)
- ii. the choroids (middle) and
- iii. the retina (innermost)



lukis rajah m/s 22

3. The function of each part of the eye.

**Pelajar diminta mencari maklumat ini (isi maklumat seperti jadual dibawah)**



part	Structure / characteristic	function
sclera		
cornea		
choroids		
conjunctiva		
iris		
pupil		
Lens <b>PMR 04</b>	Transparent and elastic convex lens	Refracts and focuses light onto the retina.
ciliary muscle		
supportive ligament		
vitreous humour		
aqueous humour		
retina		
optic nerve		

### Mechanism of Sight **PMR 03, 07**

1. The lens in the human eye is a transparent convex lens.
2. An inverted image is focused on the retina.
3. Light rays are refracted by the eye lens. The eye lens focuses the image onto the retina by changing the thickness of the eye lens. **The thickness of the lens is changed by the ciliary muscles.**
  - i. Focusing near objects  
To focus near objects onto the retina, the ciliary muscles **contract**. The eye lens become **thicker**.
  - ii. focusing distant object.  
To focus distant objects onto the retina, the ciliary muscles **relax**. The eye lens becomes **thinner**.

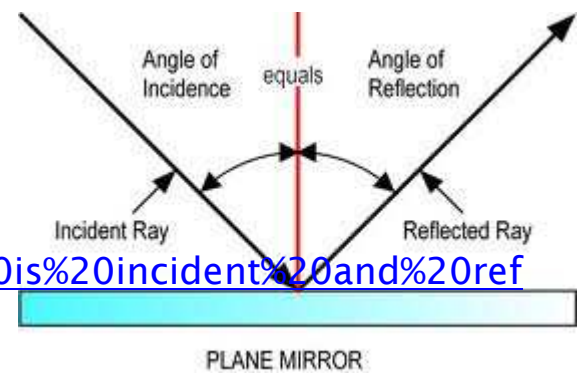
draw figure `How do we see' m/s 23

### Light and sight

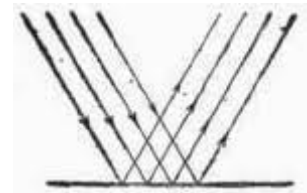
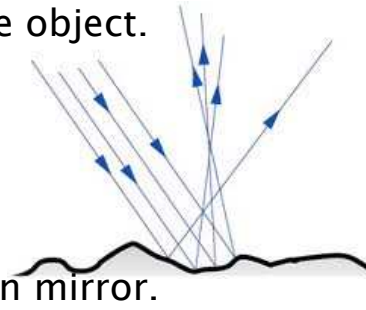
1. Light is a form of energy.
- 2.. light travels at a speed of ;
  - i. 300,000,000 meter/second (m/s) in the air.
  - ii. 225,000,000 m/s in water
  - iii. 200,000,000 m/s in glass
3. Light travels in a straight lines.

## Reflection of light.

[http://www.phys.ufl.edu/-delamater/optics\\_pictures.pdf#search=`what%20is%20incident%20and%20reflected%20ray`](http://www.phys.ufl.edu/-delamater/optics_pictures.pdf#search=`what%20is%20incident%20and%20reflected%20ray`)



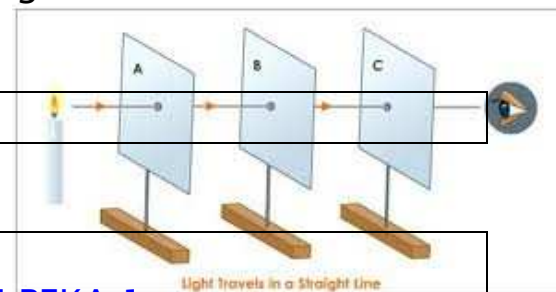
1. Light can be reflected. (that's mean change direction)
2. When the reflected light rays enter our eyes, we can see the object.
3. The image in a plane mirror is,
  - i. virtual (cannot be formed on a screen)
  - ii. upright
  - iii. laterally inverted
  - iv. the same size as the object
  - v. the same distance behind the mirror as the object is in mirror.



