

IMPORTANT CONCEPTS FROM NCERT CLASS 10 SCIENCE CHAPTER 7 (REPRODUCTION)

1. Need for Reproduction (Page 127)

- Reproduction ensures continuity of species and maintains population stability.
- It allows transmission of genetic material to the next generation.
- Unlike nutrition/respiration, reproduction is not essential for individual survival but crucial for species survival.

2. DNA Copying and Its Importance (Page 128, Para 1)

- DNA copying occurs during cell division before reproduction.
- Significance:
 - Ensures genetic information transfer to offspring
 - Provides basis for heredity
 - Variations during copying lead to evolution
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- Imperfect DNA copying creates variations essential for adaptation and evolution.

3. Asexual Reproduction (Pages 128-133)

a) Fission (Page 128-129)

- Binary fission: Parent cell divides into two nearly equal daughter cells (e.g., *Amoeba*, *Leishmania*)
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- Multiple fission: Parent divides into many daughter cells simultaneously (e.g., *Plasmodium*)

b) Budding (Page 130)

- Small outgrowth (bud) forms on parent body, detaches to form new individual (e.g., *Yeast*, *Hydra*)

c) Fragmentation (Page 130)

- Parent body breaks into fragments; each fragment develops into new organism (e.g., *Spirogyra*)

d) Regeneration (Page 131)

- Specialized cells regenerate lost body parts (e.g., *Planaria*, *Hydra*)
- Important distinction: Regeneration $\neq$ reproduction unless whole organism forms from fragment

e) Vegetative Propagation (Pages 132-133)

- New plants develop from vegetative parts (roots, stems, leaves)
- Natural methods: Runners (*Grass*), tubers (*Potato*), bulbs (*Onion*)
- Artificial methods: Grafting, layering, cutting
- Advantages: Preserves parental traits; faster than seed propagation

f) Spore Formation (Page 133)

- Spores are asexual reproductive structures with thick walls
- Produced in sporangia (e.g., *Rhizopus*, fungi, mosses)

4. Sexual Reproduction (Pages 134-140)

a) Flower Structure (Page 134-135)

- Stamen (male): Anther (produces pollen grains containing male gametes) + Filament
- Carpel (female): Stigma + Style + Ovary (contains ovules with female gametes)

b) Pollination (Page 135)

- Transfer of pollen from anther to stigma
- Self-pollination: Within same flower
- Cross-pollination: Between different flowers (requires agents: wind, water, insects)

c) Fertilization in Flowering Plants (Page 136)

- Pollen tube grows through style to reach ovule
- Male gamete fuses with female gamete $\rightarrow$ zygote formation
- Zygote develops into embryo; ovule $\rightarrow$ seed; ovary $\rightarrow$ fruit

d) Human Reproductive Systems (Pages 137-140)

Male System (Page 137-138):

- Testes: Produce sperms (in seminiferous tubules) and testosterone hormone
- Epididymis: Stores and matures sperms
- Vas deferens: Transports sperms
- Accessory glands: Seminal vesicles & prostate gland secrete fluid forming semen

- Penis: Delivers sperms into female reproductive tract

Female System (Page 138-139):

- Ovaries: Produce ova (eggs) and hormones (estrogen, progesterone)
- Fallopian tubes: Site of fertilization; transport ovum to uterus
- Uterus: Embryo implants and develops here
- Vagina: Birth canal

e) Menstrual Cycle (Page 139-140)

- Occurs in females from puberty to menopause (~28 days cycle)
- Days 1-5: Menstruation (shedding of uterine lining)
- Days 6-13: Follicular phase (ovary prepares egg; uterine lining thickens)
- Day 14: Ovulation (egg released from ovary)
- Days 15-28: Luteal phase (if no fertilization → menstruation begins again)

f) Fertilization & Pregnancy (Page 140)

- Fertilization occurs in fallopian tube
- Zygote undergoes cell division → embryo → implants in uterine wall
- Placenta develops for nutrient/waste exchange between mother and embryo
- Gestation period: ~9 months in humans

5. Reproductive Health (Page 140-141)

- Contraceptive methods:
 - Barrier methods (condoms, diaphragm)
 - Oral pills (hormonal)
 - Intrauterine devices (IUDs like Copper-T)
 - Surgical methods (vasectomy in males, tubectomy in females)
- Importance of family planning and STI prevention

PART A: 50 MULTIPLE CHOICE QUESTIONS (1 MARK EACH)

Q1. The basic event in reproduction is:

- (a) Cell enlargement
- (b) Creation of DNA copy
- (c) Cytoplasm division
- (d) Cell wall formation

Answer: (b) Creation of DNA copy

Explanation: The fundamental event in reproduction is DNA copying, which occurs before cell division. This ensures genetic information transfer to offspring while introducing variations essential for evolution. [[NCERT Pg 128, Para 1]]

Reference: NCERT Class 10 Science, Chapter 7, Page 128

Q2. Binary fission in *Leishmania* differs from that in *Amoeba* because:

- (a) *Leishmania* divides in any plane while *Amoeba* divides longitudinally
- (b) *Leishmania* divides longitudinally while *Amoeba* divides in any plane
- (c) *Leishmania* undergoes multiple fission while *Amoeba* undergoes binary fission
- (d) *Leishmania* requires two parents while *Amoeba* requires one parent

Answer: (b) *Leishmania* divides longitudinally while *Amoeba* divides in any plane

Explanation: *Leishmania* has a whip-like flagellum at one end, so it undergoes longitudinal binary fission (division along long axis). *Amoeba* lacks fixed shape/organelles, so it divides in any plane. [[NCERT Pg 129, Fig 7.2]]

Reference: NCERT Class 10 Science, Chapter 7, Page 129

Q3. Multiple fission is advantageous for *Plasmodium* because it:

- (a) Produces genetically diverse offspring
- (b) Allows survival during unfavorable conditions inside protective cyst
- (c) Requires fusion of gametes
- (d) Occurs only in presence of oxygen

Answer: (b) Allows survival during unfavorable conditions inside protective cyst

Explanation: During unfavorable conditions, *Plasmodium* forms a protective cyst around itself. Inside the cyst, nucleus divides repeatedly to form many daughter nuclei. When conditions improve, cyst breaks open releasing many daughter cells simultaneously. [[NCERT Pg 129]]

Reference: NCERT Class 10 Science, Chapter 7, Page 129

Q4. In yeast, budding occurs when:

- (a) Parent cell divides into two equal halves

- (b) Small bulge appears on parent cell that grows and may detach
- (c) Parent cell breaks into fragments
- (d) Spores are released from sporangia

Answer: (b) Small bulge appears on parent cell that grows and may detach

Explanation: Budding in yeast begins with a small protrusion (bud) on parent cell surface. Nucleus divides; one nucleus moves into bud. Bud grows and may detach to form new individual or remain attached forming chains/clusters. [[NCERT Pg 130, Fig 7.3]]

Reference: NCERT Class 10 Science, Chapter 7, Page 130

Q5. Regeneration in *Planaria* is possible due to presence of:

- (a) Chloroplasts
- (b) Specialized regenerative cells distributed throughout body
- (c) Sporangia
- (d) Gametes

Answer: (b) Specialized regenerative cells distributed throughout body

Explanation: *Planaria* possesses specialized cells called neoblasts (pluripotent stem cells) distributed throughout its body. These cells proliferate and differentiate to regenerate any missing body part. When cut into pieces, each piece with sufficient neoblasts can regenerate complete organism. [[NCERT Pg 131]]

Reference: NCERT Class 10 Science, Chapter 7, Page 131

Q6. Fragmentation differs from regeneration because:

- (a) Fragmentation is deliberate while regeneration is accidental
- (b) Fragmentation is mode of reproduction while regeneration is repair mechanism
- (c) Fragmentation occurs only in animals while regeneration occurs only in plants
- (d) Fragmentation requires gametes while regeneration does not

Answer: (b) Fragmentation is mode of reproduction while regeneration is repair mechanism

Explanation: Fragmentation is a reproductive method where parent body breaks into fragments (due to external force), each developing into new organism (e.g., *Spirogyra*). Regeneration is primarily a repair mechanism to replace lost/damaged parts; it becomes reproduction only when fragment develops into complete new organism. [[NCERT Pg 130-131]]

Reference: NCERT Class 10 Science, Chapter 7, Pages 130-131

Q7. Vegetative propagation in potato occurs through:

- (a) Roots
- (b) Leaves
- (c) Stem tubers (eyes)
- (d) Flowers

Answer: (c) Stem tubers (eyes)

Explanation: Potato reproduces vegetatively through stem tubers. "Eyes" on potato surface are actually buds (nodes) capable of sprouting into new plants when planted. Each eye contains meristematic tissue that develops roots and shoots. [[NCERT Pg 132, Fig 7.4]]

Reference: NCERT Class 10 Science, Chapter 7, Page 132

Q8. *Bryophyllum* reproduces vegetatively through:

- (a) Tubers
- (b) Bulbs
- (c) Leaf margins with adventitious buds
- (d) Runners

Answer: (c) Leaf margins with adventitious buds

Explanation: *Bryophyllum* leaves have notches along margins containing adventitious buds. When leaf touches moist soil, these buds develop roots and shoots to form new plants. This is natural vegetative propagation without seeds. [[NCERT Pg 132]]

Reference: NCERT Class 10 Science, Chapter 7, Page 132

Q9. Spores in *Rhizopus* are produced in:

- (a) Anther
- (b) Ovary
- (c) Sporangia at tips of erect hyphae
- (d) Roots

Answer: (c) Sporangia at tips of erect hyphae

Explanation: In *Rhizopus* (bread mould), fine thread-like hyphae grow on bread surface. Some hyphae grow upright; their tips swell to form sporangia (spore cases). Sporangia contain numerous spores that are released when mature. [[NCERT Pg 133, Fig 7.5]]

Reference: NCERT Class 10 Science, Chapter 7, Page 133

Q10. Advantage of spore formation is that spores:

- (a) Require immediate germination
- (b) Have thin walls for easy dispersal
- (c) Have thick walls protecting them in unfavorable conditions
- (d) Fuse with other spores before germination

Answer: (c) Have thick walls protecting them in unfavorable conditions

Explanation: Spores possess thick walls that protect them from dehydration, extreme temperatures, and other harsh conditions. They remain dormant until favorable conditions (moisture, warmth) return, then germinate to form new individuals. This ensures survival in variable environments. [[NCERT Pg 133]]

Reference: NCERT Class 10 Science, Chapter 7, Page 133

Q11. The male reproductive part of a flower is called:

- (a) Carpel
- (b) Stamen
- (c) Petal
- (d) Sepal

Answer: (b) Stamen

Explanation: Stamen is the male reproductive organ consisting of filament (stalk) and anther (bilobed structure producing pollen grains containing male gametes). Carpel is the female reproductive part. [[NCERT Pg 134, Fig 7.6]]

Reference: NCERT Class 10 Science, Chapter 7, Page 134

Q12. Pollen grains in flowering plants contain:

- (a) Female gametes
- (b) Male gametes
- (c) Zygotes
- (d) Embryos

Answer: (b) Male gametes

Explanation: Pollen grains are male gametophytes produced in anthers. Each pollen grain contains two male gametes (sperm cells) that participate in double fertilization—one fuses with egg to form zygote, the other fuses with polar nuclei to form endosperm. [[NCERT Pg 135]]

Reference: NCERT Class 10 Science, Chapter 7, Page 135

Q13. Transfer of pollen grains from anther to stigma is called:

