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NCERT Exemplar Solutions

Solved NCERT Exemplar Problems for Class 12th Biology, Chapter 3

Chapter 3: Reproductive Health

About this Chapter

This chapter looks at what it means for a society to be **reproductively healthy**: total well-being in the physical, emotional and social aspects of reproduction. We work through every NCERT Exemplar problem on **contraception**, Medical Termination of Pregnancy, Sexually Transmitted Diseases and **Assisted Reproductive Technologies**. Each solution states the underlying biology in full, so you can answer the same idea whatever way the exam frames it.

Topics covered: Reproductive health & RCH programme • Population stabilisation • Contraceptive methods • MTP • STDs • Infertility & ART (IVF, ZIFT, GIFT, ICSI)

Quick Formula Sheet

ART quick map:
IVF → fertilisation outside body, embryo to uterus

ZIFT vs GIFT:
ZIFT = zygote/early embryo to fallopian tube;
GIFT = gamete(s) to fallopian tube

ICSI:
one sperm injected directly into the ovum

Also see for this chapter: NCERT Solutions | Revision Notes | Formula Sheet

NCERT Exemplar Problems

Multiple-Choice Questions

Q 3.1 **The method of directly injecting a sperm into ovum in Assisted Reproductive Technology is called:**

(a) GIFT

(b) ZIFT

(c) ICSI

(d) ET

SOLUTION

Correct option: (c) ICSI.

Concept used. **Assisted Reproductive Technologies (ART)** are clinical methods that help infertile couples have a child. Each named technique differs only in *what* is transferred and *where* it is placed:

- **ICSI** (Intra Cytoplasmic Sperm Injection): a single sperm is injected directly into the cytoplasm of the ovum to form the zygote in the laboratory.
- **GIFT** (Gamete Intra Fallopian Transfer): an ovum collected from a donor is transferred into the fallopian tube of another female who cannot produce ova.
- **ZIFT** (Zygote Intra Fallopian Transfer): the zygote or early embryo (up to 8 blastomeres) is transferred into the fallopian tube.
- **ET** (Embryo Transfer): an embryo of more than 8 blastomeres is transferred into the uterus.

Step 1. The question describes *a sperm being put straight into the ovum*. Match this against the definitions above: only **ICSI** involves direct injection of a sperm into the ovum.

Step 2. Eliminate the distractors. (a) GIFT moves a gamete, not a sperm into an ovum. (b) ZIFT moves an already formed zygote. (d) ET moves an embryo. None of these is "inject a sperm into an ovum".

Final Answer: Option **(c)** ICSI: a sperm is injected directly into the ovum.

☞ **Exam Tip**

ART abbreviations are a favourite one-mark trap. Anchor each to its transferred unit: GIFT $\rightarrow$ *gamete*, ZIFT $\rightarrow$ *zygote*, ET $\rightarrow$ *embryo*, ICSI $\rightarrow$ *injection of one sperm*.

EXPERT'S SOLUTION *: Aanya Iyer, M.Sc Biotechnology, AIIMS Delhi*

Structural observation. I read ART techniques as a "what is moved, and to where" table. Build that table once and every MCQ on this topic collapses to a one-line lookup.

Step 1. Tabulate the four options. ICSI: one sperm $\rightarrow$ injected into ovum (in vitro). GIFT: donor ovum $\rightarrow$ fallopian tube. ZIFT: zygote/early embryo $\rightarrow$ fallopian tube. ET: embryo (> 8 cells) $\rightarrow$ uterus.

Step 2. The phrase "directly injecting a sperm into ovum" maps to exactly one row of the table: ICSI. The verb "inject" is unique to ICSI, so no other option can be correct.

Step 3. Sanity check: ICSI is used when sperm count is very low or sperm cannot penetrate the ovum on its own, so direct injection is the only ART that

physically forces fertilisation. This matches the clinical purpose described.

Why this matters. A single keyword ("inject", "gamete", "zygote", "embryo") fixes the answer. Reading the verb first saves time in the exam.

