

## Reaching The Age of Adolescence

### TOPICS COVERED

10.1 Adolescence, Puberty, Changes at Puberty	10.2 Hormones Controlling, Reproductive Phase and Sex Determination in Humans
10.3 Hormones Besides Sex Hormones	10.4 Reproductive Health

### IMPORTANT POINTS TO REMEMBER

- The period of transition from a child to an adult is known as adolescence. It continues till 18 – 19 years of age after which there is no further growth.
- The stage of life when a human being becomes sexually mature, i.e. capable of reproduction is known as puberty.
- Several changes occur in the human body during adolescence, due to the release of sex hormones.
- Some of the secondary sexual characteristics are sudden increase in height, change in body shape, change in voice, growth of body hair, increased activity of sweat and sebaceous glands, changes in behavior and attitude etc.
- The system responsible for the secretion of special chemicals called hormones that controls important functions in the body is the endocrine system.
- These glands secrete hormones and are called ductless glands. They directly pour their secretions into the blood stream.
- Pituitary gland is the master endocrine gland as it controls the functioning of other endocrine glands.
- Ovaries in females produces female sex hormone, oestrogen while testes in males produce the male sex hormone called testosterone.
- The cycle of production and release of a mature egg, thickening of the uterine wall to receive the fertilised egg and its shedding, in case fertilisation does not occur is known as menstrual cycle. It is under the hormonal control.
- The sex of the young one is determined by the father. It depends on which sperm – one containing X or the Y chromosome – fertilises the egg.
- Balanced diet, adequate rest, physical exercises and personal hygiene are important aspects of reproductive health.
- Adolescence is an age of insecurity and confusion. Thus it is important to seek help from experienced and knowledgeable sources.

### 10.1 ADOLESCENCE, PUBERTY, CHANGES AT PUBERTY

**Adolescence:** Adolescence is the transitional phase from a child into an adult. It is characterised by various physical, mental, emotional, social and psychological changes.

It lasts from around 10 years to 19 years of age. The period of adolescence varies from person to person. In girls, adolescence may begin a year or two earlier than boys.

**Puberty:** The period of life when a person becomes sexually mature and is capable of reproduction is called puberty.

**Changes of Puberty:** Some changes are common to both boys and girls at puberty. These are –

*Increase in Height:* During puberty, there is a sudden increase in the height of the adolescents due to the growth of long bones of arms and legs. Initially, boys grow faster than girls but by 18 years of age, they both reach their maximum height.

*Change in Body Shape:* In boys, the shoulders broaden and the chest widens. The body becomes more muscular than in girls. In girls, the region below the waist (pelvic region) widens. It becomes rounded. Breasts grow in size. Mammary glands (milk secreting glands) develop inside the breasts.

*Growth of Body Hair:* In both boys and girls, hair grows in pubic region and in armpits. In boys, facial hair (beard and moustache) also develops.

*Change in Voice:* The voice box or larynx begins to grow. In boys, it protrudes out in the throat region as Adam's apple. The larynx is smaller in girls than in boys and is hardly visible from outside. Boys develop deeper, low pitched voice while girls develop high pitched voice. In some adolescent boys, the muscles of the growing voice box go out of control. This makes the voice rough and hoarse. This is a temporary phase and voice gets back to the normal after sometime.

*Increased Activity of Sweat and Sebaceous Glands:* At puberty, both sweat and sebaceous glands become more active. This may lead to appearance of acne and pimples on the face. This problem can be controlled by avoiding intake of fat rich, junk food and by keeping the face clean through repeated washing.

*Maturation of Sex Organs:* Testes in males grows and starts producing sperms and the male sex hormone, testosterone.

In females, ovaries start releasing the mature eggs which leads to the onset of menstruation. They also become capable of secreting the female sex hormone, oestrogen.

*Mental, Intellectual and Emotional Maturity:* Adolescence brings a change in a person's way of thinking. Physical and mental changes during adolescence brings about mood swings. They become independent and self conscious. It is the time in one's life when the brain has the maximum capacity to learn. Sometimes, an adolescent may feel insecure while trying to adjust to these changes in body and mind. This is an integral part of growing up.