- (a) Fertilization
- (b) Germination
- (c) Pollination
- (d) Fragmentation

Answer: (c) Pollination

Explanation: Pollination is the transfer of pollen grains from anther (male part) to stigma (female part) of a flower. It precedes fertilization and can be self-pollination (within same flower) or cross-pollination (between different flowers). [[NCERT Pg 135]]

Reference: NCERT Class 10 Science, Chapter 7, Page 135

Q14. Cross-pollination is advantageous over self-pollination because it:

- (a) Requires no pollinating agents

- (b) Preserves parental traits exactly
- (c) Produces genetically diverse offspring with better adaptability
- (d) Occurs faster than self-pollination

Answer: (c) Produces genetically diverse offspring with better adaptability

Explanation: Cross-pollination brings together genetic material from two different parent plants, creating variations in offspring. These variations provide raw material for natural selection, enabling better adaptation to changing environments and long-term species survival. [[NCERT Pg 135]]

Reference: NCERT Class 10 Science, Chapter 7, Page 135

Q15. After pollination, the pollen tube grows through the:

- (a) Anther
- (b) Filament
- (c) Style
- (d) Ovary wall

Answer: (c) Style

Explanation: After pollen grain lands on compatible stigma, it absorbs moisture and germinates. It grows a pollen tube that penetrates the stigma and grows down through the style (slender stalk of carpel) toward the ovary containing ovules. [[NCERT Pg 136]]

Reference: NCERT Class 10 Science, Chapter 7, Page 136

Q16. Double fertilization is characteristic of:

- (a) Gymnosperms
- (b) Angiosperms (flowering plants)
- (c) Bryophytes
- (d) Pteridophytes

Answer: (b) Angiosperms (flowering plants)

Explanation: Double fertilization occurs only in angiosperms. One male gamete fuses with egg cell to form zygote (embryo). Second male gamete fuses with two polar

nuclei to form triploid primary endosperm nucleus that develops into endosperm (nutritive tissue). [[NCERT Pg 136]]

Reference: NCERT Class 10 Science, Chapter 7, Page 136

Q17. After fertilization in flowering plants, the ovule develops into:

- (a) Fruit
- (b) Seed
- (c) Flower
- (d) Root

Answer: (b) Seed

Explanation: After fertilization, the ovule (containing zygote) develops into seed. Zygote divides to form embryo; surrounding integuments harden to form seed coat. Ovary wall develops into fruit enclosing the seed(s). [[NCERT Pg 136]]

Reference: NCERT Class 10 Science, Chapter 7, Page 136

Q18. The primary function of testes in human males is to:

- (a) Store sperms
- (b) Produce sperms and testosterone hormone
- (c) Transport sperms
- (d) Secrete seminal fluid

Answer: (b) Produce sperms and testosterone hormone

Explanation: Testes contain seminiferous tubules where spermatogenesis (sperm production) occurs. Interstitial cells (Leydig cells) between tubules secrete testosterone hormone responsible for male secondary sexual characteristics and sperm production regulation. [[NCERT Pg 137]]

Reference: NCERT Class 10 Science, Chapter 7, Page 137

Q19. Testes are located outside abdominal cavity in scrotum because:

- (a) It provides protection from injury
- (b) Sperm development requires temperature 2-2.5°C lower than body temperature
- (c) It allows easy access for sperm collection

(d) Abdominal cavity lacks blood supply

Answer: (b) Sperm development requires temperature 2-2.5°C lower than body temperature

Explanation: Normal body temperature (37°C) is too high for viable sperm production. Scrotum maintains testicular temperature at 34-35°C (2-2.5°C lower), which is optimal for spermatogenesis. In cold conditions, scrotum contracts to bring testes closer to body for warmth. [[NCERT Pg 137]]

Reference: NCERT Class 10 Science, Chapter 7, Page 137

Q20. The structure that stores and matures sperms after production in testes is:

(a) Vas deferens

(b) Urethra

(c) Epididymis

(d) Seminal vesicle

Answer: (c) Epididymis

Explanation: Epididymis is a highly coiled tube (≈6 meters long) attached to each testis. It stores sperms produced in seminiferous tubules and provides environment for their maturation (acquiring motility and fertilizing capacity) over 2-3 weeks. [[NCERT Pg 137]]

Reference: NCERT Class 10 Science, Chapter 7, Page 137

Q21. Seminal fluid is secreted by:

(a) Testes only

(b) Epididymis only

(c) Seminal vesicles and prostate gland

(d) Vas deferens

Answer: (c) Seminal vesicles and prostate gland

Explanation: Seminal vesicles secrete viscous fluid rich in fructose (energy source for sperms) and prostaglandins. Prostate gland secretes alkaline fluid that neutralizes vaginal acidity and enhances sperm motility. Together with sperms, they form semen. [[NCERT Pg 138]]

Reference: NCERT Class 10 Science, Chapter 7, Page 138

Q22. The female gonads that produce ova and hormones are:

- (a) Fallopian tubes
- (b) Uterus
- (c) Ovaries
- (d) Vagina

Answer: (c) Ovaries

Explanation: Ovaries are primary female reproductive organs (gonads). They produce ova (eggs) through oogenesis and secrete hormones estrogen and progesterone that regulate menstrual cycle, pregnancy, and female secondary sexual characteristics. [[NCERT Pg 138]]

Reference: NCERT Class 10 Science, Chapter 7, Page 138

Q23. Fertilization in human females normally occurs in the:

- (a) Ovary
- (b) Uterus
- (c) Fallopian tube
- (d) Vagina

Answer: (c) Fallopian tube

Explanation: After ovulation, ovum is swept into fallopian tube (oviduct). If sperms are present, fertilization (fusion of sperm and egg nuclei) occurs in ampulla region of fallopian tube, forming zygote. Zygote then moves toward uterus for implantation. [[NCERT Pg 140]]

Reference: NCERT Class 10 Science, Chapter 7, Page 140

Q24. The structure where embryo implants and develops during pregnancy is:

- (a) Ovary
- (b) Fallopian tube
- (c) Uterus
- (d) Vagina

Answer: (c) Uterus

Explanation: Uterus (womb) is a muscular, pear-shaped organ with thick, vascular lining (endometrium). After fertilization, zygote undergoes cell division forming blastocyst that implants into endometrium ≈ 7 days after fertilization. Embryo develops here for ≈ 9 months. [[NCERT Pg 139]]

Reference: NCERT Class 10 Science, Chapter 7, Page 139

Q25. Menstruation occurs due to:

- (a) Fertilization of ovum
- (b) Implantation of embryo
- (c) Shedding of uterine lining when no fertilization occurs
- (d) Ovulation

Answer: (c) Shedding of uterine lining when no fertilization occurs

Explanation: If fertilization doesn't occur, corpus luteum degenerates causing progesterone levels to drop. Without progesterone support, thickened uterine lining (endometrium) breaks down and is expelled as menstrual flow containing blood and mucosal tissue through vagina. [[NCERT Pg 139-140]]

Reference: NCERT Class 10 Science, Chapter 7, Pages 139-140

Q26. The average duration of human menstrual cycle is:

- (a) 14 days
- (b) 21 days
- (c) 28 days
- (d) 35 days

Answer: (c) 28 days

Explanation: The menstrual cycle averages 28 days but can vary from 21-35 days among healthy females. Day 1 marks start of menstruation; ovulation typically occurs around day 14; cycle ends just before next menstruation begins. [[NCERT Pg 139]]

Reference: NCERT Class 10 Science, Chapter 7, Page 139

Q27. Ovulation in human females refers to:

- (a) Release of mature ovum from ovary
- (b) Shedding of uterine lining
- (c) Implantation of embryo
- (d) Fertilization of egg

Answer: (a) Release of mature ovum from ovary

Explanation: Ovulation is the release of a mature secondary oocyte (egg) from a ruptured ovarian follicle into the fallopian tube. It is triggered by LH surge from pituitary gland and typically occurs around day 14 of 28-day cycle. [[NCERT Pg 139]]

Reference: NCERT Class 10 Science, Chapter 7, Page 139

Q28. The placenta during pregnancy functions primarily to:

- (a) Produce hormones only
- (b) Protect embryo from mechanical shock
- (c) Facilitate exchange of nutrients, oxygen, and waste between mother and embryo
- (d) Store nutrients for embryo

Answer: (c) Facilitate exchange of nutrients, oxygen, and waste between mother and embryo

Explanation: Placenta is a disc-shaped organ embedding embryo to uterine wall. It contains finger-like villi on embryo side surrounded by maternal blood spaces. Allows diffusion of oxygen/nutrients from mother to embryo and CO₂/waste from embryo to mother while keeping blood supplies separate. [[NCERT Pg 140]]

Reference: NCERT Class 10 Science, Chapter 7, Page 140

Q29. Gestation period in humans is approximately:

- (a) 6 months
- (b) 9 months
- (c) 12 months
- (d) 3 months

Answer: (b) 9 months

Explanation: Gestation period is time from fertilization to birth. In humans, it averages 280 days (40 weeks or $\approx$ 9 months). During this period, embryo develops into fetus with all organ systems functional for independent survival after birth. [[NCERT Pg 140]]

Reference: NCERT Class 10 Science, Chapter 7, Page 140

Q30. Barrier method of contraception that also prevents STIs is:

- (a) Oral pills
- (b) Copper-T
- (c) Condom
- (d) Vasectomy

Answer: (c) Condom

Explanation: Condom (male/female) is a barrier method physically preventing sperms from entering female reproductive tract. Unlike other contraceptives, it also provides protection against sexually transmitted infections (STIs) including HIV/AIDS by blocking contact with bodily fluids. [[NCERT Pg 141]]

Reference: NCERT Class 10 Science, Chapter 7, Page 141

Q31. Copper-T prevents pregnancy primarily by:

- (a) Stopping ovulation
- (b) Killing sperms and preventing implantation
- (c) Blocking fallopian tubes
- (d) Reducing sperm production

Answer: (b) Killing sperms and preventing implantation

Explanation: Copper-T is an intrauterine device (IUD) inserted into uterus. Copper ions released create hostile environment for sperms (reducing motility/killing them) and prevent fertilized egg from implanting in uterine wall. It does not affect ovulation. [[NCERT Pg 141]]

Reference: NCERT Class 10 Science, Chapter 7, Page 141

Q32. Vasectomy is a surgical contraceptive method performed on:

- (a) Females to block fallopian tubes

(b) Males to block vas deferens

(c) Females to remove ovaries

(d) Males to remove testes

Answer: (b) Males to block vas deferens

Explanation: Vasectomy involves cutting and tying a small portion of vas deferens (sperm duct) in males. Sperms produced in testes cannot reach urethra, so ejaculate contains no sperms. Testosterone production and sexual function remain unaffected. [[NCERT Pg 141]]

Reference: NCERT Class 10 Science, Chapter 7, Page 141

Q33. Tubectomy involves:

(a) Blocking vas deferens in males

(b) Blocking fallopian tubes in females

(c) Removing uterus

(d) Removing ovaries

Answer: (b) Blocking fallopian tubes in females

Explanation: Tubectomy (female sterilization) involves cutting and tying fallopian tubes. Ova released from ovaries cannot reach uterus, and sperms cannot reach ovum for fertilization. Ovarian hormone production and menstruation continue normally. [[NCERT Pg 141]]

Reference: NCERT Class 10 Science, Chapter 7, Page 141

Q34. Oral contraceptive pills work primarily by:

(a) Creating physical barrier for sperms

(b) Releasing copper ions toxic to sperms

(c) Suppressing ovulation through hormonal action

(d) Preventing implantation of embryo

Answer: (c) Suppressing ovulation through hormonal action

Explanation: Oral pills contain synthetic progesterone/estrogen that inhibit FSH/LH secretion from pituitary gland. This prevents follicle maturation and ovulation. They

also thicken cervical mucus to block sperms and alter endometrium to prevent implantation. [[NCERT Pg 141]]

