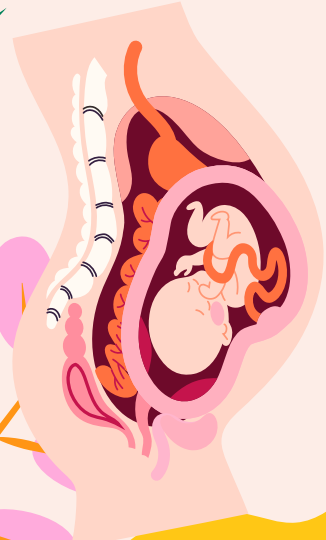




# Reproduction

Asexual Reproduction  
Cell Division

Sexual Reproduction in Flowering Plants  
Sexual Reproduction in Humans  
Sexually Transmitted Diseases





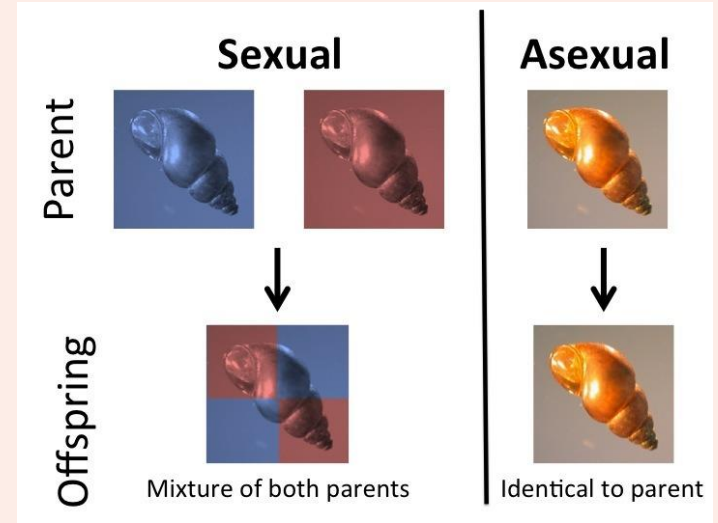
(a) Define asexual reproduction as the process resulting in the production of genetically identical offspring from one parent



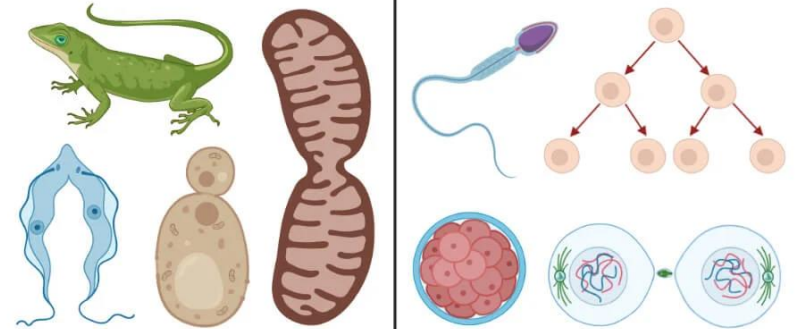


# Reproduction

- Reproduction is the biological process resulting in the production of genetically identical offspring from one parent
- New organisms are produced to ensure the perpetuation of the species
- Two type of reproduction:
  - asexual reproduction
  - sexual reproduction

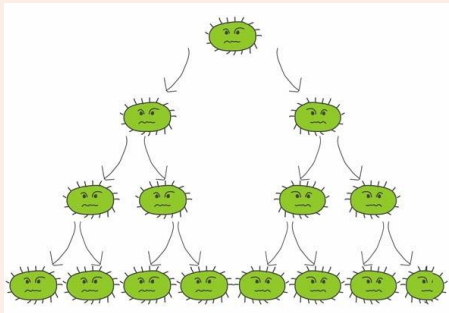
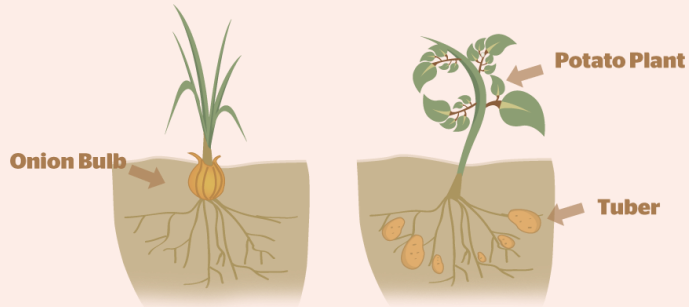


## Differences Between Asexual and Sexual Reproduction





# Asexual reproduction



Asexual reproduction is the process of producing a genetically identical offspring from one parent without the fusion of gametes.

Advantages	<ul style="list-style-type: none"><li>- Only one parent required as fusion of gametes is not required.</li><li>- All beneficial qualities are passed onto the offspring.</li><li>- Faster method of producing offspring as compared with sexual reproduction.</li><li>- Since organisms are already in a suitable habitat, they can colonise the area rapidly.</li></ul>
Disadvantages	<ul style="list-style-type: none"><li>- No genetic variation in the offspring. Hence, species are may be wiped out if not well adapted to changes in the environment.</li></ul>



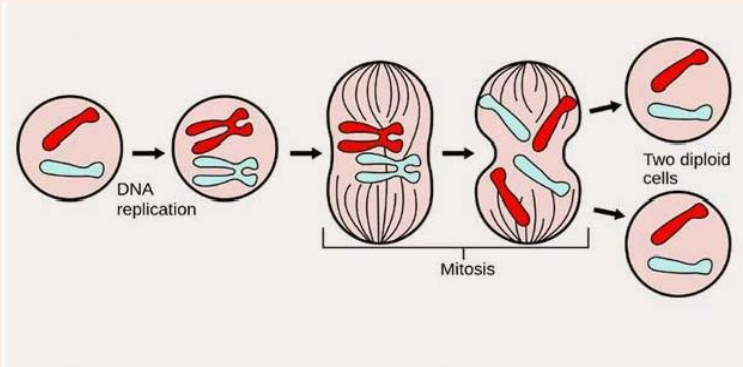
(b) State that mitosis is a type of cell division giving rise to genetically identical cells in which the chromosome number is maintained

(c) State the importance of mitosis in growth, repair and asexual reproduction





# Mitosis



## Mitosis

- In organisms that reproduce asexually, mitosis plays a central role in generating offspring
- Mitosis is nuclear division that produces 2 daughter nuclei that is genetically identical to parent nucleus.
- Daughter nuclei have the same number of chromosomes and same amount of DNA as parental nucleus. Each daughter cells therefore contain diploid ( $2n$ ) number of chromosomes.
- Diploid cells: contain two complete sets of chromosomes, one set inherited from each parent. (46 chromosomes; with 23 chromosomes inherited from each parent). **Most somatic cells are diploid.**

## Importance of mitosis

- Producing genetically identical cells is important so the daughter cells will have all the necessary genes
- Mitosis allows growth, repair and asexual reproduction that requires genetically identical cells.
  1. **Growth** - Growth requires increase in number of new genetically identical cells within an organism, which is produced by mitosis for it to increase in size
  2. **Repair** - New cells are produced to replace worn out cells that have been shed or to heal from wounds
  3. **Asexual reproduction** - producing offspring that are genetically identical to the parents as well as to one another.