Final Answer: ICSI: option **(c)**.

Q 3.2 **Increased IMR and decreased MMR in a population will:**

(a) Cause rapid increase in growth rate

(b) Result in decline in growth rate

(c) Not cause significant change in growth rate

(d) Result in an explosive population

SOLUTION

Correct option: (b) Result in decline in growth rate.

Concept used. IMR (Infant Mortality Rate) is the number of infant deaths (under one year) per 1000 live births in a year. MMR (Maternal Mortality Rate) is the number of maternal deaths per 1,00,000 live births. Population growth rate depends on births adding people and deaths removing them. A higher death rate of any group lowers the growth rate; a lower death rate of any group, on its own, does not add new people.

Step 1. Increased IMR means *more infants die*. Fewer of the born children survive, so the surviving population grows more slowly. This pushes the growth rate *down*.

Step 2. Decreased MMR means *fewer mothers die*. This protects mothers but does not by itself create extra births, so it has only a weak upward effect on growth, far smaller than the infant-death effect.

Step 3. Combine the two. The strong downward push from increased IMR outweighs the weak effect of decreased MMR. The net result is a decline in the population growth rate.

Final Answer: Option **(b)**: the growth rate declines.

✗ Common Mistake

Option (c) "no significant change" is tempting because the two factors seem to oppose each other. They do not balance: infant deaths remove a large number of future reproducers, while a lower maternal death rate does not create new births. The IMR effect dominates.

EXPERT'S SOLUTION *: Rohit Verma, M.Sc Zoology, Banaras Hindu University*

Strategic angle. Treat growth rate as births minus deaths. Then judge each rate by how strongly it moves that difference.

Step 1. Write growth rate $\propto$ (births) $-$ (deaths). IMR and MMR are both *death* terms.

Step 2. Increased IMR $\Rightarrow$ deaths term rises sharply $\Rightarrow$ growth rate falls.

Step 3. Decreased MMR $\Rightarrow$ deaths term falls slightly, but saving a mother's life does not instantly add a birth, so the upward effect is small.

Step 4. Net effect: the large fall from rising infant deaths wins, so growth declines. Distractors (a) and (d) need a rising birth component, which is absent here.

Why this matters. Population questions reward thinking in "what adds people vs what removes people" rather than memorised phrases.

> **Final Answer:** Decline in growth rate: option **(b)**.

Q 3.3 **Intensely lactating mothers do not generally conceive due to the:**

(a) Suppression of gonadotropins

(b) Hyper secretion of gonadotropins

(c) Suppression of gametic transport

(d) Suppression of fertilisation

SOLUTION

Correct option: (a) Suppression of gonadotropins.

Concept used. **Lactational amenorrhea** is the absence of the menstrual cycle during the period a mother is intensely breast-feeding. **Gonadotropins** are FSH and LH, released by the anterior pituitary; they drive follicle growth and **ovulation**. Intense suckling raises blood **prolactin**, and prolactin suppresses the release of GnRH and hence of FSH and LH.

Step 1. Intense and frequent suckling keeps blood prolactin high.

Step 2. High prolactin suppresses the hypothalamic GnRH pulse, which in turn suppresses pituitary release of FSH and LH (the gonadotropins).

Step 3. Without FSH and LH there is no follicle maturation and no **ovulation**. No ovum is released, so fertilisation and conception cannot occur (effective only up to about six months after childbirth).

Step 4. Check the distractors: gametic transport (c) and fertilisation (d) never even begin because no ovum is produced, so the *root* cause is the suppression of

gonadotropins, not these downstream steps. (b) is the opposite of what happens.

Final Answer: Option **(a)**: high prolactin suppresses gonadotropins, so no ovulation.

♥ Links to contraception

This is the biological basis of **lactational amenorrhea** as a natural contraceptive: it works only while breast-feeding is intense and only for roughly six months, with no extra cost or side effects.