## Refraction of light. **PMR 03, 05**

1. Refraction of light is the bending of light. This happens when light travels from one transparent medium to another which is of a different density.
2. The speed of light decrease when light enters a denser medium.
3. Light travels through media like air, water and glass.

draw figure 1.27 page 24



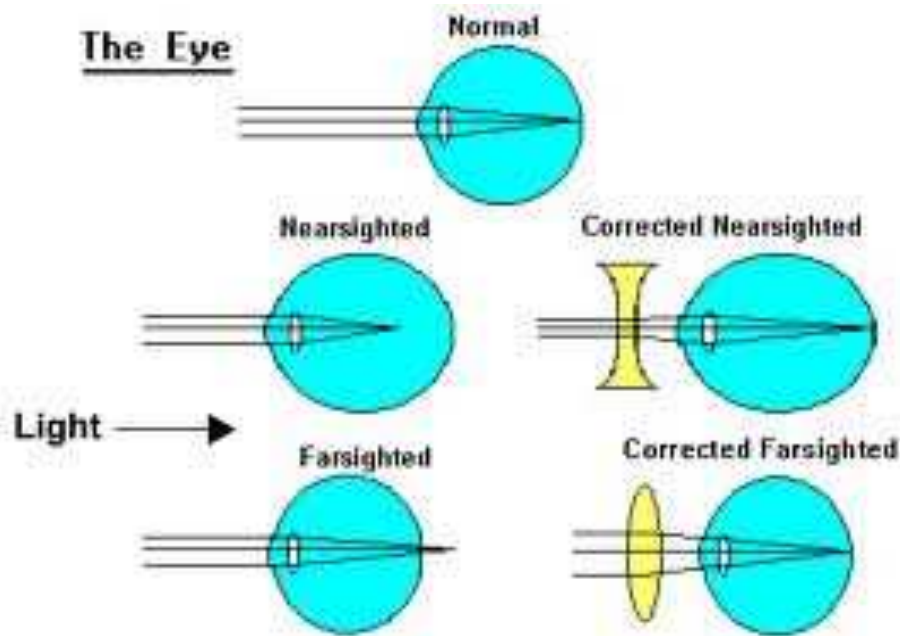
[Experiment page 25. LAPORAN PEKA 1](#)

## Various defect of vision. **PMR 03, 06, 07**

[http://www.chemsoc.org/exemplarchem/entries/2002/upton/defects\\_of\\_the\\_eye.htm](http://www.chemsoc.org/exemplarchem/entries/2002/upton/defects_of_the_eye.htm)

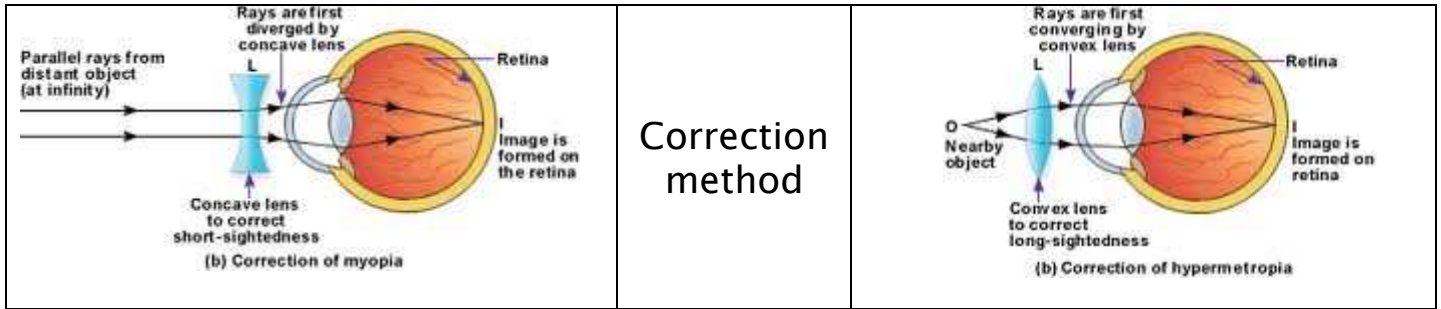
1. Two common vision defects are *long-sightedness* (hypermetropia) and *short-sightedness* (myopia).