(d) Define sexual reproduction as the process involving the fusion of nuclei of male and female gametes to form a zygote and the production of genetically dissimilar offspring





# Sexual reproduction



Sexual reproduction is the process involving the fusion of male and female gametes (one from each parents) to form a zygote during fertilisation. The outcome is genetically dissimilar offspring.

Therefore, gametes have a haploid ( $n$ ) number of chromosomes, in order to restore diploid chromosome number in the zygote when gametes fuses. This is necessary for normal growth and development

Advantages	<ul style="list-style-type: none"><li>- Offspring may inherit beneficial qualities from both parents.</li><li>- There is greater genetic variation in the offspring, thus species can be better adapted to changes in the environment.</li></ul>
Disadvantages	<ul style="list-style-type: none"><li>- Two parents are required (except in plants with bisexual flowers) as fusion of gametes is required</li><li>- Slower method of producing offspring as compared to asexual reproduction</li></ul>



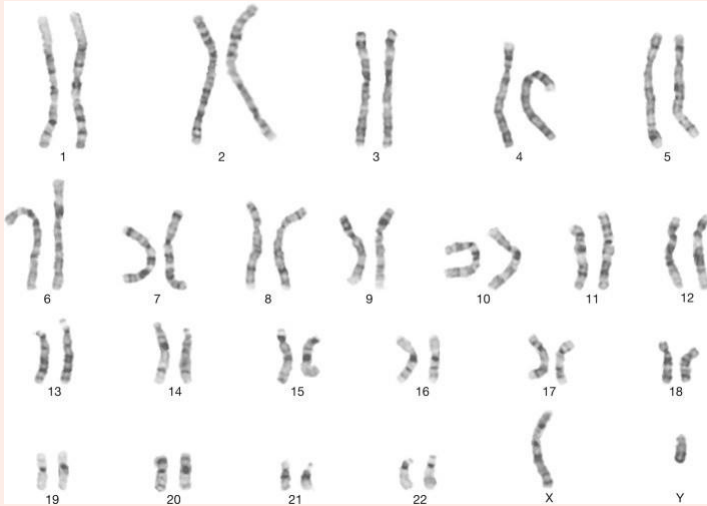


(f) State what is meant by homologous pairs of chromosomes

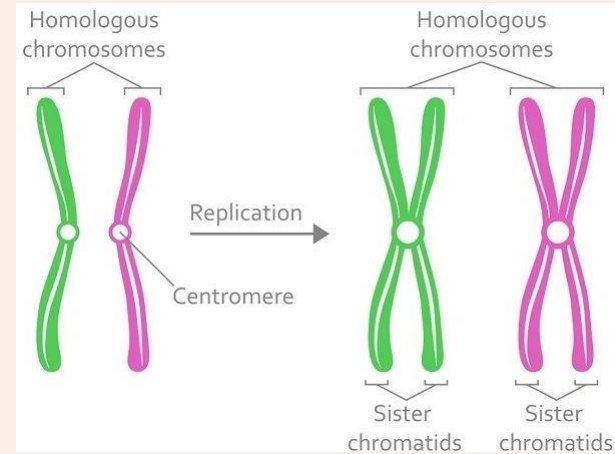




# Homologous Chromosomes



human has 23 pairs of homologous chromosomes



- A pair of chromosomes that are similar in structure, shape, length, size, and have the same centromere position and same genes with the same corresponding loci.
- One chromosome is inherited from the maternal parent and one is inherited from paternal parent
- Homologous chromosomes may contain different types of alleles



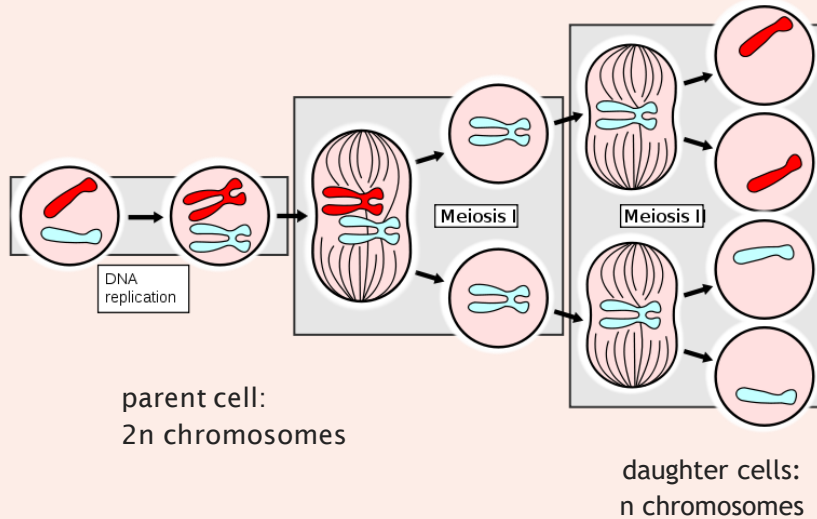
(g) State that meiosis is a type of cell division that gives rise to genetically dissimilar cells in which the chromosome number is halved due to the separation of homologous chromosomes

(h) State that meiosis is used in the formation of gametes





# Meiosis



## Meiosis

- Meiosis is a reduction nuclear division that produces daughter nuclei containing half the number of chromosomes as the parent nucleus due to separation of homologous chromosomes.
- A parent nucleus undergoes meiosis to give 4 daughter nuclei
- Each daughter cells contain haploid number of chromosomes.
- Meiosis is used in the formation of gametes

## Gametes

- Gametes are haploid cells which means it contains half the number of chromosomes as compared to normal body cell
- For example, a human cell with diploid number of chromosomes, 23 pairs of chromosomes, 46 chromosomes, undergo meiosis to give 4 human gametes that each have 23 chromosomes.



(I) Identify using a hand lens if necessary, the sepals, petals, stamens and carpels of insect-pollinated, dicotyledonous flowers, and examine the pollen grains under a light microscope

(J) State the functions of the sepals, petals, anthers and carpels



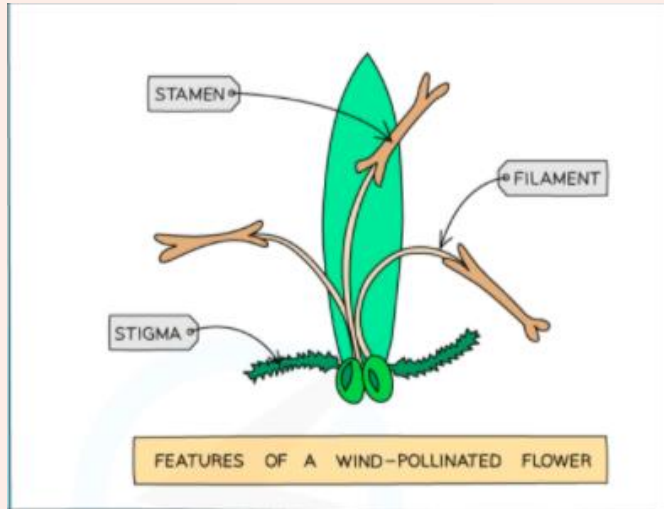


(K) Identify, using a hand lens if necessary, the stamens and stigmas of wind-pollinated flowers, and examine the pollen grains under a light microscope