**Secondary Sexual Characteristics:** Secondary sexual characters are the traits that helps to distinguish between a male and a female. These traits appear during adolescence and are controlled by sex hormones, testosterone in males and oestrogen in females, secreted by testes and ovaries respectively.

---

---

## Exercise 10.1

---

---

### I. Very Short Answer Type Questions (1 Mark)

1. The stage at which body becomes capable of reproduction is called \_\_\_\_\_.
  2. In males, the hormone \_\_\_\_\_ controls the secondary sexual characteristics.
-

3. All parts of the body grow at the same rate during adolescence. (T/F)
4. Larynx is bigger in \_\_\_\_\_.
5. Adolescence is marked by the onset of puberty. (T/F)
6. Is it true that adolescents sweat more than the adults?
7. During adolescence, acne is common due to increased activity of \_\_\_\_\_ and \_\_\_\_\_ glands.

## II. Short Answer Type Questions-1 (2 Marks)

8. List two functions each of testes and ovaries.
9. State the formula used to calculate maximum height that can be achieved by a person.

## III. Short Answer Type Questions-2 (3 Marks)

10. Why do adolescent boys have a deeper voice as compared to adolescent girls?
11. Adolescents generally look awkward and disproportionate. Why?
12. What changes in body shape are seen in adolescent boys and girls?

### ANSWERS

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. puberty</li> <li>2. testosterone</li> <li>3. False</li> <li>4. boys</li> <li>5. True</li> <li>6. Yes</li> <li>7. Sweat and sebaceous glands.</li> <li>8. Testes in males produces sperms and the male sex hormone, testosterone. In females, ovaries releases the mature eggs and also secretes the female sex hormone, oestrogen.</li> <li>9. Calculation of full height (cm):<br/> <math display="block">= \frac{\text{Present height (cm)}}{\% \text{ of full height at this age}} \times 100</math> </li> <li>10. In boys, the voice box or larynx protrudes out in the throat region as Adam's apple. The larynx is smaller in girls than in boys and is hardly visible from the outside. As a result of protruding out of voice box, boys develop deeper voice</li> </ol> | <p>while in girls where voice box does not protrudes out as in boys, develop high pitched voice.</p> <ol style="list-style-type: none"> <li>11. During puberty, there is a sudden increase in the height of adolescents due to the growth of long bones of arms and legs. Different parts of the body do not grow at the same rate. Arms and legs grow faster than the other body parts, thus making adolescents appear oversized and awkward.</li> <li>12. In boys, the shoulders broaden and the chest widens. The body becomes more muscular than in girls. In girls, the region below the waist (pelvic region) widens. It becomes rounded. Breasts grows in size. Mammary glands (milk secreting glands) develop inside the breasts.</li> </ol> |
|---|--|

## 10.2 HORMONES CONTROLLING, REPRODUCTIVE PHASE AND SEX DETERMINATION IN HUMANS

**Hormones Controlling Secondary Sexual Characteristics:** The production of sex hormones is under the control of master endocrine gland, the pituitary gland. Pituitary secretes many hormones. It is located at the base of the brain. Hormones from pituitary stimulate testes/ovaries to release testosterone in males and oestrogen in females. When these hormones reaches the target site, they stimulate the changes that produces secondary sexual characteristics.

---

**Reproductive Phase in Humans:** In human males, sperm production continues from puberty all throughout the life. The reproductive phase in human females starts at puberty and continues till 45-50 years of age. During this period, after every 28 – 30 days, one of the two ovaries releases an egg. This is termed as ovulation. The wall of the uterus becomes thick and spongy to receive the egg.

- (a) If the egg gets fertilised, it results in pregnancy. The fertilized egg divides and redivides to form the embryo that gets implanted in the uterine wall. It continues to complete its development in the uterus for about 9 months.
- (b) If the egg does not get fertilised, the egg, the thickened lining of the uterus along with the blood vessels are shed off. This bleeding lasts for about 4-6 days and is known as menstruation.

The cycle of production and release of a mature egg, thickening of the uterine wall to receive the fertilised egg and its shedding in case fertilisation does not occur is known as menstrual cycle. It is under hormonal control. The first menstrual flow in females is known as menarche. It occurs at puberty. The menstrual cycle stops at the age of about 45-50 years. This stoppage of menstruation is termed as menopause. It marks the end of a female’s reproductive phase.