Reference: NCERT Class 10 Science, Chapter 7, Page 141

Q35. Advantage of vegetative propagation is that it:

- (a) Produces genetically diverse offspring
- (b) Requires pollinating agents
- (c) Preserves desirable parental traits exactly
- (d) Takes longer time than seed propagation

Answer: (c) Preserves desirable parental traits exactly

Explanation: Vegetative propagation produces clones (genetically identical offspring) because no gamete fusion or DNA recombination occurs. This preserves all desirable traits of parent plant—fruit quality, flower color, disease resistance—making it valuable in agriculture/horticulture. [[NCERT Pg 132]]

Reference: NCERT Class 10 Science, Chapter 7, Page 132

Q36. Grafting is an artificial method of vegetative propagation where:

- (a) Stem cutting is planted directly in soil
- (b) Scion (desired variety) is attached to stock (root system of another plant)
- (c) Leaves are placed on moist soil to develop roots
- (d) Roots are cut and planted separately

Answer: (b) Scion (desired variety) is attached to stock (root system of another plant)

Explanation: In grafting, scion (stem piece of plant with desired characteristics) is attached to stock (rooted plant of related species). Their vascular tissues fuse, allowing scion to grow using stock's root system. Used for roses, mango, apple to combine desirable shoot traits with hardy root system. [[NCERT Pg 133]]

Reference: NCERT Class 10 Science, Chapter 7, Page 133

Q37. The part of flower that receives pollen grains is:

- (a) Anther
- (b) Stigma

(c) Ovary

(d) Filament

Answer: (b) Stigma

Explanation: Stigma is the sticky or feathery tip of carpel (female reproductive part) that receives pollen grains during pollination. Its sticky surface helps trap and hold pollen grains for germination. [[NCERT Pg 134, Fig 7.6]]

Reference: NCERT Class 10 Science, Chapter 7, Page 134

Q38. Unisexual flowers contain:

(a) Both stamens and carpels

(b) Only stamens or only carpels

(c) Only petals and sepals

(d) Only ovules

Answer: (b) Only stamens or only carpels

Explanation: Unisexual flowers possess either stamens (male flowers) or carpels (female flowers), but not both. Plants may be monoecious (both flower types on same plant, e.g., maize) or dioecious (flower types on separate plants, e.g., papaya). [[NCERT Pg 134]]

Reference: NCERT Class 10 Science, Chapter 7, Page 134

Q39. Bisexual flowers contain:

(a) Only stamens

(b) Only carpels

(c) Both stamens and carpels

(d) Neither stamens nor carpels

Answer: (c) Both stamens and carpels

Explanation: Bisexual (perfect) flowers contain both male (stamens) and female (carpels) reproductive organs in same flower. Examples: Hibiscus, mustard, rose. These flowers can undergo self-pollination or cross-pollination. [[NCERT Pg 134]]

Reference: NCERT Class 10 Science, Chapter 7, Page 134

Q40. Variation during DNA copying is important because it:

- (a) Ensures exact replication of parental traits
- (b) Provides raw material for evolution and adaptation
- (c) Prevents reproduction
- (d) Slows down cell division

Answer: (b) Provides raw material for evolution and adaptation

Explanation: Imperfect DNA copying introduces variations (mutations) in offspring. While most variations are neutral/harmful, some provide survival advantages in changing environments. Natural selection favors beneficial variations, leading to evolution and species adaptation over generations. [[NCERT Pg 128, Para 1]]

Reference: NCERT Class 10 Science, Chapter 7, Page 128

Q41. In *Spirogyra*, reproduction by fragmentation occurs when:

- (a) Parent divides into two equal halves
- (b) Parent body breaks into pieces due to water current/mechanical stress
- (c) Buds form on parent body
- (d) Spores are released from sporangia

Answer: (b) Parent body breaks into pieces due to water current/mechanical stress

Explanation: *Spirogyra* is filamentous green alga. Its long filamentous body can break into smaller fragments due to water currents or mechanical disturbance. Each fragment containing at least one cell can grow into complete new filament by cell division. [[NCERT Pg 130]]

Reference: NCERT Class 10 Science, Chapter 7, Page 130

Q42. The male gamete in humans is:

- (a) Ovum
- (b) Zygote
- (c) Sperm
- (d) Embryo

Answer: (c) Sperm

Explanation: Sperm (spermatozoon) is the male gamete produced in testes. It is small, motile cell with head (containing nucleus), middle piece (mitochondria for energy), and tail (flagellum for movement). Fuses with ovum during fertilization. [[NCERT Pg 137]]

Reference: NCERT Class 10 Science, Chapter 7, Page 137

Q43. The female gamete in humans is:

- (a) Sperm
- (b) Zygote
- (c) Ovum (egg)
- (d) Embryo

Answer: (c) Ovum (egg)

Explanation: Ovum (egg) is the female gamete produced in ovaries. It is large, non-motile cell containing nutrients (yolk) for early embryo development. Contains haploid nucleus that fuses with sperm nucleus during fertilization to form diploid zygote. [[NCERT Pg 138]]

Reference: NCERT Class 10 Science, Chapter 7, Page 138

Q44. Zygote is formed by fusion of:

- (a) Two sperms
- (b) Two ova
- (c) Sperm and ovum
- (d) Two embryos

Answer: (c) Sperm and ovum

Explanation: Zygote is diploid cell formed by fusion of haploid male gamete (sperm) and haploid female gamete (ovum) during fertilization. It contains complete set of chromosomes (half from each parent) and undergoes mitotic divisions to form embryo. [[NCERT Pg 140]]

Reference: NCERT Class 10 Science, Chapter 7, Page 140

Q45. Puberty in human males is marked by:

- (a) Onset of menstruation

(b) Production of sperms and secondary sexual characteristics

(c) Menopause

(d) Ovulation

Answer: (b) Production of sperms and secondary sexual characteristics

Explanation: Puberty ($\approx$ 13-14 years in boys) marks reproductive maturity. Triggered by testosterone, it involves sperm production initiation, growth of facial/body hair, deepening of voice, muscle development, and enlargement of reproductive organs. [[NCERT Pg 137]]

Reference: NCERT Class 10 Science, Chapter 7, Page 137

Q46. Puberty in human females is marked by:

(a) Sperm production

(b) Onset of menstruation (menarche) and secondary sexual characteristics

(c) Menopause

(d) Vasectomy

Answer: (b) Onset of menstruation (menarche) and secondary sexual characteristics

Explanation: Puberty ($\approx$ 10-12 years in girls) marks reproductive maturity. Triggered by estrogen/progesterone, it involves menarche (first menstruation), breast development, widening of hips, growth of pubic/axillary hair, and onset of ovulation. [[NCERT Pg 139]]

Reference: NCERT Class 10 Science, Chapter 7, Page 139

Q47. Menopause refers to:

(a) First menstrual cycle

(b) Cessation of menstrual cycles around age 45-50 years

(c) Monthly menstrual cycle

(d) Ovulation phase

Answer: (b) Cessation of menstrual cycles around age 45-50 years

Explanation: Menopause is permanent stoppage of menstrual cycles occurring typically between 45-55 years due to declining ovarian function and hormone production. It marks end of reproductive phase in females. [[NCERT Pg 139]]

Reference: NCERT Class 10 Science, Chapter 7, Page 139

Q48. Advantage of sexual reproduction over asexual reproduction is:

- (a) Faster population increase
- (b) No need for mate
- (c) Greater genetic variation in offspring
- (d) Preservation of exact parental traits

Answer: (c) Greater genetic variation in offspring

Explanation: Sexual reproduction involves meiosis (creating genetic diversity in gametes) and fusion of gametes from two parents. This produces offspring with novel gene combinations, enhancing adaptability to environmental changes and evolutionary potential—key advantage over asexual reproduction. [[NCERT Pg 128, Para 1]]

Reference: NCERT Class 10 Science, Chapter 7, Page 128

Q49. Disadvantage of asexual reproduction is:

- (a) Slow reproduction rate
- (b) Requires two parents
- (c) Lack of genetic variation limiting adaptability
- (d) Energy-intensive process

Answer: (c) Lack of genetic variation limiting adaptability

Explanation: Asexual reproduction produces genetically identical clones. While efficient for rapid population growth in stable environments, lack of variation makes entire population vulnerable to diseases/environmental changes that can wipe out all individuals lacking resistant traits. [[NCERT Pg 128, Para 1]]

Reference: NCERT Class 10 Science, Chapter 7, Page 128

Q50. The process ensuring species continuity on Earth is:

- (a) Respiration

- (b) Nutrition
- (c) Reproduction
- (d) Excretion

Answer: (c) Reproduction

Explanation: Reproduction is biological process by which organisms produce new individuals of same species. While not essential for individual survival (unlike respiration/nutrition), it is crucial for species survival, maintaining population stability, and ensuring continuity of life on Earth across generations. [[NCERT Pg 127]]

Reference: NCERT Class 10 Science, Chapter 7, Page 127

PART B: 20 SHORT ANSWER QUESTIONS (2-3 MARKS EACH)

Q1. Why is DNA copying essential in reproduction? State two reasons. (2 marks)

Solution:

DNA copying is essential in reproduction because:

- (i) Genetic continuity: It ensures transfer of hereditary information from parents to offspring, maintaining species characteristics across generations. Without DNA copying, offspring wouldn't inherit parental traits. [[NCERT Pg 128, Para 1]]
- (ii) Source of variations: Imperfect DNA copying introduces variations (mutations) during replication. These variations provide raw material for natural selection and evolution, enabling species to adapt to changing environments over time.

Reference: NCERT Class 10 Science, Chapter 7, Page 128

Q2. Differentiate between binary fission and multiple fission. Give one example of each. (2 marks)

Solution:

Binary Fission	Multiple Fission
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Parent divides into two nearly equal daughter cells	Parent divides into many daughter cells simultaneously
Occurs in favorable conditions	Often occurs in unfavorable conditions within protective cyst
Example: <i>Amoeba</i> , <i>Leishmania</i>	Example: <i>Plasmodium</i> (malarial parasite)

[[NCERT Pg 128-129]]

Reference: NCERT Class 10 Science, Chapter 7, Pages 128-129

Q3. What is vegetative propagation? State two advantages of this method. (2 marks)

Solution:

Vegetative propagation is asexual reproduction in plants where new individuals develop from vegetative parts (roots, stems, leaves) without involvement of seeds, spores, or gametes. Offspring are genetically identical to parent plant. [[NCERT Pg 132]]

Advantages:

- (i) Preserves desirable traits: Produces clones maintaining exact parental characteristics (fruit quality, flower color, disease resistance) valuable in agriculture/horticulture.
- (ii) Faster than seed propagation: Bypasses seed germination stage; plants mature quicker and bear flowers/fruits earlier.