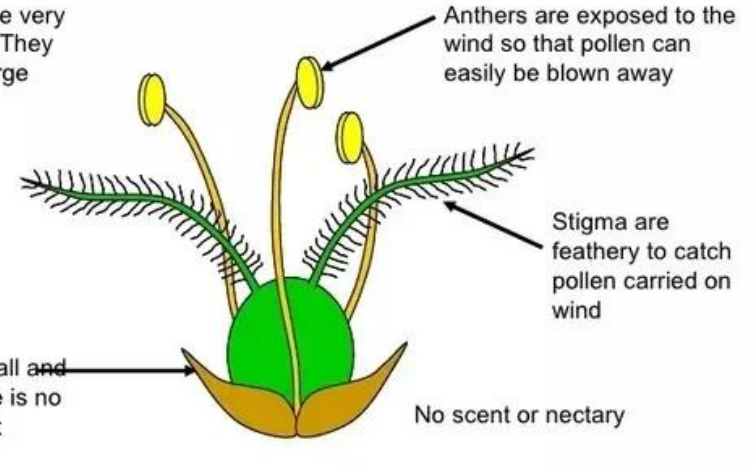
# Structure of a flower plant



structure of a typical wind-pollinated flower

**Wind-pollinated** flowers are different in structure because they do not have to attract insects to them but do need to be exposed to the wind.

Pollen grains are very small and light. They occur in very large numbers





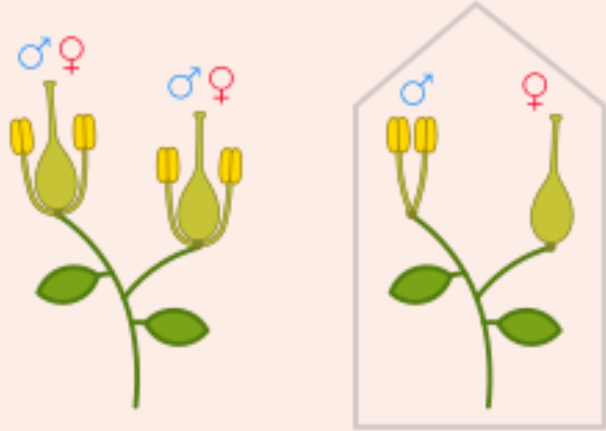
(L) Outline the process of pollination and distinguish between self-pollination and cross-pollination







# Self Pollination



Pollination is the transfer of pollen grains from the anther to the stigma, enabling fertilisation.

Both self-pollination and cross-pollination are sexual reproduction as there is fusion of gametes.

**Self pollination:** transfer of pollen grains from the anther to the stigma of the same flower or from the anther of a flower to the stigma of another flower on the same plant.

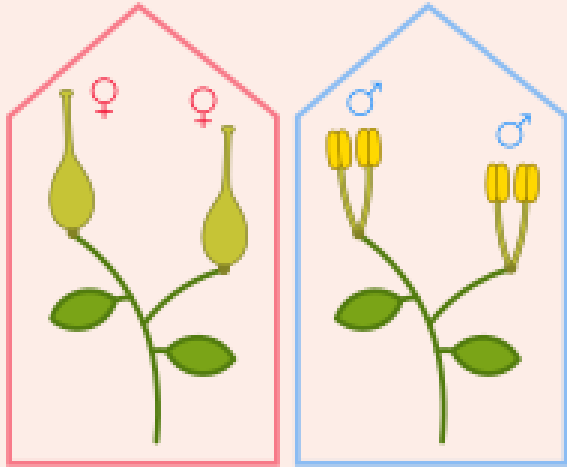
It is favoured when:

- Bisexual flowers with anthers and stigma maturing at the same time
- Stigma being located directly below the anthers, allowing pollen grains to fall onto it

Advantages	<ul style="list-style-type: none"><li>• Not dependent on external agents of pollination such as insects or wind</li><li>• Less wastage of pollen and energy. During wind and insect pollination, a great number of pollen grains are lost as only a few pollen grains come into contact with a stigma of a flower of the same species.</li><li>• Only one parent plant is required</li></ul>
Disadvantages	<ul style="list-style-type: none"><li>• There is less genetic variation, hence the offspring is less adapted to environmental changes.</li></ul>



# Cross Pollination



Cross pollination: transfer of pollen grains from the anther of a flower to the stigma of a flower of another plant belonging to the same species.

It is favoured when:

- Plants bear only male or female flowers, thus self pollination is not possible
- In plants with bisexual flowers, the anthers and the stigmas mature at different times.
- The stigma and anthers are located very far away.

Advantages	<ul style="list-style-type: none"><li>- Greater genetic variation, hence the offspring has a higher chance of surviving environmental changes.</li><li>- Offspring may have inherited beneficial qualities from both parents.</li></ul>
Disadvantages	<ul style="list-style-type: none"><li>- Energy-consuming - lots of energy is required to make large amounts of pollen grains.</li><li>- A great number of pollen grains are wasted due to the randomness</li><li>- External agents of pollination i.e. wind, insects are required.</li><li>- Two parent plants are required.</li></ul>

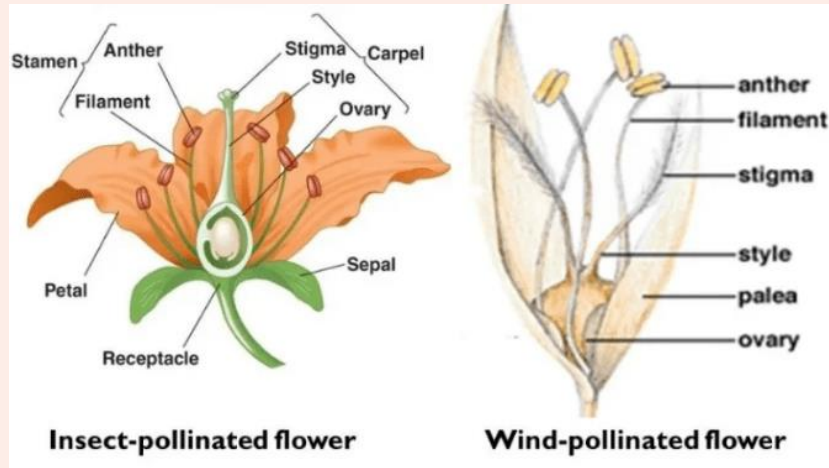


(M) Compare, using fresh specimens, an insect-pollinated and a wind-pollinated flower and explain their differences