2. Comparison between [long-sightedness and short-sightedness](#).



‘Comparison between long-sightedness and short-sightedness’

Short-sightedness	Differences	Long-sightedness
1. The eye is too long and/or the cornea is too steep 	Symptoms of defect.	
1. 2.	Causes of defect	
1.	Position of image of object	
Lihat power point	Diagram	



### 3. *Astigmatism* is another vision defect.

- i. Its caused by the cornea and the eye lens that are not evenly curved.
- ii. As a result, the image formed on the retina is distorted and not clear (hazy/blurred).
- iii. This defect can be overcome by wearing glasses with cylindrical lenses or contact lens or by surgery.

### 4. *Optical illusion.*

<http://www.michaelbach.de/ot/>

<http://www.indianchild.com/3d%20mainpage.htm>

- i. Optical illusion occurs when the brain cannot interpret impulses received properly.
- ii. Examples of optical illusion.

draw figure 1.41 page 30

### 5. *Blind spot*

- i. The blind spot is a spot on the retina of the eye that cannot detect light stimulus.
- ii. The image of the object formed at the blind spot cannot be seen by the eye because there are no light-sensitive cells (photoreceptors) at the blind spot.

Experiment seperti ms 29

Monocular and stereoscopic vision.

<http://nzphoto.tripod.com/sterea/3dvision.htm>

1. The stereoscopic vision is vision using both eyes.
2. The overlapping area of the vision of both the left and right eyes is called stereoscopic field
3. Advantages of stereoscopic vision.
  - a. See three-dimensional pictures of objects.
  - b. Enables more accurate estimation of distance and position.
  - c. Animal predators normally have stereoscopic vision so better estimate the distance when getting to pounce on their prey.

draw figure 1.43 page 31

4. Monocular vision is a vision using only one eye.
5. The advantage of monocular vision is having a wide vision field.
6. Its disadvantage is that it cannot estimate distance accurately.
7. Animal preys use monocular vision to detect predators coming from all direction.

draw figure 1.42 page 30

### Appropriate devices to overcome the limitations of sight

Go to [www.google.com](http://www.google.com). Type LASIK or PRK. you can get more information about the latest technologies to correct the different types of defects of vision.

1. Optical devices are invented to increase the ability to see minute or very distant objects.

INSTRUMENT	FUNCTION
Microscope	To see minute objects such as microorganisms and bacteria.
Telescope	to see far-off objects such as stars and planets.
Binocular	to see tiny distant objects such as birds in the sky.
Magnifying	to magnify tiny objects to become glass larger than original.



## STIMULI AND RESPONSE IN PLANTS.

Go to [www.emc.maricopa.edu/faculty/farabee/BIOBK/Biobook\\_TOC.html](http://www.emc.maricopa.edu/faculty/farabee/BIOBK/Biobook_TOC.html)

Click on '24 plant hormones and nutrition' then 'plants respond to external stimuli'.. For easy access, go to [www.icd.com.my](http://www.icd.com.my)

1. Movements of any plant parts towards stimuli are known as tropic movement or tropism.
2. Type of tropism:
  - a. Growth of plant part towards an external stimulus is known as positive tropism.
  - b. Growth away from an external stimulus is known as negative tropism.
3. Tropism responses in plants include:
  - a. Phototropism **PMR 03, 08**
  - b. Geotropism **PMR 06**
  - c. Hydrotropism **PMR 03, 08**
  - d. Thigmotropism - move towards - to obtain support
  - e. Nastic movement - move run away -

Salin nota sendiri dari buku teks m/s 33, 34, 35  
masukkan gambar rajah sekali ....

.....tammatt.....