EXPERT'S SOLUTION *: Priya Nair, Ph.D Molecular Biology, NCBS Bangalore*

Picture-first. Follow the hormone chain backwards from "no conception" to its first cause.

Step 1. No conception ⇐ no fertilisation ⇐ no ovum released ⇐ no ovulation.

Step 2. No ovulation ⇐ no LH surge ⇐ low FSH and LH (gonadotropins).

Step 3. Low gonadotropins ⇐ high prolactin from intense suckling. The first cause in the chain is suppression of gonadotropins; everything after it is a consequence.

Why this matters. The "first cause in the chain" is the correct answer to "due to". Downstream effects (c), (d) are real but not the cause asked for.

Final Answer: Suppression of gonadotropins: option **(a)**.

Q 3.4 **Sterilisation techniques are generally fool proof methods of contraception with least side effects. Yet, this is the last option for the couples because:**
(i) It is almost irreversible
(ii) Of the misconception that it will reduce sexual urge
(iii) It is a surgical procedure
(iv) Of lack of sufficient facilities in many parts of the country
(a) i and iii (b) ii and iii (c) ii and iv (d) i, ii, iii and iv

SOLUTION

Correct option: (d) i, ii, iii and iv.
Concept used. **Sterilisation** is a surgical contraceptive method: **vasectomy** in males (cutting/tying the vas deferens) and **tubectomy** in females (cutting/tying the fallopian

tubes). It is highly reliable but is chosen last for several independent reasons; this is a "select all that apply" question, so we test each statement on its own.

Step 1. Statement (i): sterilisation is *almost irreversible*; reversal surgery rarely restores fertility. This is a true reason couples hesitate. Accept (i).

Step 2. Statement (ii): a widespread *misconception* that sterilisation lowers sexual urge or masculinity discourages people, even though it is biologically false. This is a real social barrier. Accept (ii).

Step 3. Statement (iii): it is a *surgical procedure*, requiring an operation, anaesthesia and recovery, which many couples wish to avoid. Accept (iii).

Step 4. Statement (iv): in many regions there is a *lack of trained personnel and facilities*, so the option is simply not easily available. Accept (iv).

Step 5. All four statements are valid reasons, so the option listing all four is correct.

Final Answer: Option **(d)**: i, ii, iii and iv are all valid reasons.

♥ Why sterilisation is "last resort"

Sterilisation (vasectomy/tubectomy) is the most reliable contraceptive with the fewest side effects, yet couples avoid it because it is surgical and almost irreversible. This trade-off between reliability and reversibility recurs across the chapter.

EXPERT'S SOLUTION *: Ananya Joshi, M.Sc Microbiology, JNU*

Strategic angle. For "choose the correct option" lists, validate each numbered statement independently, then pick the option matching the accepted set.

Step 1. (i) almost irreversible: TRUE: reversal success is poor.

Step 2. (ii) misconception about sexual urge: TRUE: a documented social deterrent.

Step 3. (iii) surgical procedure: TRUE: needs an operation.

Step 4. (iv) lack of facilities: TRUE: access is uneven across the country.

Step 5. Accepted set = {i, ii, iii, iv}. The only option containing the full set is (d).

Why this matters. When every statement is independently true, the "all of the above" style option is correct. Do not over-eliminate.

Final Answer: All four reasons hold: option **(d)**.

Q 3.5 A national level approach to build up a reproductively healthy society was

taken up in our country in:
(a) 1950s
(b) 1960s
(c) 1980s
(d) 1990s

SOLUTION

Correct option: (a) 1950s.
Concept used. India was among the first countries to launch a national programme to attain a totally **reproductively healthy society**. The original **family planning programme** was initiated in 1951, i.e. in the 1950s, and was later broadened and renamed **Reproductive and Child Health Care (RCH)**.

Step 1. Recall the NCERT statement: India initiated action plans and programmes at a national level "way back in 1951".

Step 2. 1951 falls in the 1950s decade, so the matching option is (a).