# Mechanism of cross pollination



## 1. Insect-pollination

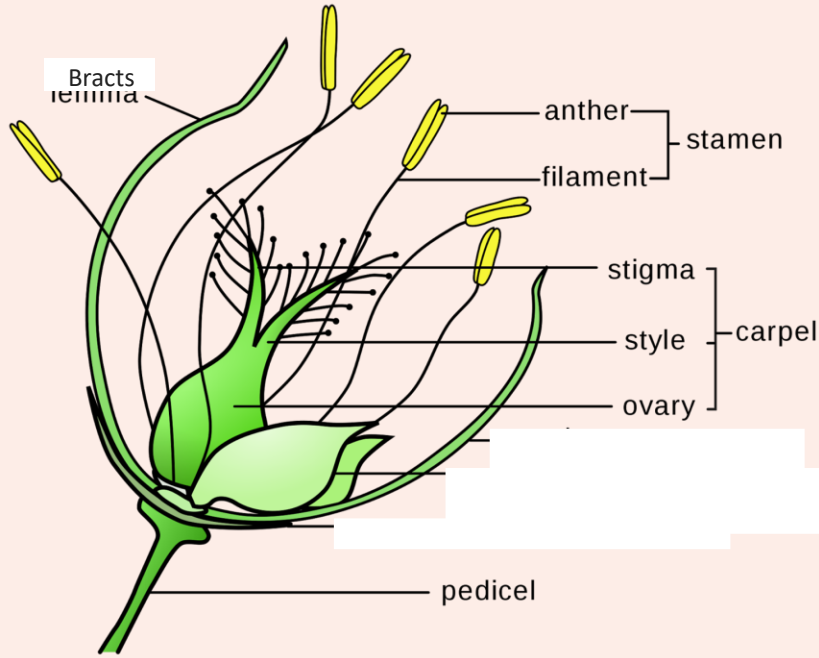
Insect such as bees and butterfly enters the flower for the nectar, pollen grains from the anthers stick onto the insect. When they visit other flowers, the pollen grain will be transferred to the next flower sticky stigma.

## 2. Wind-pollination

Wind-pollinated flowers have their pollen carried away by the wind when the exposed anthers shake in the wind. When pollen grains may come into contact with large feathery stigmas of another flower, they would be trapped.



# Insect pollinated vs wind pollinated



**structure of a typical insect-pollinated flower**

	Insect-pollinated Flowers	Wind-pollinated Flowers
Petals	Large, brightly-coloured petals	Small and dull petals, flower parts are protected by modified leaves called bracts
Scent	Flowers are fragrant or sweet smelling	Flowers are scentless
Nectar	Present	Absent
Nectar guide (lines visible to insects, guiding them to nectar)	Present	Absent
Stamen	Not pendulous and do not protrude out of the flower	long pendulous filaments and protruding anthers, so pollen grains are easily shaken off by the wind
Stigma	Small and compact, do not protrude out of the flower	large, feathery and protrude out of the flower to provide a large surface area to trap pollen.
Pollen grains	Fairly abundant large and sticky with rough surface so it can readily stick to body insects	Very abundant, small and light to be carried by the wind

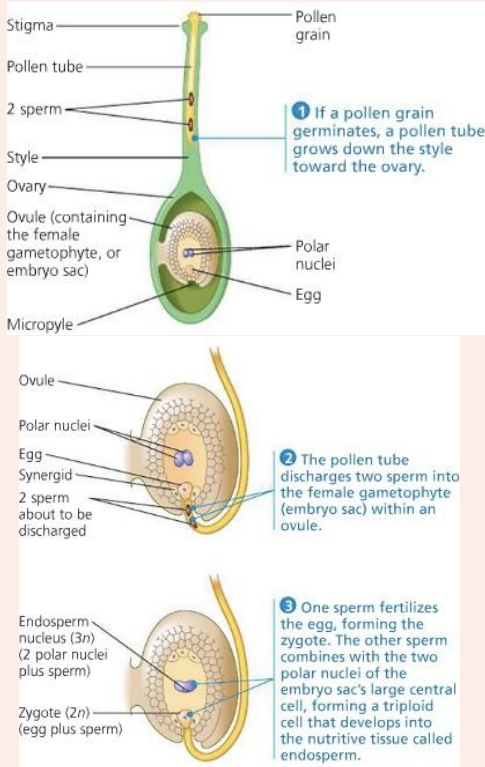


(N) Outline the growth of the pollen tube and its entry into the ovule followed by fertilisation (production of endosperm and details of development are not required)





# Fertilisation in plants



Fertilisation: The fusion of nuclei of the male gamete (pollen) and the female gamete (ovule)

1. After pollination, the pollen grains germinate in response to the sugary fluid secreted by stigma.
2. A pollen tube grows out from each pollen grain. The cytoplasm and the two nuclei of the pollen grain, namely generative nucleus and pollen tube nucleus, pass into the pollen tube
1. Pollen tube secretes enzymes to digest the surrounding tissue of the stigma and style.
1. The generative nucleus divides to form two male gametes.
2. The pollen tube enters the ovule in the ovary through the micropyle.
3. Within the ovule, the tip of the pollen tubes absorbs sap and bursts, releasing the two male gametes.
4. One male gametes fuses with the nucleus of the ovum to form the zygote, while the other male gamete fuses with the definitive nucleus to form the endosperm nucleus.
5. The ovule will develop into a seed and the ovary will develop into a fruit.



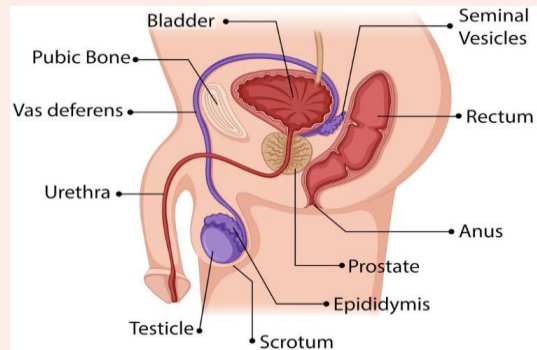
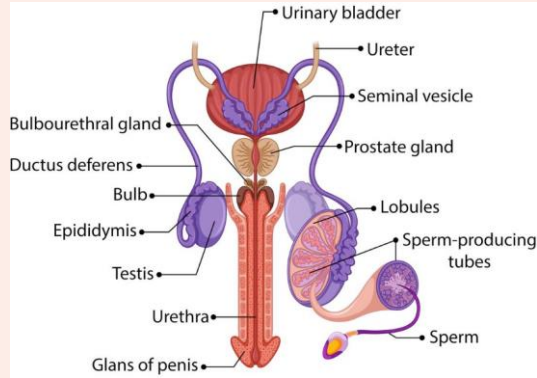
(0) Identify the male reproductive system and state the functions of: testes, scrotum, sperm ducts, prostate gland, urethra and penis







# Male reproductive system



Testes	<ul style="list-style-type: none"><li>- Produces sperms (male gametes)</li><li>- Produce male sex hormones e.g. testosterone. Male sex hormones are responsible for development and maintenance of secondary sexual characteristics.</li></ul>
Epididymis	<ul style="list-style-type: none"><li>- Where sperms are stored</li></ul>
Scrotum	<ul style="list-style-type: none"><li>- Testes are held in the scrotum, which are pouch-like sac outside the body</li><li>- This allows the scrotum to be at a lower temperature than body temperature, which is essential for sperm production.</li></ul>
Sperm ducts / Vas deferens	<ul style="list-style-type: none"><li>- Transport sperm from the epididymis to the urethra.</li></ul>
Prostate gland	<ul style="list-style-type: none"><li>- Together with Seminal vesicle and Cowper's gland/Bulbourethral gland, these 3 glands secrete fluid that is mixed with sperms to make semen</li><li>The fluids contain nutrients and enzymes which nourish and activate the sperm, allowing them to swim actively.</li></ul>
Urethra	<ul style="list-style-type: none"><li>- Urethra is a tube which passes from the bladder passage for urine and semen to pass out of the body</li></ul>
Penis	<ul style="list-style-type: none"><li>- Penis is an erectile organ, containing erectile tissue, which allows the spaces within the tissue to be filled up with blood.</li><li>- When filled with blood, the penis becomes erect and hard, allowing it to enter the vagina of a woman during sexual intercourse to deposit semen.</li></ul>