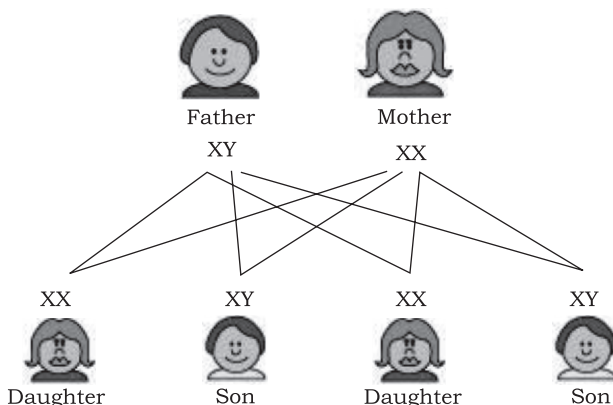
**Sex Determination in Humans:** Nucleus of every cell contains DNA condensed in the form of thread like structures called chromosomes. They carry all the information essential for its survival. Chromosomes come in pairs. Each cell in the human body has 23 pairs of chromosomes. In each pair, one chromosome comes from the mother and one from the father. The first 22 pairs are called autosomes and the 23rd is called the sex chromosome.

Female have two X chromosomes (XX) as the 23rd pair, while in males the 23rd pair is a mismatched XY. Each gamete has only one sex chromosome. Thus, all the gametes produced by females (eggs) will have X as the 23rd chromosome while in males two types of chromosomes are possible – either X or Y as the 23rd chromosome.

Thus, a mother will always contribute X chromosome to the child. Depending upon which chromosome carrying sperm will fuse with the egg, there are two possibilities.

**If the sperm with X chromosome fuses with the egg, a girl is produced (XX).**

**If the sperm with Y chromosome fuses with the egg, a boy is produced (XY).**



## Exercise 10.2

### I. Very Short Answer Type Questions (1 Mark)

1. What are secondary sexual characteristics?

2. Fill in the blanks:

- (a) The combination of sex chromosomes present in females is \_\_\_\_\_.
- (b) \_\_\_\_\_ is release of an egg by one of the \_\_\_\_\_.
- (c) The first menstrual flow in females is termed as \_\_\_\_\_.
- (d) If fertilisation of egg does not occur, it is expelled from the body during \_\_\_\_\_.
- (e) The human female is in the reproductive phase between menarche and \_\_\_\_\_.

3. If the egg is fertilised, menstruation does not occur.

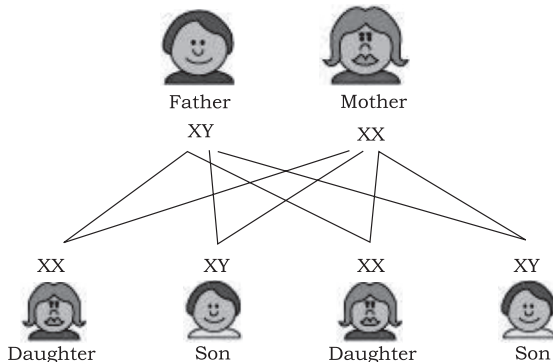
(T/F)

II. Short Answer Type Questions (2/3 Marks)

- 4. What happens in case the egg is not fertilised?
- 5. Schematically explain sex determination in humans.
- 6. Father is responsible for the sex of the child. Comment.
- 7. What are autosomes and sex chromosomes?
- 8. Define ovulation, menarche and menopause.
- 9. What are sex hormones?
- 10. How long does the reproductive phase last in human males and females?

**ANSWERS**

- 1. Secondary sexual characters are the traits that help to distinguish between a male and a female.
- 2. (a) XX (b) Ovulation, ovaries
- (c) Menarche (d) menstruation
- (e) menopause
- 3. True
- 4. If the egg does not get fertilised, the egg, the thickened lining of the uterus along with the blood vessels are shed off. This bleeding lasts for about 4-6 days and is known as menstruation.
- 5.



6. Females have two X chromosomes (XX) as 23rd pair sex chromosome while in

males the 23rd pair/sex chromosome is a mismatched XY. Each gamete has only one sex chromosome. Thus, all the gametes produced by females (eggs) will have X as the 23rd chromosome while in males two types of chromosomes are possible – either X or Y as the 23rd chromosome.