Reference: NCERT Class 10 Science, Chapter 7, Page 132

Q4. Name the parts of human male reproductive system that:

- (a) Produce sperms
- (b) Store and mature sperms
- (c) Transport sperms
- (d) Secrete fluid forming semen (2 marks)

Solution:

- (a) Testes (specifically seminiferous tubules within testes) [[NCERT Pg 137]]
- (b) Epididymis (highly coiled tube attached to each testis) [[NCERT Pg 137]]
- (c) Vas deferens (muscular duct transporting sperms from epididymis) [[NCERT Pg 138]]
- (d) Seminal vesicles and prostate gland (accessory glands secreting seminal fluid) [[NCERT Pg 138]]

Reference: NCERT Class 10 Science, Chapter 7, Pages 137-138

Q5. Why are testes located outside the abdominal cavity? Explain. (2 marks)

Solution:

Testes are located in scrotum outside abdominal cavity because sperm development (spermatogenesis) requires temperature 2-2.5°C lower than normal body temperature (37°C). Scrotum maintains optimal temperature of 34-35°C essential for production of viable sperms. Higher temperatures impair sperm formation and motility. [[NCERT Pg 137]]

Reference: NCERT Class 10 Science, Chapter 7, Page 137

Q6. What happens to the uterine lining if fertilization does not occur? Why does this happen? (2 marks)

Solution:

If fertilization does not occur:

- The thickened uterine lining (endometrium), prepared to receive embryo, breaks down and is expelled through vagina as menstrual flow containing blood and mucosal tissue (menstruation). [[NCERT Pg 139-140]]
- Reason: Without fertilization, corpus luteum (formed from ruptured follicle) degenerates after ≈14 days, causing progesterone levels to drop sharply. Progesterone is essential for maintaining endometrium; its withdrawal triggers shedding of lining.

Reference: NCERT Class 10 Science, Chapter 7, Pages 139-140

Q7. Differentiate between self-pollination and cross-pollination. (2 marks)

Solution:

Self-pollination	Cross-pollination

Pollen transfer within same flower or between flowers of same plant	Pollen transfer between flowers of different plants of same species
Does not require pollinating agents	Requires agents (wind, water, insects, birds)
Preserves parental traits; less variation	Creates genetic diversity; better adaptability
Example: Pea, wheat	Example: Apple, pumpkin

[[NCERT Pg 135]]

Reference: NCERT Class 10 Science, Chapter 7, Page 135

Q8. What is regeneration? How is it different from reproduction? Explain with example. (2 marks)

Solution:

Regeneration is the ability of organisms to repair or replace lost/damaged body parts using specialized cells.

Difference from reproduction: Regeneration is primarily a repair mechanism (e.g., lizard regrowing tail). It becomes reproduction only when a body fragment develops into a complete new organism.

Example: When *Planaria* is cut into pieces, each piece with sufficient specialized cells (neoblasts) regenerates missing parts to form complete new worm—here regeneration serves as mode of reproduction. [[NCERT Pg 131]]

Reference: NCERT Class 10 Science, Chapter 7, Page 131

Q9. Name the parts of a flower that develop into:

(a) Fruit

(b) Seed

after fertilization. (2 marks)

Solution:

(a) Ovary develops into fruit (ovary wall → pericarp/fruit wall) [[NCERT Pg 136]]

(b) Ovule develops into seed (zygote → embryo; integuments → seed coat)
[[NCERT Pg 136]]

Reference: NCERT Class 10 Science, Chapter 7, Page 136

Q10. What is the role of placenta during pregnancy? (2 marks)

Solution:

Placenta is a special disc-shaped tissue embedding embryo to uterine wall. Its roles:

(i) Nutrient/waste exchange: Contains villi on embryo side surrounded by maternal blood spaces. Allows diffusion of oxygen/nutrients from mother to embryo and CO₂/waste products from embryo to mother. [[NCERT Pg 140]]

(ii) Hormone production: Secretes hormones (hCG, progesterone, estrogen) essential for maintaining pregnancy.

(iii) Barrier function: Prevents mixing of maternal and fetal blood while allowing selective material exchange.

Reference: NCERT Class 10 Science, Chapter 7, Page 140

Q11. What are the functions of testosterone and estrogen hormones? (2 marks)

Solution:

Testosterone (produced by testes in males):

- Stimulates sperm production (spermatogenesis)
- Promotes development of male secondary sexual characteristics (facial/body hair, deep voice, muscle growth) [[NCERT Pg 137]]

Estrogen (produced by ovaries in females):

- Regulates menstrual cycle and promotes development of female secondary sexual characteristics (breast development, widening hips)
- Prepares uterine lining for implantation during menstrual cycle [[NCERT Pg 138-139]]

Reference: NCERT Class 10 Science, Chapter 7, Pages 137-139

Q12. What is menstruation? When does it start and stop in a female's life? (2 marks)

Solution:

Menstruation is monthly shedding of thickened uterine lining (endometrium) along with blood and mucosal tissue through vagina when fertilization does not occur. It marks Day 1 of menstrual cycle. [[NCERT Pg 139]]

- Starts at puberty as menarche (first menstrual cycle, typically age 10-12 years)
- Stops at menopause (permanent cessation, typically age 45-55 years) marking end of reproductive phase

Reference: NCERT Class 10 Science, Chapter 7, Page 139

Q13. How does budding occur in *Hydra*? Explain with diagram description. (2 marks)

Solution:

In *Hydra* (multicellular organism):

- Small outgrowth (bud) forms on parent body due to repeated mitotic divisions of regenerative cells
- Bud develops tentacles and mouth; grows in size while attached to parent
- Eventually detaches from parent to become independent new individual
- Sometimes buds remain attached forming colonies before detaching [[NCERT Pg 130, Fig 7.3]]

[Diagram description: Parent Hydra with bulge on body wall developing into miniature Hydra with tentacles]

Reference: NCERT Class 10 Science, Chapter 7, Page 130

Q14. What are spores? Why are they protected by thick walls? (2 marks)

Solution:

Spores are microscopic, asexual reproductive structures produced by fungi, algae, mosses, and ferns. They contain genetic material and minimal cytoplasm enclosed in protective wall. [[NCERT Pg 133]]

Thick walls protect spores because:

- Prevent dehydration in dry conditions
- Shield against extreme temperatures, UV radiation, and mechanical damage
- Allow dormancy during unfavorable conditions; germinate only when moisture/warmth return

This ensures survival and dispersal in variable environments.

Reference: NCERT Class 10 Science, Chapter 7, Page 133

Q15. What is the significance of variation in reproduction? (2 marks)

Solution:

Variations (differences in DNA sequences among individuals) are significant because:

(i) Adaptation: Provide raw material for natural selection. Individuals with beneficial variations survive better in changing environments and pass these traits to offspring.

(ii) Evolution: Accumulation of favorable variations over generations leads to formation of new species better suited to their habitats.

(iii) Disease resistance: Genetic diversity ensures some individuals may possess resistance to pathogens, preventing entire population extinction. [[NCERT Pg 128, Para 1]]

Reference: NCERT Class 10 Science, Chapter 7, Page 128

Q16. Name two plants propagated by:

(a) Roots

(b) Stems

(c) Leaves (2 marks)

Solution:

(a) Roots: Sweet potato (*Ipomoea batatas*), Dahlia (adventitious buds on roots) [[NCERT Pg 132]]

(b) Stems: Potato (tubers with eyes), Onion (bulbs), Grass (runners/stolons) [[NCERT Pg 132]]

(c) Leaves: *Bryophyllum* (adventitious buds on leaf margins), *Begonia* (leaf cuttings) [[NCERT Pg 132]]

Reference: NCERT Class 10 Science, Chapter 7, Page 132

Q17. What is the role of fallopian tubes in human female reproduction? (2 marks)

Solution:

Fallopian tubes (oviducts) have two primary roles:

(i) Site of fertilization: After ovulation, ovum is swept into fallopian tube where it may encounter sperms; fertilization (fusion of gametes) occurs in ampulla region forming zygote. [[NCERT Pg 140]]

(ii) Transport: Ciliated epithelium and peristaltic movements transport ovum from ovary toward uterus; also transport zygote/early embryo toward uterus for implantation.

Reference: NCERT Class 10 Science, Chapter 7, Page 140

Q18. What happens during ovulation in human females? (2 marks)

Solution:

Ovulation occurs around day 14 of 28-day menstrual cycle:

(i) Mature ovarian follicle ruptures due to LH (luteinizing hormone) surge from pituitary gland

(ii) Secondary oocyte (ovum/egg) is released from ovary into pelvic cavity

(iii) Fimbriae (finger-like projections) of fallopian tube sweep ovum into tube

(iv) Ruptured follicle transforms into corpus luteum secreting progesterone to maintain uterine lining [[NCERT Pg 139]]

Ovum remains viable for fertilization for 12-24 hours after release.

Reference: NCERT Class 10 Science, Chapter 7, Page 139

Q19. What is gestation period? What is its duration in humans? (2 marks)

Solution:

Gestation period is the time interval between fertilization (zygote formation) and birth of fully developed offspring. During this period, embryo develops into fetus with all organ systems functional for independent survival. [[NCERT Pg 140]]

Duration in humans: Approximately 280 days (40 weeks or 9 months) from last menstrual period (LMP), or ≈ 38 weeks from actual fertilization.

Reference: NCERT Class 10 Science, Chapter 7, Page 140

Q20. List four methods of contraception and classify them. (2 marks)

Solution:

Method	Classification
Condom (male/female)	Barrier method
Oral contraceptive pills	Hormonal method
Copper-T	Intrauterine device (IUD)
Vasectomy/Tubectomy	Surgical method

[[NCERT Pg 141]]

Additional methods: Natural methods (rhythm method, withdrawal), emergency contraception (morning-after pill).

Reference: NCERT Class 10 Science, Chapter 7, Page 141

PART C: 20 LONG ANSWER QUESTIONS (5 MARKS EACH)

Q1. Describe various modes of asexual reproduction in organisms with examples. How does asexual reproduction differ from sexual reproduction? (5 marks)

Solution:

Modes of Asexual Reproduction:

(i) Fission:

- *Binary fission*: Parent divides into two nearly equal daughter cells (e.g., *Amoeba* divides in any plane; *Leishmania* divides longitudinally due to flagellum) [[NCERT Pg 128-129]]
- *Multiple fission*: Parent divides into many daughter cells within protective cyst during unfavorable conditions (e.g., *Plasmodium*)

(ii) Budding: Small outgrowth (bud) forms on parent, grows and may detach (e.g., *Yeast* - unicellular; *Hydra* - multicellular) [[NCERT Pg 130]]

(iii) Fragmentation: Parent body breaks into fragments; each develops into new organism (e.g., *Spirogyra* filament breaks due to water current) [[NCERT Pg 130]]

(iv) Regeneration: Specialized cells regenerate lost parts; becomes reproduction when fragment forms complete organism (e.g., *Planaria* pieces forming new worms) [[NCERT Pg 131]]

(v) Vegetative propagation: New plants from vegetative parts without seeds (e.g., potato tubers, *Bryophyllum* leaf buds) [[NCERT Pg 132-133]]

(vi) Spore formation: Spores with thick walls produced in sporangia; germinate under favorable conditions (e.g., *Rhizopus*, fungi) [[NCERT Pg 133]]

Differences between Asexual and Sexual Reproduction:

Asexual Reproduction	Sexual Reproduction
Single parent involved	Two parents (male & female) involved
No gamete formation/fusion	Involves gamete formation and fusion
Offspring genetically identical (clones)	Offspring genetically diverse
Faster population growth	Slower population growth
No variations (except mutations)	Generates variations through meiosis & fertilization
Common in unicellular/simple organisms	Common in complex multicellular organisms

Significance: Asexual reproduction efficient for rapid colonization in stable environments; sexual reproduction advantageous for adaptation/evolution in changing environments due to genetic diversity. [[NCERT Pg 128, Para 1]]

Reference: NCERT Class 10 Science, Chapter 7, Pages 128-133

Q2. Draw a labeled diagram of the human male reproductive system. Explain the function of any five parts. (5 marks)

Solution:

[Diagram description for 2 marks]

Essential labels: Testes in scrotum, epididymis coiled over testes, vas deferens, seminal vesicles, prostate gland, urethra running through penis, penis.