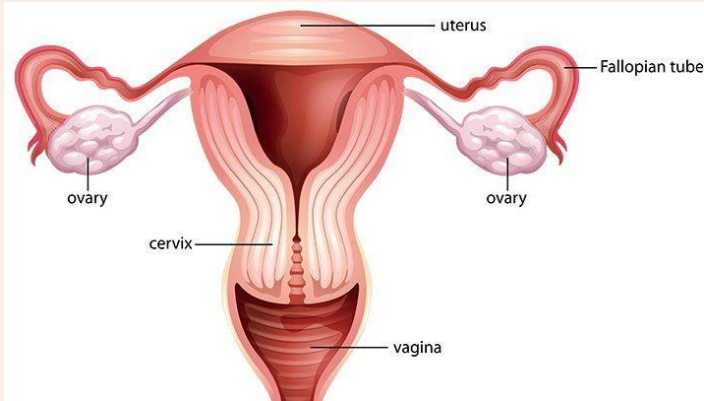


(P) Identify the female reproductive system and state the functions of: ovaries, oviducts, uterus, cervix and vagina





# Female reproductive system



Ovaries	<ul style="list-style-type: none"><li>• Produces ova (S:ovum), female gamete</li><li>• Produce female sex hormones e.g. estrogen and progesterone. Female sex hormones are responsible for development and maintenance of secondary sexual characteristics.</li></ul>
Oviducts / Fallopian tubes	<ul style="list-style-type: none"><li>• Narrow muscular tube where ovary releases the ovum into and leads to uterus</li><li>• Cilia on the inner lining help move the ovum to the uterus.</li><li>• Where fertilisation happens</li></ul>
Uterus	<ul style="list-style-type: none"><li>• The uterus is a thick muscular organ.</li><li>• The uterus is lined by uterine lining or endometrium</li><li>• The endometrium is richly supplied with blood vessels.</li><li>• It is broken down every month and flows out of the body during menstruation</li><li>• It is the site of embryo implantation post-fertilisation</li><li>• Uterus is where foetus develops during pregnancy</li></ul>
Cervix	<ul style="list-style-type: none"><li>• The cervix is a circular ring of muscle that opens into the vagina.</li><li>• It enlarges during birth to allow the passage of the foetus.</li></ul>
Vagina	<ul style="list-style-type: none"><li>• Birth canal through which the baby is born.</li><li>• Where sperm is deposited during sexual intercourse.</li><li>• Where menstrual blood leaves the body</li></ul>

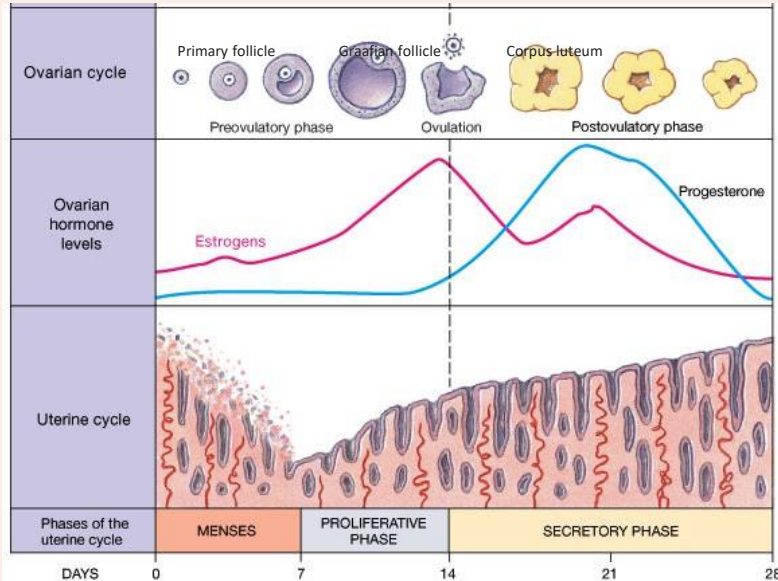


(Q) Outline the menstrual cycle with reference to the alternation of menstruation and ovulation, the natural variation in its length, and the fertile and infertile phases of the cycle with reference to the effects of progesterone and oestrogen only





# Menstrual cycle



## Estrogen and progesterone

female sex hormones secreted by the ovaries  
Role: thickening and functioning of uterine lining

Day 1 - 5	<b>Menstruation</b> <ul style="list-style-type: none"><li>The endometrium breaks down and flows out of the body through the vagina.</li></ul>
Day 6 - 13	<ul style="list-style-type: none"><li>The ovaries secrete estrogen which stimulates repair and growth of the endometrium. It becomes thick and spongy with blood vessels.</li></ul>
Day 14	<b>Ovulation-- high level of estrogen induce ovulation</b> <ul style="list-style-type: none"><li>a mature ovum is released from the one ovary to oviduct.</li><li>Estrogen level starts to fall and secretion of progesterone is stimulated.</li></ul>
Day 15 - 28	<ul style="list-style-type: none"><li>The ovaries secrete progesterone, which maintains the endometrium by causing it to thicken further and preparing for implantation of zygote.</li><li>Progesterone inhibits ovulation</li></ul>
Day 28	<ul style="list-style-type: none"><li>Secretion of progesterone and estrogen decline sharply at the end of cycle</li><li>If there is no implantation, The endometrium is no longer maintained and disintegrates.</li><li>The cycle repeats.</li></ul>



# Natural variation in its length

- Average length: 28 days; may vary between 21 days and 33 days
- Ovulation takes place 14 days before the last day of menstrual cycle



# Fertile & infertile phases

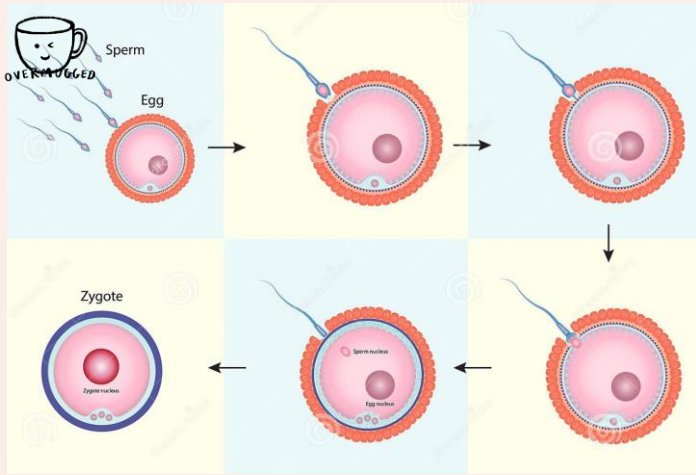
- The fertile phase of the cycle is from day 11 to 17.
- This is because sperms can survive for 2 to 3 days in the female reproductive system, thus sperms deposited in the vagina from day 11 onwards can fertilise the ovum which is released on day 14 from the ovaries
- The ovum can survive for 1 to 2 days after ovulation; hence fertilisation is possible up till day 17.
- Other days of the menstrual cycle are infertile phase.
- If fertilisation occur, the level of progesterone will continue to remain high to maintain the uterine lining, so zygote can be implanted into the uterine lining and continue to grow and develop into a foetus