Thus, a mother will always contribute X chromosome to the child. Depending on which sperm will fuse with the egg, there are two possibilities.

**If the sperm with X chromosome fuses with the egg, a girl is produced (XX).**

**If the sperm with Y chromosome fuses with the egg, a boy is produced (XY).**

Hence, father is responsible for the sex of the child.

- 7. In human beings, 22 pairs of chromosomes are autosomes while the 23rd pair that determines the gender of the child is referred to as sex chromosome.
- 8. The release of egg from the ovary is termed as ovulation.

The first menstrual flow in females is known as menarche.

The stoppage of menstruation is termed as menopause.

9. Hormones that bring about the development of the secondary sexual characteristics are called sex hormones.

For example, testosterone in males and oestrogen in females.

10. In human males, sperm production continues from puberty all throughout the life. The reproductive phase in human females starts at puberty and continues till about 45-50 years of age.

### 10.3 HORMONES BESIDES SEX HORMONES

Our body needs a special category of chemicals for its proper functioning and development. These are called hormones. Hormones are secreted by the endocrine glands. These glands do not have ducts for transporting hormones from one part of the body to the other part and so are also called ductless glands. Hormones are produced in very small quantities. Their site of action is different from their site of production, so they are directly poured into the blood stream and are carried to their target site or organ.

**Pituitary gland** is the master gland of the endocrine system. It controls the functioning of all the other endocrine glands by secreting stimulating hormones. The following table gives details of some endocrine glands in the human body, their location, their secretion and function.

**Role of Hormones in Metamorphosis:** In human beings and most other animals, the young one directly grows into an adult. However, in some animals, the young ones are different from adults. They undergo a series of drastic changes before they change into an adult. This set of changes is called metamorphosis.

Metamorphosis in insects is controlled by insect hormones.

In frogs, thyroxine produced by thyroid gland controls metamorphosis. If the thyroid gland is removed from the larva, it will not change into an adult frog. The production of thyroxine requires the presence of iodine in water. If a tadpole grows in water that does not contain iodine, it will not develop into an adult frog.

GLAND	LOCATION	SECRETION	FUNCTION/ FEATURE
Thyroid	Neck	Thyroxine	Controls the body metabolism. It requires iodine to produce thyroxin. Lack of iodine leads to swelling of thyroid gland and this condition is called goitre.
Pancreas	Abdomen	Insulin	Insulin converts excess sugar into glycogen. Thus, it controls the blood sugar level. Lack of insulin leads to a condition called diabetes (excess sugar in blood). Diabetics are administered regular doses of artificial insulin.
Adrenal	Above each kidney	Adrenalin	It prepares our body for emergency situations. It is also called fight or flight hormone. It controls anger, anxiety etc. It also regulates the blood pressure and heartbeat. Adrenal gland also secrete a hormone that maintains the correct salt balance of blood.
Pituitary	Lower side of brain	Growth hormone, Stimulating hormones	Growth hormone controls the growth of long bones and muscles. Its increased activity causes gigantism while its reduced activity causes dwarfism. Pituitary gland controls all the other endocrine glands through stimulating hormones.

## Exercise 10.3

### I. Very Short Answer Type Questions (1 Mark)

1. The gland that secretes hormone thyroxine is \_\_\_\_\_ gland.
2. The glands of the \_\_\_\_\_ system secrete hormones.
3. The organs that respond to hormones are \_\_\_\_\_ organs.
4. In the absence of \_\_\_\_\_ in water, tadpoles cannot develop into frogs.
5. \_\_\_\_\_ is the master endocrine gland. It is located at the base of the \_\_\_\_\_.
6. Endocrine glands releases hormones into the blood stream through ducts. (T/F)
7. Hormones act wherever they are released by the glands. (T/F)

### II. Short Answer Type Questions (2 Marks)

8. What are the secretions of endocrine glands known as ? List their two characteristic features.
9. What is the significance of pituitary gland?
10. Name the hormone secreted by adrenal gland. State its function.
11. What is metamorphosis? Name the hormone responsible for this process in insects.
12. What leads to diabetes? How can it be treated?
13. Where is thyroid gland located in our body? What is its function?
14. What leads to gigantism and dwarfism?