Functions of five parts [[NCERT Pg 137-138]]:

(i) Testes:

- Produce sperms in seminiferous tubules through spermatogenesis
- Secrete testosterone hormone from Leydig cells regulating male secondary sexual characteristics and sperm production

(ii) Epididymis:

- Highly coiled tube (≈ 6 m long) storing sperms after production
- Provides environment for sperm maturation (acquiring motility and fertilizing capacity over 2-3 weeks)

(iii) Vas deferens:

- Muscular duct (≈ 45 cm long) transporting mature sperms from epididymis toward urethra
- Joins duct from seminal vesicle to form ejaculatory duct

(iv) Seminal vesicles:

- Paired glands secreting viscous fluid rich in fructose (energy source for sperms) and prostaglandins (stimulate uterine contractions)
- Contributes $\approx 60\%$ of semen volume

(v) Prostate gland:

- Secretes milky alkaline fluid neutralizing vaginal acidity and enhancing sperm motility
- Contributes $\approx 30\%$ of semen volume; contains enzymes activating sperms

Additional note: Urethra serves dual function—carries urine from bladder and semen during ejaculation (not simultaneously due to sphincter control). Penis delivers sperms into female vagina during intercourse.

Reference: NCERT Class 10 Science, Chapter 7, Pages 137-138

Q3. Draw a labeled diagram of the human female reproductive system. Explain the function of any five parts. (5 marks)

Solution:

[Diagram description for 2 marks]

Essential labels: Ovaries, fallopian tubes (with fimbriae), uterus (with endometrium), cervix, vagina, vulva.

Functions of five parts [[NCERT Pg 138-140]]:

(i) Ovaries:

- Primary female gonads producing ova (eggs) through oogenesis (one mature ovum per menstrual cycle after puberty)
- Secrete estrogen and progesterone hormones regulating menstrual cycle, pregnancy, and female secondary sexual characteristics

(ii) Fallopian tubes (oviducts):

- Site of fertilization: Ovum released during ovulation is swept into tube by fimbriae; fertilization occurs in ampulla region if sperms present
- Transport ovum/zygote toward uterus via ciliary action and peristalsis

(iii) Uterus (womb):

- Muscular, pear-shaped organ where embryo implants into thickened endometrium ≈ 7 days after fertilization
- Nourishes developing embryo/fetus; muscular walls contract during childbirth to expel baby

(iv) Cervix:

- Narrow lower portion of uterus opening into vagina
- Produces mucus that changes consistency during cycle (thin at ovulation to allow sperm passage; thick otherwise as barrier)
- Dilates during childbirth to allow passage of baby

(v) Vagina:

- Muscular tube serving as birth canal during delivery
- Receives penis during intercourse; sperms deposited near cervix
- Passage for menstrual flow expulsion

Additional note: Endometrium (uterine lining) thickens monthly under hormonal influence to receive embryo; sheds during menstruation if no fertilization occurs.

Reference: NCERT Class 10 Science, Chapter 7, Pages 138-140

Q4. Explain the process of sexual reproduction in flowering plants with labeled diagram showing essential parts. What changes occur after fertilization? (5 marks)

Solution:

[Diagram description for 1.5 marks]

Essential floral parts: Stamen (anther + filament), Carpel/Pistil (stigma + style + ovary containing ovules), Petals, Sepals. Show pollen grains on stigma and pollen tube growing through style to ovule.

Process of sexual reproduction [[NCERT Pg 134-136]]:

(i) Pollination:

- Transfer of pollen grains from anther to stigma
- *Self-pollination*: Within same flower or between flowers of same plant (no genetic variation)
- *Cross-pollination*: Between flowers of different plants (requires agents: wind—insect-pollinated flowers have bright petals/scent; wind-pollinated have exposed anthers/feathery stigma)

(ii) Pollen tube formation:

- Pollen grain absorbs moisture on compatible stigma and germinates
- Grows pollen tube through style toward ovary; two male gametes travel down tube

(iii) Fertilization (Double fertilization—unique to angiosperms):

- Pollen tube enters ovule through micropyle
- One male gamete fuses with egg cell → diploid zygote (develops into embryo)
- Second male gamete fuses with two polar nuclei → triploid primary endosperm nucleus (develops into endosperm providing nutrition to embryo)

Post-fertilization changes [[NCERT Pg 136]]:

- Ovule → Seed (zygote → embryo; endosperm → nutritive tissue; integuments → seed coat)
- Ovary → Fruit (ovary wall → pericarp/fruit wall protecting seeds)
- Other floral parts (petals, sepals, stamens, style/stigma) wither and fall off
- Example: In mango, ovule → seed (stone); ovary → fleshy fruit

Significance: Fruit aids seed dispersal; seed protects embryo and provides nutrition for germination.

Reference: NCERT Class 10 Science, Chapter 7, Pages 134-136

Q5. Describe the menstrual cycle in human females with its phases. What hormonal changes regulate this cycle? (5 marks)

Solution:

Menstrual cycle (~28 days) prepares female body monthly for possible pregnancy. Day 1 = first day of menstruation. [[NCERT Pg 139-140]]

Phases of menstrual cycle:

(i) Menstrual phase (Days 1-5):

- If previous cycle had no fertilization, corpus luteum degenerates → progesterone levels drop
- Thickened uterine lining (endometrium) breaks down and is expelled as menstrual flow (blood + mucosal tissue) through vagina
- Pituitary gland begins secreting FSH (Follicle Stimulating Hormone)

(ii) Follicular/Proliferative phase (Days 6-13):

- FSH stimulates development of ovarian follicle containing immature ovum
- Follicle secretes estrogen → repairs and thickens endometrium with blood vessels
- Estrogen levels rise gradually, peaking near ovulation

(iii) Ovulation (Day 14):

- High estrogen triggers LH (Luteinizing Hormone) surge from pituitary
- Mature follicle ruptures → releases secondary oocyte (ovum) into fallopian tube
- Ovum viable for fertilization for 12-24 hours

(iv) Luteal/Secretory phase (Days 15-28):

- Ruptured follicle transforms into corpus luteum secreting progesterone
- Progesterone maintains thickened endometrium and inhibits further ovulation
- If fertilization occurs: Embryo implants → secretes hCG hormone → maintains corpus luteum → progesterone continues → no menstruation (pregnancy)
- If no fertilization: Corpus luteum degenerates after ≈14 days → progesterone drops → endometrium sheds → menstruation begins (Day 1 of next cycle)

Hormonal regulation summary:

- FSH: Stimulates follicle development and estrogen secretion
- Estrogen: Thickens endometrium; triggers LH surge at peak
- LH: Triggers ovulation; transforms follicle into corpus luteum
- Progesterone: Maintains endometrium; suppresses further ovulation

Significance: Cycle ensures regular ovulation and prepares uterus for embryo implantation; cessation at menopause marks end of reproductive phase.

Reference: NCERT Class 10 Science, Chapter 7, Pages 139-140

Q6. What is reproductive health? Describe various contraceptive methods with their working principles. Why is family planning important? (5 marks)

Solution:

Reproductive health means total well-being in all aspects of reproduction—physical, emotional, behavioral, and social. It includes awareness about reproductive organs, adolescence changes, safe sexual practices, prevention of STIs, and access to contraceptive/family planning services. [[NCERT Pg 140]]

Contraceptive methods [[NCERT Pg 141]]:

(i) Barrier methods:

- *Condoms* (male/female): Thin rubber sheath preventing sperms from entering female tract; also prevents STI transmission
- *Diaphragm/Cervical cap*: Dome-shaped device covering cervix to block sperms

(ii) Hormonal methods:

- *Oral pills*: Contain synthetic progesterone/estrogen suppressing ovulation, thickening cervical mucus, and altering endometrium
- *Injectables/Implants*: Slow-release hormones providing long-term contraception

(iii) Intrauterine devices (IUDs):

- *Copper-T*: T-shaped device releasing copper ions toxic to sperms and preventing implantation
- *Hormonal IUDs*: Release progesterone thickening cervical mucus and thinning endometrium

(iv) Surgical methods (sterilization):

- *Vasectomy* (males): Cutting/tying vas deferens to block sperm transport; testosterone production unaffected
- *Tubectomy* (females): Cutting/tying fallopian tubes to prevent ovum-sperm meeting; ovarian function continues

(v) Natural methods:

- *Rhythm method*: Avoiding intercourse during fertile window (days 10-17 of cycle)
- *Withdrawal*: Withdrawing penis before ejaculation (less reliable)

Importance of family planning:

- (i) Controls population growth by spacing births and limiting family size
- (ii) Improves maternal/child health through adequate recovery time between pregnancies
- (iii) Empowers women with reproductive choices enhancing education/economic opportunities
- (iv) Reduces poverty by enabling families to invest more resources per child
- (v) Contributes to sustainable development and resource management at national level

Reference: NCERT Class 10 Science, Chapter 7, Pages 140-141

Q7. Explain the process of fertilization and development of embryo in human beings. What is the role of placenta? (5 marks)

Solution:

Fertilization [[NCERT Pg 140]]:

- (i) During intercourse, ≈ 200 -300 million sperms deposited in vagina travel through cervix and uterus into fallopian tubes
- (ii) Only few hundred reach ampulla region where ovum (if present) is located
- (iii) One sperm penetrates ovum's protective layers (corona radiata, zona pellucida) using enzymes from acrosome
- (iv) Sperm nucleus fuses with ovum nucleus $\rightarrow$ diploid zygote (46 chromosomes) formed
- (v) Fertilization triggers cortical reaction preventing polyspermy (entry of multiple sperms)

Embryo development:

- (i) Cleavage: Zygote undergoes rapid mitotic divisions without growth $\rightarrow$ forms morula (solid ball of 16 cells) within 3-4 days
- (ii) Blastulation: Morula develops fluid-filled cavity $\rightarrow$ blastocyst (≈ 100 cells) with:

- *Trophoblast*: Outer cell layer forming placenta

- *Inner cell mass*: Develops into embryo

(iii) Implantation: Blastocyst reaches uterus $\approx$ 6-7 days after fertilization; trophoblast embeds into endometrium

(iv) Gastrulation: Inner cell mass forms three germ layers (ectoderm, mesoderm, endoderm) giving rise to all tissues/organs

(v) Organogenesis: By end of 8 weeks, all major organs formed; developing human called fetus

Role of placenta [[NCERT Pg 140]]:

- Structure: Disc-shaped organ with finger-like villi (embryo side) surrounded by maternal blood spaces
- Functions:
 - (a) *Nutrient/waste exchange*: Oxygen/glucose/amino acids diffuse from mother to embryo; CO₂/urea diffuse from embryo to mother
 - (b) *Hormone production*: Secretes hCG (maintains corpus luteum early in pregnancy), progesterone, estrogen
 - (c) *Barrier*: Prevents mixing of maternal/fetal blood while allowing selective material transfer; blocks some pathogens/toxins (not all—e.g., alcohol, viruses cross)
- Duration: Fully functional by end of first trimester; expelled after birth as "afterbirth"

Gestation period: $\approx$ 280 days (40 weeks) from LMP to birth; divided into three trimesters with distinct developmental milestones.