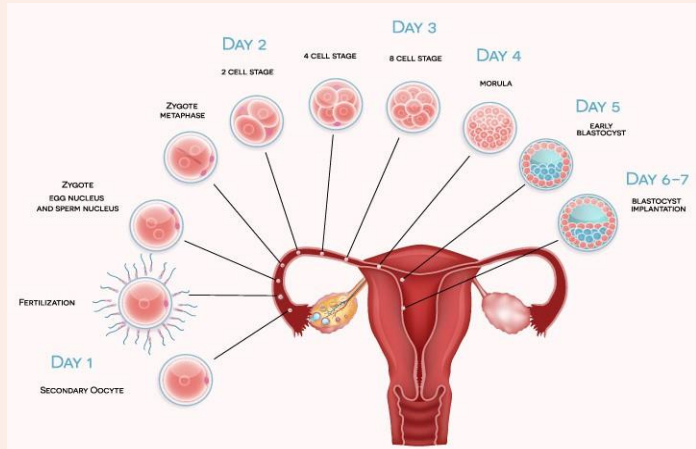
(R) Describe fertilisation and early development of the zygote simply in terms of the formation of a ball of cells which becomes implanted in the wall of the uterus





# Fertilisation

1. During sexual intercourse, semen containing sperms is deposited into the vagina of a woman.
2. The sperms swim up the oviducts and encounter the ovum.
3. The acrosome of the sperms release enzymes to disperse the layer of cells surrounding the ovum and break down the outer membrane of the ovum.
4. The haploid sperm nucleus fuses with the haploid egg nucleus. This process is called fertilisation, forming zygote, a single diploid cell
5. The plasma membrane of the egg undergoes a change as soon as a single sperm has entered, preventing other sperms from entering.
6. The remaining sperms eventually die.



# Implantation

1. Cilia lining the oviduct sweep the fertilised egg or zygote along the oviduct.
2. Peristaltic movement of the oviduct also help the zygote move towards the uterus.
3. The zygote divides by mitosis to form a hollow ball of cells called the embryo.
4. It takes about five days for the embryo to reach the uterus.
5. The developing embryo moves down the uterus and eventually embeds itself in the uterine lining. This is known as implantation



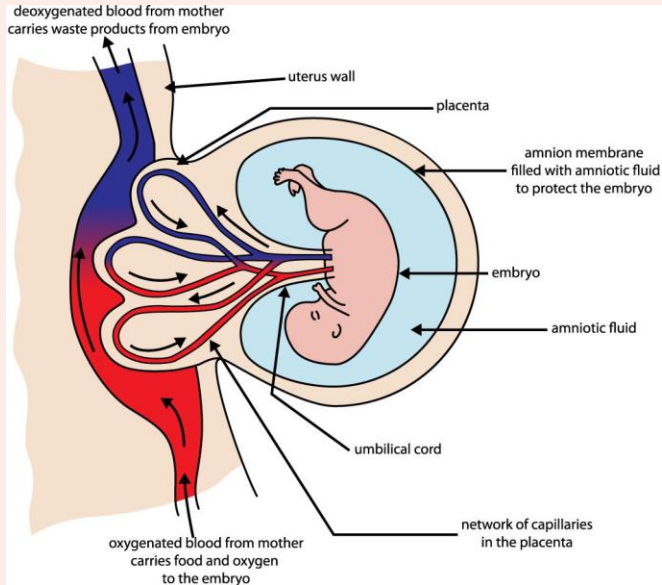


(S) State the functions of the amniotic sac and the amniotic fluid





# Amniotic sac & Amniotic cavity



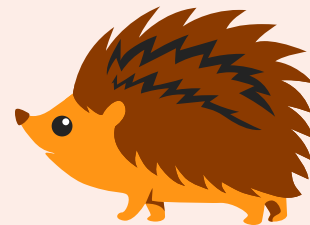
## Amniotic sac

- develops at the same time as the placenta
- it is a membrane that surrounds the fetus
- It encloses the embryo in a fluid-filled space known as the amniotic cavity.
- It secretes fluid known as amniotic fluid

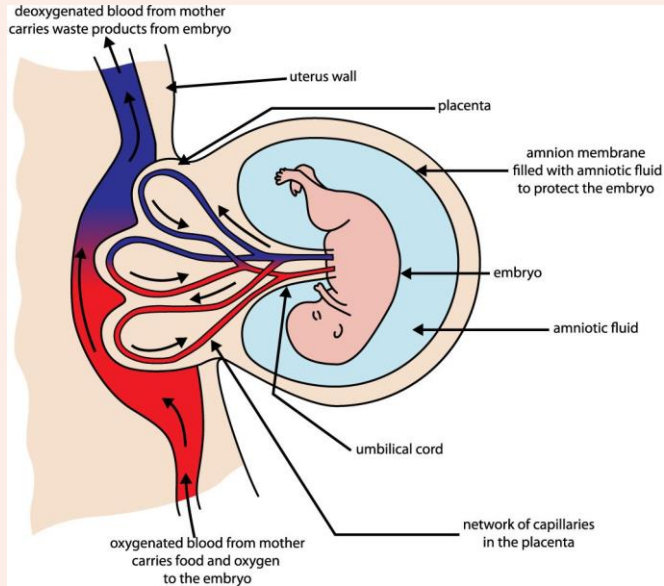
## Amniotic fluid

- acts as a cushion to absorb shock and protect the fetus against mechanical injury.
- Allows the foetus to move freely.
- Prevents the foetus from dehydration.
- Maintains a constant temperature for optimum development of the fetus.
- Acts as lubricating fluid for the passage of the baby during birth.

(T) Describe the function of the placenta and umbilical cord in relation to exchange of dissolved nutrients, gases and excretory products (structural details are not required)

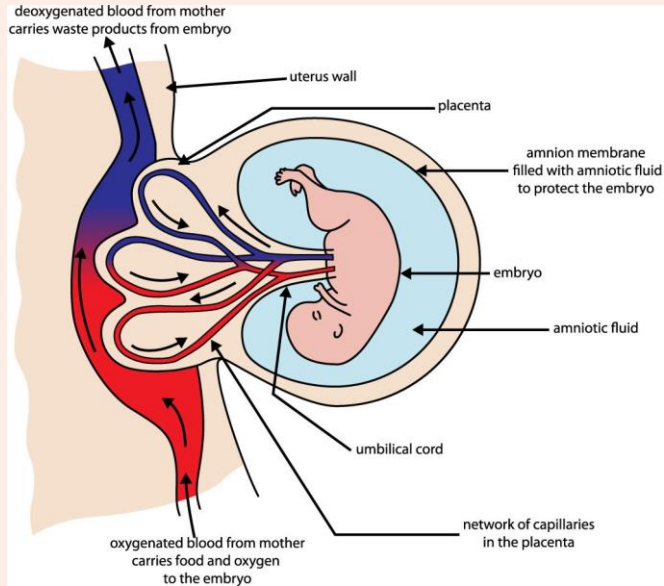


# Placenta



- After implantation, tissues growing out from the embryo grow into the endometrium, forming the placenta.
  - The placenta is an organ that contains both maternal and embryonic blood vessels.
  - it acts as a site of exchange of nutrients, gases and waste between the fetus and mother
- 
- **Functions of placenta**
    - Provide nutrients such as glucose, amino acids and mineral salts and oxygen from maternal blood to the embryo
    - Remove waste materials such as urea and carbon dioxide from the foetus
    - Allows protective antibodies to diffuse from maternal blood into embryonic blood/ prevent pathogens from crossing over from maternal blood to fetus
    - Allow exchange of gases
    - Produces progesterone which maintains endometrium during pregnancy
    - Provides a barrier preventing the mixing of maternal blood and embryonic blood
      - maternal blood pressure is much higher than embryonic blood pressure and would damage vital tissues
      - embryo might have a different blood group, which can result in agglutination when blood is mixed which is fatal

# Umbilical cord



- A flexible, tube-like structure that connects the fetus to the placenta during pregnancy
- The umbilical cord attaches the embryo to the placenta.
- One umbilical vein transports oxygenated blood and food substances from the placenta to the foetus.
- Two umbilical arteries transport deoxygenated blood and metabolic waste products from the foetus to the placenta.