### ANSWERS

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. thyroid</li> <li>2. endocrine</li> <li>3. target</li> <li>4. iodine</li> <li>5. Pituitary gland, brain.</li> <li>6. False</li> <li>7. False</li> <li>8. Hormones. Hormones are produced in very small quantities. Their site of action is different from their site of</li> </ol> | <p>production, so they are directly poured into the blood stream and are carried to their target site or organ.</p> <ol style="list-style-type: none"> <li>9. Pituitary gland is the master gland of the endocrine system. It controls the functioning of other endocrine glands by secreting stimulating hormones.</li> </ol> |
|---|--|

10.

GLAND	LOCATION	SECRETION	FUNCTION/ FEATURE
Adrenal	Above each kidney	Adrenalin	It prepares our body for emergency situations. It is also called fight or flight hormone. It controls anger, anxiety etc. It also regulates the blood pressure and heartbeat. Adrenal gland also secrete a hormone that maintains the correct salt balance of blood.

- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>11. Change of an organism from larva stage into an adult through drastic changes is metamorphosis. Metamorphosis in insects is controlled by insect hormones.</li> </ol> | <ol style="list-style-type: none"> <li>12. Improper functioning of endocrine system by less or no secretion of insulin via pancreas leads to diabetes. It can be treated by taking regular doses of artificial insulin.</li> </ol> |
|---|--|

13.

GLAND	LOCATION	SECRETION	FUNCTION/ FEATURE
Thyroid	Neck	Thyroxine	Controls the body metabolism. It requires iodine to produce thyroxine. Lack of iodine leads to swelling of thyroid gland and this condition is called goitre.

14. Growth hormone controls the growth of long bones and muscles. Its increased activity causes gigantism while its reduced activity causes dwarfism.

## 10.4 REPRODUCTIVE HEALTH

Adolescence is the time for rapid physical and mental growth. It is therefore important to make correct food choices that supports the growing body, besides avoiding health problems in future.

**Nutritional Needs:** For proper physical health, a balanced diet is required that contains the right amount of proteins, carbohydrates, fats, vitamins and minerals. The diet should contain adequate amount of cereals for carbohydrates; milk, meat, nuts and pulses for proteins; limited butter/ghee/oils and sugar for energy and fruits and vegetables for protection against diseases. Fat rich food may be tasty but it does not provide adequate nutrition , such as chips, aerated drinks etc. So, it should not be used as a substitute for meals.

**Personal Hygiene:** Due to increased activity of sweat and sebaceous glands, proper personal hygiene is very important for adolescents. Taking bath everyday and cleaning the body thoroughly is essential to avoid body odour and bacterial infections. Girls should be especially careful about hygiene during menstruation.

**Physical Exercise:** Physical exercises like walking, jogging, aerobics etc. are good for the growing adolescents body.

**Drugs:** Since adolescence is a stage of insecurity and confusion, it is easy for an adolescent mind to fall prey to drug and alcohol abuse. Drugs are addictive . They can harm the health of the person in the long run. Thus, it is important to seek advice from experienced and knowledgeable people and always say NO to drugs. AIDS is a deadly viral infection that can be transmitted from an infected mother to the foetus during pregnancy or to the infant through mother's milk. This virus can also be transmitted through sexual contact with an infected person.

Medical problems such as eating disorders and depression can also affect the adolescents and cause emotional instability.

**Adolescent Pregnancy:** During this stage, many young boys and girls may also get involved in sexual activities that may result in teenage pregnancies. Since they are not fully aware of its physical, mental, emotional and financial consequences, it may leads to serious issues.

In India, legal age of marriage for boys is 21 years and for girls, it is 18 years. Early marriage and motherhood can cause serious health problems for the mother and the child. It also curtails employment opportunities for the young woman and may cause mental agony as she is not ready for the responsibilities of motherhood.