Reference: NCERT Class 10 Science, Chapter 7, Page 140

Q8. What is vegetative propagation? Describe natural and artificial methods with examples. State advantages and disadvantages. (5 marks)

Solution:

Vegetative propagation is asexual reproduction in plants where new individuals develop from vegetative parts (roots, stems, leaves) without seeds, spores, or gamete fusion. Offspring are genetically identical clones of parent. [[NCERT Pg 132]]

Natural methods (occur without human intervention):

(i) Runners/Stolons: Horizontal above-ground stems producing new plants at nodes (e.g., *Grass*, *Strawberry*)

(ii) Tubers: Swollen underground stems storing food with "eyes" (buds) sprouting new plants (e.g., *Potato*) [[NCERT Pg 132, Fig 7.4]]

(iii) Bulbs: Short underground stems with fleshy leaves storing food; lateral buds form new bulbs (e.g., *Onion*, *Garlic*)

(iv) Rhizomes: Horizontal underground stems with nodes producing shoots/roots (e.g., *Ginger*, *Turmeric*)

(v) Leaf buds: Adventitious buds on leaf margins developing into plantlets (e.g., *Bryophyllum*) [[NCERT Pg 132]]

(vi) Root tubers: Roots with adventitious buds (e.g., *Sweet potato*, *Dahlia*)

Artificial methods (human-assisted):

(i) Cutting: Stem/leaf/root piece planted to develop roots/shoots (e.g., *Rose*, *Sugarcane*, *Money plant*)

(ii) Layering: Bending stem to ground, covering node with soil while attached to parent; roots develop before separation (e.g., *Jasmine*, *Strawberry*)

(iii) Grafting: Scion (desired variety shoot) attached to stock (rooted plant); vascular tissues fuse (e.g., *Mango*, *Apple*, *Rose*) [[NCERT Pg 133]]

(iv) Tissue culture: Growing plantlets from cells/tissues in sterile nutrient medium (e.g., *Orchids*, disease-free *Banana*)

Advantages:

- Preserves exact parental traits (desirable fruit quality, flower color, disease resistance)
- Faster than seed propagation; plants mature and bear fruits earlier
- Useful for plants with poor seed viability (e.g., *Seedless grapes*, *Banana*)
- Enables mass production of uniform plants

Disadvantages:

- No genetic variation → entire crop vulnerable to diseases/environmental changes
- Accumulation of viral diseases over generations (solved by tissue culture)
- Some methods require skill/expertise (e.g., grafting)

Significance: Widely used in agriculture/horticulture for commercial crop production and preservation of elite varieties.

Reference: NCERT Class 10 Science, Chapter 7, Pages 132-133

Q9. Why is DNA copying important in reproduction? Explain how variations arise during DNA copying and their significance in evolution. (5 marks)

Solution:

Importance of DNA copying in reproduction [[NCERT Pg 128, Para 1]]:

- (i) Genetic continuity: DNA contains hereditary information determining organism's body design and functions. Copying ensures this information transfers from parents to offspring, maintaining species characteristics across generations.
- (ii) Basis for cell division: Before reproduction (asexual or sexual), DNA must duplicate so each daughter cell receives complete genetic material.
- (iii) Foundation for variations: Imperfect copying introduces changes (mutations) providing raw material for evolution.

How variations arise during DNA copying:

- (i) Errors in replication: DNA polymerase occasionally incorporates wrong nucleotide; though proofreading corrects most, some errors persist as mutations
- (ii) Environmental factors: Radiation (UV, X-rays), chemicals (mutagens) cause DNA damage altering base sequence
- (iii) Meiosis (in sexual reproduction):
 - *Crossing over*: Homologous chromosomes exchange segments during prophase I creating new gene combinations
 - *Independent assortment*: Random alignment of chromosome pairs at metaphase I produces 2^{23} (8 million) possible gamete combinations in humans
 - *Random fertilization*: Fusion of any sperm (8 million possibilities) with any ovum (8 million) yields 64 trillion possible zygote combinations

Significance of variations in evolution [[NCERT Pg 128, Para 1]]:

- (i) Natural selection: In changing environments, individuals with beneficial variations survive better and reproduce more ("survival of fittest"). Example: Peppered moth—dark variant survived better on soot-covered trees during industrial revolution.
- (ii) Adaptation: Accumulation of favorable variations over generations enables populations to adapt to specific habitats (e.g., camel's hump for desert survival).
- (iii) Speciation: Prolonged accumulation of variations in isolated populations leads to formation of new species unable to interbreed with ancestors.

(iv) Disease resistance: Genetic diversity ensures some individuals may possess resistance to pathogens (e.g., HIV resistance due to CCR5-Δ32 mutation), preventing species extinction.

Balance: While most variations are neutral/harmful, rare beneficial ones drive evolutionary progress. Sexual reproduction accelerates variation generation compared to asexual reproduction, explaining its prevalence in complex organisms.

Reference: NCERT Class 10 Science, Chapter 7, Page 128

Q10. Compare asexual and sexual reproduction with respect to: number of parents, gamete formation, genetic variation, speed of reproduction, and evolutionary significance. Give one example of each. (5 marks)

Solution:

Parameter	Asexual Reproduction	Sexual Reproduction
Number of parents	Single parent involved	Two parents (male & female) involved
Gamete formation	No gametes formed or fused	Involves formation and fusion of male/female gametes
Genetic variation	Offspring genetically identical to parent (clones); variations only through mutations	Offspring genetically diverse due to meiosis (crossing over, independent assortment) and random fertilization
Speed of reproduction	Rapid population increase; no mate search required; favorable in stable environments	Slower due to mate finding, courtship, gestation; energy-intensive
Evolutionary significance	Limited adaptability; entire population vulnerable to environmental changes/diseases	Generates variations providing raw material for natural selection and evolution; enhances species survival in changing environments

Examples:

- Asexual: *Amoeba* reproduces by binary fission—single parent divides into two identical daughter cells [[NCERT Pg 128-129]]
- Sexual: Humans—sperm from male fuses with ovum from female forming genetically unique zygote [[NCERT Pg 137-140]]

Additional points:

- Asexual reproduction common in unicellular organisms (bacteria, protozoa), simple multicellular organisms (hydra, planaria), and plants (vegetative propagation)
- Sexual reproduction dominant in complex multicellular organisms (animals, flowering plants) despite energy cost because long-term evolutionary benefits outweigh disadvantages
- Some organisms use both strategies (e.g., *Spirogyra*—vegetative fragmentation in favorable conditions; conjugation/spore formation in stress)

Conclusion: Asexual reproduction efficient for rapid colonization; sexual reproduction advantageous for long-term species survival through genetic diversity. Most complex organisms evolved sexual reproduction despite costs because benefits for adaptation/evolution are crucial in dynamic environments.

Reference: NCERT Class 10 Science, Chapter 7, Pages 128-140

Q11. Describe the structure of a bisexual flower with labeled diagram. Explain the significance of colorful petals and fragrant scent in flowers. (5 marks)

Solution:

[Diagram description for 1.5 marks]

Essential parts to label:

- Male reproductive part: Stamen = Anther (produces pollen) + Filament (stalk)
- Female reproductive part: Carpel/Pistil = Stigma (receives pollen) + Style (tube) + Ovary (contains ovules)
- Accessory parts: Petals (corolla), Sepals (calyx), Receptacle (base)

Structure of bisexual flower [[NCERT Pg 134, Fig 7.6]]:

(i) Sepals (Calyx): Outermost whorl; green leaf-like structures protecting flower bud before opening

(ii) Petals (Corolla): Inner to sepals; usually colorful and fragrant to attract pollinators

(iii) Stamens (Androecium): Male reproductive organs arranged in whorl inside petals

- *Filament*: Slender stalk supporting anther
 - *Anther*: Bilobed structure producing pollen grains containing male gametes
- (iv) Carpel/Pistil (Gynoecium): Central female reproductive organ (single or multiple fused carpels)
- *Stigma*: Sticky/feathery tip receiving pollen grains
 - *Style*: Slender stalk connecting stigma to ovary
 - *Ovary*: Swollen base containing one or more ovules (each with female gamete/egg)

Significance of colorful petals and fragrant scent:

These are adaptations for cross-pollination by biotic agents (insects, birds, bats):

(i) Attraction: Bright colors (especially UV patterns invisible to humans but visible to bees) and sweet fragrances attract pollinators from distance

(ii) Reward association: Nectar/pollen rewards reinforce pollinator visits; scent guides them to nectar source

(iii) Pollinator specificity: Flower traits co-evolved with specific pollinators:

- *Bees*: Prefer blue/yellow flowers with sweet scent (e.g., *Sunflower*)
- *Butterflies*: Attracted to red/pink flowers with landing platform (e.g., *Lantana*)
- *Moths*: White/pale flowers with strong night fragrance (e.g., *Jasmine*)
- *Birds*: Red/orange tubular flowers with copious nectar (e.g., *Hibiscus*)

(iv) Genetic diversity: Cross-pollination facilitated by these adaptations brings together genetic material from different plants, increasing variation essential for evolution [[NCERT Pg 135]]

Contrast with wind-pollinated flowers: Lack petals/fragrance; have exposed anthers and feathery stigmas to catch airborne pollen (e.g., *Grass*, *Maize*).

Reference: NCERT Class 10 Science, Chapter 7, Pages 134-135

Q12. What is puberty? Describe physical and hormonal changes occurring during puberty in males and females. (5 marks)

Solution:

Puberty is the period during adolescence when reproductive organs become functionally active and secondary sexual characteristics develop, marking transition from childhood to reproductive maturity. Triggered by hormonal changes from hypothalamus-pituitary-gonadal axis. [[NCERT Pg 137, 139]]

Puberty in males (typically begins 13-14 years):

Hormonal changes:

- Hypothalamus releases GnRH → pituitary secretes FSH and LH
- LH stimulates Leydig cells in testes to secrete testosterone
- FSH + testosterone stimulate spermatogenesis in seminiferous tubules

Physical changes:

- (i) Growth of testes, scrotum, and penis
- (ii) Sperm production begins (first ejaculation ≈13-15 years)
- (iii) Development of facial hair (beard, moustache), chest/axillary/pubichair
- (iv) Voice deepening due to larynx enlargement ("Adam's apple")
- (v) Muscle mass increase and shoulder broadening
- (vi) Occasional acne due to increased sebaceous gland activity

Puberty in females (typically begins 10-12 years, earlier than males):

Hormonal changes:

- Hypothalamus releases GnRH → pituitary secretes FSH and LH
- FSH stimulates follicle development and estrogen secretion from ovaries
- LH triggers ovulation and progesterone secretion from corpus luteum
- Menarche (first menstruation) occurs ≈2 years after breast development begins

Physical changes:

- (i) Breast development (thelarche—usually first sign)
- (ii) Growth of pubic and axillary hair
- (iii) Widening of hips and fat deposition in thighs/buttocks
- (iv) Onset of menstruation (menarche) and ovulation
- (v) Uterus, fallopian tubes, and vagina enlarge

(vi) Skin becomes oilier; occasional acne

Common changes in both sexes:

- Growth spurt (rapid increase in height/weight)
- Development of pubic/axillary hair
- Increased activity of sweat and sebaceous glands
- Emotional/psychological changes due to hormonal fluctuations

Significance: Puberty prepares body for reproduction; timing varies genetically and nutritionally (better nutrition → earlier puberty). Completion marked by regular menstrual cycles in females and consistent sperm production in males.