(U) Discuss the transmission of human immunodeficiency virus (HIV) and methods to reduce transmission





# Transmission of HIV

## Exchange of bodily fluid NOT including saliva

- By sexual intercourse with an infected person
- By sharing and reusing contaminated needles during intravenous drug use, tattoos and piercing (that were poorly sterilised)
- By receiving a blood transfusion from an infected donor
- During pregnancy and breastfeeding



# Methods to reduce transmission of HIV

- Abstinence
- Have sex with only one partner
- Use a condom during sex (only reduces the risk of infection)
- Needles must be new and sterilised for tattoos, piercings or acupuncture
- Infected mothers should undergo antiretroviral therapies and give birth by caesarean section to minimise risk of transmission to the foetus.
- Reduce drug abuse as drug addicts usually share syringes to inject drugs

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6,214 subscribers



OVERMUGGED, 'A' Levels Channel  
2,778 subscribers

One of SG largest Telegram student community

# LEADERS IN THE CHANGING EDUCATION LANDSCAPE

FEATURED ON STRAITS TIMES

Our efforts to go out of our way to support our students were captured by local new publications.

OVERMUGGED was SG first tuition center to host **large scale mock exam!**

Our **student's needs come first!**

TODAY  
June 16 at 5:49 PM · 🌐

One Primary 6 student who is sitting mock exams told TODAY: "I feel stress didn't do any exams all the way until prelims and PSLE... I'll be unfamiliar w/ environment and I cannot concentrate."

TODAYONLINE.COM  
Hundreds sign up for tuition centre mock exams costing up to \$100,000 after scrapping of all mid-year school exams

👍❤️😬 53  
Like



**P6 and Sec 4 students flock to tuition centres for mock exams after scrapping of school midterms**

Wong Shyh Ying  
The Straits Times

Vulcan Post  
Overmugged launched a tuition subscription plan for 'O' Levels subjects to make education more affordable and accessible, and has achieved a six-figure revenue in its first year.

VULCANPOST.COM  
**OVERMUGGED: This 28-year-old built S'pore's first online tuition subscription service**  
You and 8 others  
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## With midterms scrapped, students take mock exams at tuition centres



**Many in Primary 6 and Secondary 4 seek to build experience ahead of national exams**

**Wong Shyh Ying**  
The scrapping of all mid-year school exams has led to a surge in students flocking to tuition centres for mock exams. This is especially true for Primary 6 and Secondary 4 students who are preparing for the upcoming national exams.

Overmugged, a tuition subscription service, has seen a significant increase in sign-ups for its mock exam packages. The company's founder, Wong Shyh Ying, says that the service provides a safe and supportive environment for students to practice and receive feedback on their work.

Wong Shyh Ying, founder of Overmugged, says that the service provides a safe and supportive environment for students to practice and receive feedback on their work. The company's founder, Wong Shyh Ying, says that the service provides a safe and supportive environment for students to practice and receive feedback on their work.

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She has continued to support her students and has been instrumental in the success of Overmugged. She has also been involved in various community activities and has been recognized for her contributions to the education sector.

Wong Shyh Ying, founder of Overmugged, says that the service provides a safe and supportive environment for students to practice and receive feedback on their work. The company's founder, Wong Shyh Ying, says that the service provides a safe and supportive environment for students to practice and receive feedback on their work.

# OUR LOCATIONS



## **BUKIT TIMAH**

**Tan Kah Kee**

2 min walk from Tan Kah Kee MRT.



## **Kovan**

**Upper Serangoon Road**

5min walk from Kovan MRT.



## **MARINE PARADE**

**PARKWAY CENTER**

Upcoming TE line in 2024.



## **TOA PAYOH**

**CLASSROOM**

Conveniently located near Toa Payoh MRT



## **JURONG EAST**

**CLASSROOM**

Right beside Jurong East MRT



## **WOODLANDS**

**CLASSROOM**

Right beside Woodlands MRT



## **TAMPINES**

**READY IN 2024**

Right beside Tampines MRT



# OUR SECRET TO PRODUCE TOP RESULTS?



**CONSISTENT HARD WORK,**  
**OVER A LONG PERIOD OF TIME.**

We work hard consistently alongside you,  
week in, week out.

**We grind hard when no one is watching**  
because we know that when it comes time for  
exams, we will be one cut above the rest.

# LEARNING RESOURCES

IF YOU THOUGHT THE FREE MATERIALS ARE GOOD,  
Wait till you see the resources our own students get!