---



---

---

## Exercise 10.4

---

---

### I. Very Short Answer Type Questions (1 Mark)

1. Write the full form of AIDS.
2. Name the microbe that causes AIDS.
3. Government has legalised child marriage in our country. (T/F)
5. Adolescents are more prone to drug and alcohol abuse. (T/F)
4. Eating disorders are more common in adolescents than in children or adults. (T/F)

### II. Short Answer Type Questions-1 (2 Marks)

6. List any three important factors of reproductive health.
7. How can spread of AIDS be prevented?

### III. Short Answer Type Questions-2 (3 Marks)

8. List any three harmful consequences of teenage pregnancies.
9. How does AIDS spread?

### ANSWERS

- |   |  |
|---|--|
| <ol style="list-style-type: none"><li>1. Acquired Immuno Deficiency Syndrome</li><li>2. Human Immuno Deficiency Virus (HIV)</li><li>3. False      4. True      5. True</li><li>6. Balanced diet, personal hygiene, adequate rest and physical exercises.</li><li>7. By avoiding sexual contact with multiple partners, by using disposable syringes, by getting the mother tested for the infection etc.</li><li>8. Early marriage and motherhood can cause serious health problems for mother and the child. It curtails</li></ol> | <p>the employment opportunities for the young woman and may cause mental agony as she is not ready for the responsibilities of motherhood.</p> <ol style="list-style-type: none"><li>9. AIDS is a deadly viral infection that spreads from an infected to a healthy person by sharing used needles for injecting drugs. It can also be transferred from an infected mother to the foetus during pregnancy or to the infant through mother's milk. This virus can also be transmitted through sexual contact with an infected person.</li></ol> |
|---|--|

### Did You Know?

- Hormone testosterone in males is secreted under the influence of luteinizing hormone and oestrogen in females is secreted under the influence of follicle stimulating hormone released from the pituitary gland.
  - Release of ovum from the ovary takes place on the 14th day of the menstrual cycle.
  - The glands that have ducts to release their secretions in the body are called exocrine glands. For example salivary glands, sweat glands etc.
  - The shape of thyroid gland is like a bow or a butterfly.
  - Pineal gland, located in the middle of the brain, secretes a hormone called melatonin that helps to regulate our sleep timings.
-

## HOTS & VALUE BASED QUESTIONS

1. Justify the statement, “the reproductive span of a human female lasts from menarche to menopause”. **(HOTS)**
2. Why is the hormone adrenalin also referred to as the fight or flight hormone? **(HOTS)**
3. Do you agree with the statement that the father is responsible for the sex of the child? Justify. **(HOTS)**
4. In our country, the mother is blamed for giving birth to a girl child. As enlightened students, what efforts can be made by you to get rid of this stigma? **(VBQ)**
5. In a workshop conducted in a girls govt. school, the social worker talked about personal hygiene during menstruation, substance abuse and AIDS.  
(a) What do you think is the significance of such a workshop?  
(b) What values are shown by the social worker? **(VBQ)**

### ANSWERS

1. The first menstrual flow in females is known as menarche. It occurs at puberty. The menstrual cycle stops at the age of 45-50 years. This stoppage of menstruation is termed as menopause. It marks the end of a female's reproductive phase. In between this time span, the human female is reproductively active.
  2. Adrenalin prepares body for emergency. It controls anger, anxiety etc. It regulates blood pressure and heartbeat. Therefore, it is also called fight or flight hormone
  3. Yes. Female have two X chromosomes (XX) as sex chromosome while in males the 23rd pair is a mismatched XY. Each gamete has only one sex chromosome. Thus, all the gametes produced by females (eggs) will have X as the 23rd chromosome while in males two types of sperms are possible – either X or Y as the 23rd chromosome. Thus, a mother will always contribute X chromosome to the child. Depending on which sperm will fuse with the egg, there are two possibilities.  
If the sperm with X chromosome fuses with the egg, a girl is produced (XX).  
If the sperm with Y chromosome fuses with the egg, a boy is produced (XY).  
So, father is responsible for the sex of the child.
  4. Carry out campaigns, social drives to educate people that mother does not decide the gender of the child.  
Information, education can get rid of a lot of problems.
  5. (a) Educating young minds can get rid of problems that plaguing our society. Maintaining personal hygiene, saying no to drugs is the step in progressing towards a healthier future.  
(b) Social responsibility, dispersing of basic but certainly very important information, significance of personal hygiene in controlling many infections etc.
-