Reference: NCERT Class 10 Science, Chapter 7, Pages 137, 139

Q13. Explain the process of budding in yeast and hydra. How does it differ from binary fission? (5 marks)

Solution:

Budding in Yeast (unicellular fungus) [[NCERT Pg 130, Fig 7.3]]:

- (i) Small bulge (bud) appears on parent cell surface due to unequal cytokinesis
- (ii) Parent nucleus undergoes mitosis; one daughter nucleus moves into bud
- (iii) Bud grows in size while attached to parent
- (iv) Separation: Bud may detach to form independent new individual OR remain attached forming chain/clusters (pseudomycelium)
- (v) Process repeats rapidly under favorable conditions (sugar solution, warmth)
- (vi) Genetic outcome: Offspring genetically identical to parent (clone)

Budding in Hydra (multicellular cnidarian) [[NCERT Pg 130]]:

- (i) Small outgrowth forms on parent body wall due to repeated mitotic divisions of regenerative cells
- (ii) Bud develops tentacles and mouth at free end while attached to parent
- (iii) Bud grows in size; digestive cavity connects with parent's cavity for nutrition
- (iv) Separation: Bud detaches when fully developed to become independent organism
- (v) Sometimes buds remain attached forming temporary colonies before detaching

(vi) Genetic outcome: Offspring genetically identical to parent

Differences between budding and binary fission:

Parameter	Budding	Binary Fission
Division pattern	Unequal cytokinesis; small bud forms on parent	Equal cytokinesis; parent divides into two nearly equal halves
Parent identity	Parent persists after bud detachment	Parent ceases to exist; becomes two new individuals
Speed	Slower; bud requires time to grow before separation	Faster; division completes in single step
Examples	Yeast (unicellular), Hydra (multicellular)	Amoeba, Leishmania (unicellular only)
Visibility	Bud visible as protrusion before separation	No intermediate stage; division appears instantaneous

Significance: Both are asexual reproduction methods producing clones. Budding allows parent to continue functioning while producing offspring—advantageous in stable environments. Binary fission enables rapid population doubling (e.g., bacteria every 20 minutes under ideal conditions).

Reference: NCERT Class 10 Science, Chapter 7, Page 130

Q14. What is the need for reproductive health services? Describe measures for improving reproductive health in society. (5 marks)

Solution:

Need for reproductive health services [[NCERT Pg 140-141]]:

(i) Population control: Unchecked population growth strains resources (food, water, housing, education); family planning services help achieve sustainable development

(ii) Maternal/infant mortality reduction: Proper antenatal care, skilled birth attendance, and postnatal services prevent deaths during pregnancy/childbirth (India's MMR still 97/100,000 live births—NFHS-5)

(iii) STI/HIV prevention: Awareness and access to barrier contraceptives reduce transmission of sexually transmitted infections including HIV/AIDS

(iv) Adolescent health: 21% of India's population is 10-19 years; they need accurate information about puberty, safe sex, and consent to prevent early pregnancies/STIs

(v) Gender equality: Reproductive autonomy empowers women to pursue education/careers; reduces child marriage and domestic violence

(vi) Genetic disorder prevention: Pre-marital counseling and prenatal screening help prevent congenital abnormalities

Measures for improving reproductive health:

(i) Education and awareness:

- Comprehensive sex education in schools covering anatomy, consent, contraception, STI prevention
- Mass media campaigns (TV, radio, social media) in regional languages
- Community workshops by ASHA workers addressing myths/misconceptions

(ii) Healthcare infrastructure:

- Increase availability of PHCs/CHCs with trained gynecologists and obstetricians
- Free/subsidized contraceptives (condoms, pills, IUDs) at government facilities
- Mobile health clinics for rural/remote areas

(iii) Legal framework:

- Enforce PCPNDT Act preventing sex-selective abortions
- Implement POCSO Act protecting children from sexual abuse
- Raise legal marriage age to 21 for both sexes (proposed) to prevent early pregnancies

(iv) Empowerment programs:

- Promote girls' education (each additional year of schooling reduces fertility by 0.2-0.3 births)
- Economic opportunities for women enabling reproductive choices
- Engage men/boys in conversations about shared responsibility

(v) Technology integration:

- Telemedicine consultations for antenatal care in underserved areas
- mHealth apps for menstrual cycle tracking and contraceptive reminders
- HPV vaccination programs preventing cervical cancer

Government initiatives in India:

- Mission Parivar Vikas (high fertility districts)
- Pradhan Mantri Surakshit Matritva Abhiyan (free antenatal checkups)
- National AIDS Control Programme (NACP)

Conclusion: Reproductive health is fundamental human right linked to SDG 3 (good health) and SDG 5 (gender equality). Holistic approach combining education, healthcare access, legal protection, and social empowerment yields sustainable improvements.

Reference: NCERT Class 10 Science, Chapter 7, Pages 140-141

Q15. Describe the structure and function of human sperm and ovum. How are they adapted for their roles in reproduction? (5 marks)

Solution:

Human Sperm (Spermatozoon) [[NCERT Pg 137]]:

Structure:

- Head:
 - *Acrosome*: Cap-like structure containing hydrolytic enzymes (hyaluronidase, proteases) to digest ovum's protective layers during fertilization
 - *Nucleus*: Contains haploid set of 23 chromosomes (22 autosomes + X or Y sex chromosome)
- Middle piece:
 - Packed with mitochondria spirally arranged around axial filament
 - Produces ATP for tail movement
- Tail (Flagellum):
 - Long, whip-like structure with microtubules in 9+2 arrangement
 - Propels sperm through female tract via lashing movements

Adaptations for function:

(i) Streamlined shape reduces drag for efficient swimming

(ii) Mitochondria-rich middle piece provides sustained energy for long journey (≈15-18 cm from vagina to fallopian tube)

(iii) Acrosomal enzymes enable penetration of ovum's barriers

(iv) Haploid nucleus ensures diploid zygote after fusion with ovum

(v) Millions produced (≈ 100 million/ejaculation) compensating for high mortality during journey

Human Ovum (Egg) [[NCERT Pg 138]]:

Structure:

- Size: Largest human cell (≈ 0.1 mm diameter); visible to naked eye
- Cytoplasm: Rich in nutrients (yolk/albumen) providing energy for early embryonic development before implantation
- Nucleus: Contains haploid set of 23 chromosomes (22 autosomes + X chromosome only)
- Protective layers:
 - *Zona pellucida*: Thick glycoprotein layer surrounding plasma membrane; species-specific sperm receptor
 - *Corona radiata*: Outer layer of follicle cells adhering to zona pellucida after ovulation

Adaptations for function:

(i) Large size stores nutrients for zygote's first week before placental connection

(ii) Haploid nucleus ensures diploid zygote after sperm fusion

(iii) Zona pellucida prevents polyspermy (entry of multiple sperms) via cortical reaction after first sperm entry

(iv) Chemical attractants (chemotaxis) guide sperms toward ovum in fallopian tube

(v) Limited number produced (≈ 400 mature ova in lifetime) reflects high investment per gamete

Key differences reflecting reproductive strategies:

Sperm	Ovum
Small, motile, numerous	Large, non-motile, few
Minimal cytoplasm/nutrients	Abundant cytoplasm/nutrients
Produced continuously after puberty	Produced cyclically (one/month)

Energy for movement	Energy for early development
"Quantity strategy"	"Quality strategy"

Significance: Complementary adaptations ensure successful fertilization—sperm's motility reaches ovum; ovum's nutrients support early development until implantation. Haploid nature of both maintains species chromosome number across generations.

Reference: NCERT Class 10 Science, Chapter 7, Pages 137-138

Q16. Explain regeneration in *Planaria* and *Spirogyra*. Why is regeneration considered a form of asexual reproduction in some organisms but not in others? (5 marks)

Solution:

Regeneration in *Planaria* (flatworm) [[NCERT Pg 131]]:

- (i) *Planaria* possesses abundant neoblasts—pluripotent stem cells distributed throughout body
- (ii) When cut into pieces (even 1/279th fragment), neoblasts near wound site:
 - Proliferate rapidly through mitosis
 - Differentiate into required cell types (nerve, muscle, epidermal)
 - Reorganize to form missing structures (head/tail polarity maintained by Wnt signaling)
- (iii) Complete regeneration takes $\approx$ 2-3 weeks depending on fragment size/temperature
- (iv) Reproductive significance: Each fragment develops into complete new organism → regeneration serves as mode of asexual reproduction

Regeneration in *Spirogyra* (filamentous alga) [[NCERT Pg 130]]:

- (i) *Spirogyra* consists of unbranched filaments of cylindrical cells
- (ii) Filament breaks due to mechanical stress/water currents → fragmentation
- (iii) Each fragment containing at least one living cell:
 - Undergoes mitotic divisions at broken ends

- Elongates to form complete new filament

(iv) Reproductive significance: Fragmentation is deliberate reproductive strategy; regeneration of broken ends completes reproduction process

Why regeneration $\neq$ reproduction in all organisms:

Regeneration is primarily a repair mechanism to replace lost/damaged body parts. It becomes asexual reproduction only when:

- The lost fragment itself develops into a complete new organism
- This occurs in organisms with high regenerative capacity and simple body organization

Examples where regeneration = reproduction:

- *Planaria*: Body fragments $\rightarrow$ complete worms
- *Hydra*: Body pieces $\rightarrow$ new hydras
- *Spirogyra*: Filament fragments $\rightarrow$ new filaments

Examples where regeneration $\neq$ reproduction:

- Lizard: Regrows lost tail but tail fragment cannot form new lizard $\rightarrow$ repair only
- Starfish: Some species regenerate whole body from single arm with central disc portion; others only regrow arms $\rightarrow$ context-dependent
- Humans: Liver regenerates after partial hepatectomy; skin heals wounds; but lost limbs/organs cannot regenerate $\rightarrow$ repair only

Key determining factors:

(i) Distribution of stem cells: Organisms with pluripotent cells throughout body (e.g., *Planaria*) regenerate better than those with localized stem cells

(ii) Body complexity: Simple organisms (few cell types, no organ systems) regenerate more completely than complex organisms

(iii) Evolutionary adaptation: Regeneration evolved primarily for survival after injury; reproductive use is secondary adaptation in some lineages

Conclusion: Regeneration's classification depends on outcome—repair of self vs. production of new individual. In NCERT context, *Planaria* regeneration is taught as reproductive method because fragments form complete organisms, unlike lizard tail regrowth.

Reference: NCERT Class 10 Science, Chapter 7, Pages 130-131

Q17. What is pollination? Describe types of pollination and agents involved. How does the plant prevent self-pollination? (5 marks)

Solution:

Pollination is the transfer of pollen grains from anther (male part) to stigma (female part) of a flower. It precedes fertilization and is essential for sexual reproduction in seed plants. [[NCERT Pg 135]]

Types of pollination:

(i) Self-pollination:

- Pollen transfer within same flower (autogamy) or between flowers of same plant (geitonogamy)
- Advantages:
 - No dependence on external agents; occurs even in isolation
 - Preserves well-adapted parental traits in stable environments
- Disadvantages:
 - No genetic variation → reduced adaptability to environmental changes
 - Accumulation of deleterious recessive alleles (inbreeding depression)
- Examples: Pea, wheat, tomatoes (cleistogamous flowers never open, ensuring self-pollination)

(ii) Cross-pollination:

- Pollen transfer between flowers of different plants of same species
- Advantages:
 - Generates genetic diversity through recombination
 - Enhances adaptability and evolutionary potential
 - Masks deleterious mutations through heterosis (hybrid vigor)
- Disadvantages:
 - Requires pollinating agents; fails if agents absent
 - Energy cost for producing attractants (nectar, scent, color)
- Examples: Apple, pumpkin, sunflower

Pollinating agents:

Agent	Flower adaptations	Examples
Insects (Entomophily)	Bright petals, sweet scent, nectar guides, landing platform	Rose, Jasmine, Sunflower

Wind (Anemophily)	Small/no petals, exposed anthers, feathery stigma, lightweight abundant pollen	Grass, Maize, Oak
Water (Hydrophily)	Long pollen strands, reduced perianth	Vallisneria, Hydrilla
Birds (Ornithophily)	Red/orange tubular flowers, copious nectar, no scent	Hibiscus, Coral tree
Bats (Chiropterophily)	Large pale flowers, strong musty scent, night blooming	Banana, Agave

Mechanisms preventing self-pollination (promoting cross-pollination):

(i) Dichogamy: Anther and stigma mature at different times

- *Protandry*: Anthers mature first (e.g., Sunflower)

- *Protogyny*: Stigma receptive first (e.g., Fig)

(ii) Self-incompatibility: Biochemical block preventing pollen germination on same plant's stigma (e.g., Tobacco)

(iii) Unisexual flowers: Male and female flowers separate (monoecious: maize; dioecious: papaya)

(iv) Herkogamy: Spatial separation of anther and stigma within same flower (e.g., Gloriosa—stigma positioned above anthers)

(v) Cleistogamy avoidance: Some plants produce both cleistogamous (self-pollinating) and chasmogamous (cross-pollinating) flowers depending on conditions

Significance: While self-pollination ensures seed set in isolation, cross-pollination predominates in nature due to evolutionary advantages of genetic diversity. Plants often employ mixed strategies—self-pollination as "reproductive assurance" when cross-pollination fails.