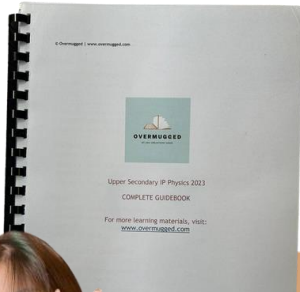
## WEEKLY WORKSHEETS

Topical, Thematic, Mock Test, Mock Exam,  
Prelim Prep, Practical Prep



## EXCLUSIVE CHEATSHEETS

Revision booklets, extra cheatsheets,  
Practical Assessment booklet

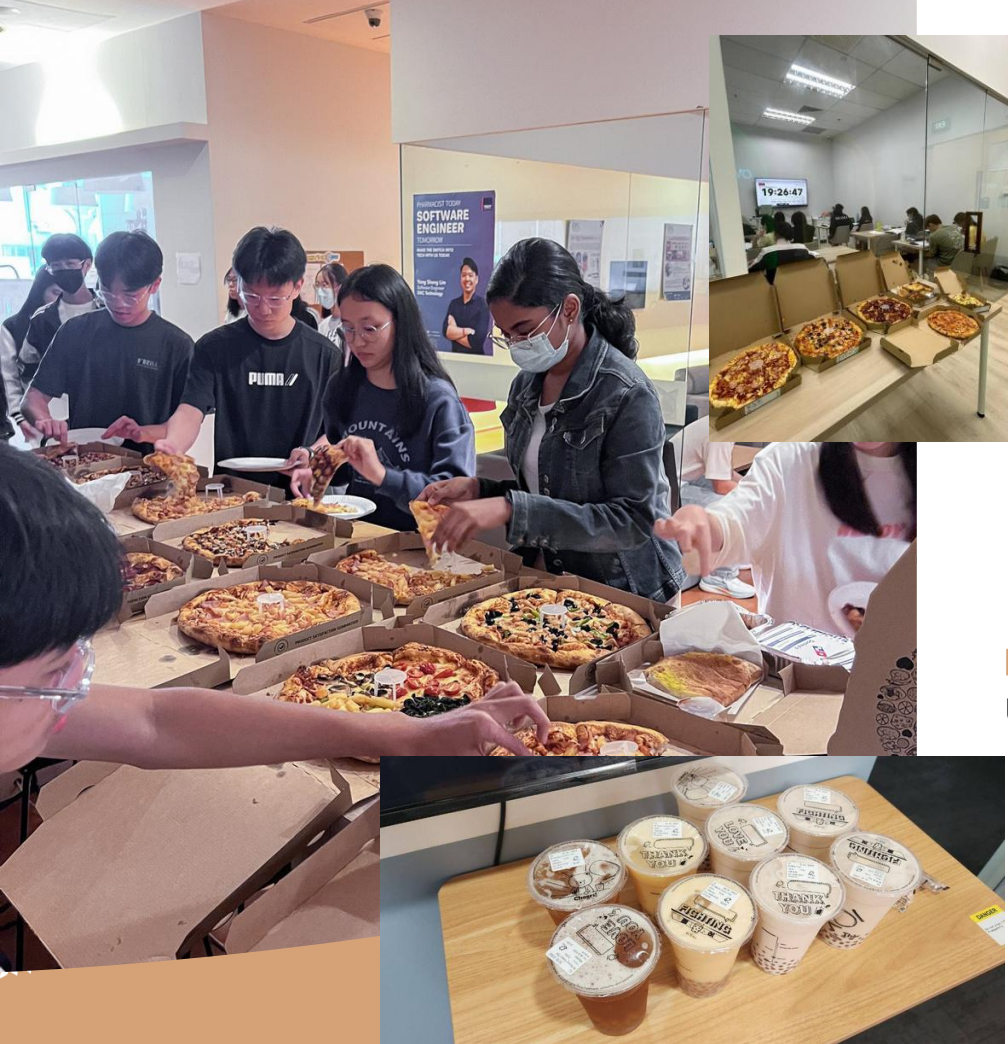


TOPIC: KINEMATICS			
Type	Definition	Formula	Remarks
Linear Motion	Object that is moving in a straight line • 1-D motion	$v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$	<ul style="list-style-type: none"> <li>Motion can be represented (upwards or right) or -ve (down or left) sign.</li> <li>Equations can only be used if acceleration is constant.</li> </ul>
2-D Motion	Object that is moving in a plane (horizontal and vertical directions) • 2-D motion • Acceleration is experienced in both axes • Vertical and horizontal motion are independent of each other	<b>Horizontal motion</b> (acceleration = 0) $v_x = u_x$ $s_x = u_x t$ <b>Vertical motion</b> (uniform vertical acceleration = g) $v_y = u_y + at$ $s_y = u_y t + \frac{1}{2}at^2$ $v_y^2 = u_y^2 + 2as$	<ul style="list-style-type: none"> <li>Acceleration always acts down</li> <li>Parabola will fall and go parabolic if resistance is negligible</li> </ul>
v Vectors	Analyse the horizontal and vertical motion separately	For a vector $\vec{v}$ pointing at an angle $\theta$ from the horizontal:  $v_x = v \cos(\theta)$ $v_y = v \sin(\theta)$ $v = \sqrt{v_x^2 + v_y^2}$ $\tan \theta = \frac{v_y}{v_x} = \tan^{-1} \left( \frac{v_y}{v_x} \right)$	



It reached in a time $t$ $u_y = 0$	$v_y^2 = (u \sin \theta)^2 - 2gh$ $\therefore H = \frac{u^2 \sin^2 \theta}{2g}$	<b>With air resistance,</b> <ul style="list-style-type: none"> <li>Drag force acts in the same direction as the weight of object.</li> <li>Net acceleration <math>&gt;&gt; g</math></li> <li>Maximum height reached lower.</li> </ul>
$v_y = u \sin \theta - gt$ $\therefore t_{up} = \frac{u \sin \theta}{g}$		<b>With air resistance,</b> <ul style="list-style-type: none"> <li>Drag force acts in the same direction as the weight of object.</li> <li>Net acceleration <math>&gt;&gt; g</math></li> <li>Final vertical speed smaller than vertical speed.</li> <li>Average speed upwards <math>&gt;</math></li> </ul>

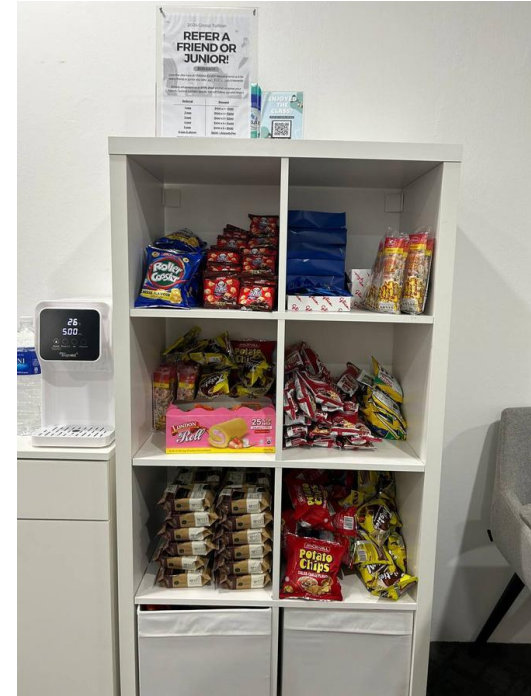




# WELFARE, ALL DAY EVERYDAY



**NEED FOOD TO THINK**  
Unlimited snack shelf





### Our Policy

No deposit fee.

No extra material fee.

Unlimited access to study lounge.

Unlimited snacks.

Free consultations.

Special discounts for holiday program.

# TUITION RATES

## 'O' LEVELS

\$80/lesson

\$85/lesson (weekend)

## INTEGRATED PROGRAM

\$90/lesson

\$95/lesson (weekend)

## 'A' LEVELS

\$100/lesson

\$105/lesson (weekend)

*10% if signing up for 2 'A' Levels subject & above*

**Fees are collected at the start of the term  
(every 3 months).**

# ACADEMIC YEAR

## TERM 1: NOV – JAN

### Topical Recaps

Key highlight: Christmas Party

## TERM 2: FEB – APR

### Topical Mastery

Key highlight: March Holiday Cohesion Program

## TERM 3: MAY – JUL

### Prelim/EOY Preparation

Key highlight: Mock Prelim/EOY

## TERM 4: AUG – OCT

### 'O' Levels / 'A' Levels Preparation

Key highlight: Mock Exams, Science Practical Assessment







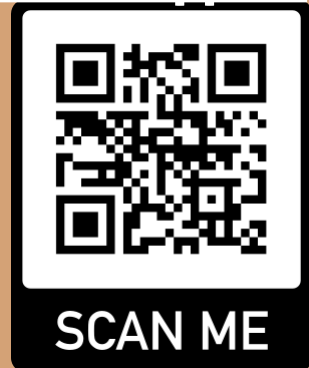
# Sign up for a free trial lesson today!

Class Schedule:

SCAN ME



Whatsapp us:



540  
d@gmail.com  
ermugged.com  
mugged