Reference: NCERT Class 10 Science, Chapter 7, Page 135

Q18. Describe the process of embryo development from zygote to fetus in humans. What precautions should be taken during pregnancy? (5 marks)

Solution:

Embryo development timeline [[NCERT Pg 140]]:

Week 1 (Fertilization to Implantation):

- Day 1: Fertilization in fallopian tube → zygote formation
- Days 2-3: Cleavage divisions → morula (16-cell solid ball)
- Day 4-5: Blastocyst formation (fluid-filled cavity; inner cell mass + trophoblast)
- Day 6-7: Implantation into uterine endometrium; trophoblast forms chorionic villi

Weeks 2-4 (Gastrulation and Organogenesis initiation):

- Week 2: Bilaminar disc (epiblast + hypoblast); amniotic cavity forms
- Week 3: Gastrulation → three germ layers form:
 - *Ectoderm*: Nervous system, skin epidermis, sense organs
 - *Mesoderm*: Muscles, bones, circulatory system, kidneys
 - *Endoderm*: Digestive tract lining, liver, pancreas, lungs
- Week 4: Neural tube (future brain/spinal cord) forms; heart begins beating (day 22); limb buds appear

Weeks 5-8 (Major organ formation):

- Week 5: Eyes, ears begin developing; hand/foot plates form
- Week 6: Brain develops rapidly; fingers/toes visible
- Week 7: Elbows/knees distinct; palate forms
- Week 8: All major organs formed; embryo now called fetus; tail disappears; external genitalia begin differentiation

Months 3-9 (Fetal growth and maturation):

- Month 3: Sex distinguishable; bones begin ossification; spontaneous movements
- Month 4: Quickening (mother feels movements); vernix caseosa (protective coating) forms
- Month 5: Lanugo (fine hair) covers body; sucking reflex develops
- Month 6: Eyebrows/lashes visible; lungs produce surfactant (critical for breathing)
- Month 7: Viability outside womb possible with intensive care; eyes open
- Month 8: Rapid brain development; fat deposition under skin
- Month 9: Lungs fully mature; fetus positions head-down for birth; average weight 3-3.5 kg

Precautions during pregnancy:

(i) Nutrition:

- Balanced diet rich in proteins, iron, calcium, folic acid (prevents neural tube defects)
- Avoid alcohol (causes fetal alcohol syndrome), excess caffeine, raw fish/meat (listeria risk)
- Prenatal vitamins as prescribed

(ii) Healthcare:

- Regular antenatal checkups (blood pressure, weight, fetal heartbeat monitoring)
- Ultrasound scans at 12, 20, and 32 weeks to monitor development
- Tetanus toxoid vaccination; treat infections promptly

(iii) Lifestyle:

- Avoid smoking (low birth weight, preterm birth) and secondhand smoke
- Moderate exercise (walking, prenatal yoga); avoid heavy lifting/contact sports
- Adequate rest (7-9 hours sleep); manage stress through meditation

(iv) Environmental:

- Avoid X-rays/radiation exposure; limit chemical exposure (pesticides, paints)
- Prevent infections: Wash hands frequently; avoid cat litter (toxoplasmosis risk)

(v) Warning signs requiring immediate medical attention:

- Vaginal bleeding, severe abdominal pain
- Sudden swelling of face/hands (pre-eclampsia sign)
- Decreased fetal movements after 28 weeks
- Fluid leakage (possible premature rupture of membranes)

Significance: First trimester most critical for organ formation; teratogens (alcohol, drugs, infections) cause maximum damage during weeks 3-8. Proper prenatal care reduces maternal/infant mortality and ensures healthy child development.

Reference: NCERT Class 10 Science, Chapter 7, Page 140

Q19. What are sexually transmitted infections (STIs)? Name four STIs and their causative agents. How can STIs be prevented? (5 marks)

Solution:

Sexually Transmitted Infections (STIs) are infections spread primarily through sexual contact (vaginal, anal, oral) involving exchange of bodily fluids (semen, vaginal secretions, blood) or skin-to-skin contact with infected areas. Some STIs can also transmit via blood transfusion, shared needles, or mother-to-child during pregnancy/delivery/breastfeeding. [[NCERT implied in Pg 141 re: condom use]]

Four STIs with causative agents:

STI	Causative Agent	Type	Key Symptoms
Gonorrhea	<i>Neisseria gonorrhoeae</i> (bacterium)	Bacterial	Painful urination, pus discharge from genitals; pelvic inflammatory disease (PID) in females
Syphilis	<i>Treponema pallidum</i> (bacterium)	Bacterial	Painless chancre sore (primary stage); rash, fever (secondary); organ damage if untreated (tertiary)
Genital Herpes	Herpes Simplex Virus type 2 (HSV-2)	Viral	Painful blisters/ulcers on genitals; recurrent outbreaks triggered by stress/immunosuppression
HIV/AIDS	Human Immunodeficiency Virus (HIV)	Viral	Flu-like illness initially; years later—opportunistic infections, cancers due to CD4+ T-cell depletion

Additional important STIs:

- *Chlamydia*: *Chlamydia trachomatis* (bacterium)—most common bacterial STI; often asymptomatic but causes PID/infertility

- *Trichomoniasis*: *Trichomonas vaginalis* (protozoan)—frothy yellow-green discharge, itching
- *HPV*: Human Papillomavirus—genital warts; high-risk types cause cervical/oral cancers
- *Hepatitis B*: HBV virus—liver inflammation; vaccine available

Prevention of STIs:

(i) Barrier protection:

- Consistent condom use (male/female) during all sexual acts reduces STI transmission by 80-95%
- Dental dams for oral sex

(ii) Vaccination:

- HPV vaccine (Gardasil/Cervarix) prevents cervical cancer-causing strains
- Hepatitis B vaccine (part of universal immunization)

(iii) Behavioral strategies:

- Mutual monogamy with uninfected partner
- Limiting number of sexual partners
- Avoiding sex under influence of alcohol/drugs (impairs judgment)

(iv) Testing and treatment:

- Regular STI screening especially before new relationships/pregnancy
- Prompt treatment of infections (bacterial STIs curable with antibiotics; viral STIs manageable but not curable)
- Partner notification and treatment to prevent reinfection

(v) Education and awareness:

- Comprehensive sex education covering STI transmission/prevention
- Destigmatizing STI testing/treatment to encourage early care

Special note on HIV prevention:

- Pre-exposure prophylaxis (PrEP) for high-risk individuals
- Post-exposure prophylaxis (PEP) within 72 hours of exposure
- Prevention of mother-to-child transmission (PMTCT) with antiretrovirals during pregnancy/delivery

Why prevention matters: Untreated STIs cause infertility (PID from chlamydia/gonorrhea), ectopic pregnancy, chronic pelvic pain, cancers (HPV), and

increased HIV susceptibility. Early detection and treatment prevent complications and further transmission.

Reference: NCERT Class 10 Science, Chapter 7, Page 141 (condom as STI prevention)

Q20. Explain how reproduction contributes to stability of populations and species continuity. Why is variation during reproduction important for survival of species? (5 marks)

Solution:

Reproduction and population stability [[NCERT Pg 127]]:

(i) Replacement of deaths: Organisms have finite lifespans; reproduction replaces individuals lost to aging, predation, disease, or accidents, maintaining relatively constant population size over time

(ii) Carrying capacity balance: Birth rates typically adjust to environmental resources—high mortality triggers increased reproduction (e.g., r-strategists like insects); stable environments favor lower birth rates with higher parental care (K-strategists like elephants)

(iii) Age structure maintenance: Continuous reproduction ensures presence of all age groups (juveniles, adults, seniors), preventing population collapse from aging

(iv) Genetic reservoir: Large reproducing populations maintain genetic diversity buffer against environmental stochasticity (random events like fires/floods)

Reproduction and species continuity:

(i) Genetic transmission: DNA copying during reproduction transfers hereditary information across generations, preserving species-defining characteristics (body plan, physiology, behavior)

(ii) Life cycle completion: Reproduction is final stage of individual life cycle; without it, species would cease within one generation despite individual survival

(iii) Habitat colonization: Reproductive output enables species expansion into new territories (e.g., dandelion seeds dispersed by wind colonizing disturbed areas)

(iv) Evolutionary persistence: Species surviving mass extinctions did so through reproduction adapting to post-catastrophe environments

Importance of variation during reproduction [[NCERT Pg 128, Para 1]]:

Variations arise from:

- Imperfect DNA copying (mutations)
- Genetic recombination during meiosis (crossing over, independent assortment)
- Random fertilization combining diverse gametes

Why variations crucial for species survival:

(i) Environmental change adaptation:

- Static environments favor uniformity; changing environments favor diversity
- Example: During ice age, mammals with thicker fur variants survived better; these traits became dominant through natural selection

(ii) Disease resistance:

- Pathogens evolve rapidly; genetically uniform populations vulnerable to epidemics
- Example: Panama disease wiped out Gros Michel banana monocultures (1950s); Cavendish variety now threatened similarly due to clonal propagation
- Sexual reproduction in wild bananas maintains resistance genes absent in cultivated clones

(iii) Resource competition:

- Variations create niche differentiation reducing intraspecific competition
- Example: Darwin's finches—beak size variations allowed different species to exploit distinct food sources on Galápagos Islands

(iv) Evolutionary innovation:

- Accumulated variations over generations lead to speciation
- Example: Tetrapod limb variations enabled transition from aquatic to terrestrial life (lobe-finned fish → amphibians)

(v) Extinction avoidance:

- IUCN data shows genetically diverse populations have 30% lower extinction risk
- Cheetahs suffered historical bottleneck; low genetic diversity increases cub mortality and disease susceptibility today

Balance between stability and variation:

- Asexual reproduction: Maximizes short-term population growth in stable environments but risks extinction if conditions change
- Sexual reproduction: Slower population growth but long-term survival advantage through variation generation

- Most complex organisms evolved sexual reproduction despite costs because Earth's environments are dynamic over geological time

Conclusion: Reproduction ensures numerical continuity of populations; variation during reproduction ensures qualitative adaptability of species. Together they enable life's persistence on Earth for 3.5 billion years despite mass extinctions, climate shifts, and asteroid impacts. As NCERT states: "The consistency of DNA copying is important for stability, while variations are necessary for evolution."

Reference: NCERT Class 10 Science, Chapter 7, Pages 127-128