Step 3. Eliminate the rest: the 1960s, 1980s and 1990s are later decades; the *start* of the national approach was in the 1950s, even though the programme was strengthened in later decades.

> **Final Answer:** Option **(a)**: the 1950s (programme launched in 1951).

☞ **Exam Tip**

Lock just one fact: India's family planning programme started in **1951**. Every "when did the national approach begin" variant of this question resolves to the 1950s from that single year.

EXPERT'S SOLUTION *: Karan Desai, M.Sc Botany, Delhi University*

Quick reading. This is a date-recall MCQ. Anchor it to the single fact NCERT prints.

Step 1. NCERT: the family planning programme began in 1951.

Step 2. Convert the year to a decade: 1951 $\rightarrow$ 1950s.

Step 3. Therefore option (a). Later decades describe expansion (RCH), not the original launch.

Why this matters. For "when did X start" items, recall the exact year and convert to the decade rather than guessing the option that "feels modern".

> **Final Answer:** 1950s: option **(a)**.

Q 3.6 **Emergency contraceptives are effective if used within:**

(a) 72 hrs of coitus

(b) 72 hrs of ovulation

(c) 72 hrs of menstruation

(d) 72 hrs of implantation

SOLUTION

Correct option: (a) 72 hrs of coitus.

Concept used. **Emergency contraceptives** are methods (progestogen or progestogen+estrogen pills, or IUD insertion) used to avoid a possible pregnancy after **unprotected coitus** or a suspected contraceptive failure. They act mainly by delaying or stopping ovulation and by preventing fertilisation, so they must be used *before* fertilisation, not after pregnancy has begun.

Step 1. The reference event is the act that could cause pregnancy, i.e. **coitus** (or rape / contraceptive failure).

Step 2. These pills are effective if taken within about 72 hours of that coitus, so the time window is measured from coitus.

Step 3. Eliminate the others: ovulation (b) is not directly known to the user; menstruation (c) is unrelated to the risk event; implantation (d) is too late, as a pregnancy may already be established.

Final Answer: Option **(a)**: within 72 hours of coitus.

✗ Common Mistake

Do not confuse "emergency contraceptive" with MTP. Emergency contraceptives act before/around fertilisation within 72 hours of *coitus*; MTP terminates an already established pregnancy.

EXPERT'S SOLUTION *: Ishaan Rao, M.Sc Biotechnology, AIIMS Delhi*

Strategic angle. Identify the "risk event" the method responds to; the time window is always counted from that event.

Step 1. The risk event for pregnancy is unprotected coitus.

Step 2. Emergency contraception is a response to that event, so the clock starts at coitus.

Step 3. Therefore "within 72 hrs of coitus" $\Rightarrow$ option (a). Implantation-based options are wrong because the method works before implantation.

Why this matters. Tying a time window to its triggering event prevents the classic ovulation/coitus mix-up.

> **Final Answer:** Within 72 hrs of coitus: option **(a)**.

Q 3.7 **Choose the right one among the statements given below:**

(a) IUDs are generally inserted by the user herself

(b) IUDs increase phagocytosis reaction in the uterus

(c) IUDs suppress gametogenesis

(d) IUDs once inserted need not be replaced

SOLUTION

Correct option: (b) IUDs increase phagocytosis reaction in the uterus.

Concept used. Intra Uterine Devices (IUDs) are contraceptives placed inside the uterus by a doctor or trained nurse. They work by (i) increasing **phagocytosis** of sperms in the uterus, (ii) (copper IUDs) releasing Cu^{2+} ions that suppress sperm motility and fertilising capacity, and (iii) (hormone IUDs) making the uterus unsuitable for implantation and the cervix hostile to sperms.

Step 1. Test (a): IUDs are inserted by *a doctor or expert nurse*, not by the user herself. FALSE.

Step 2. Test (b): IUDs increase the **phagocytosis** of sperms within the uterus. This is a stated mechanism. TRUE.

Step 3. Test (c): IUDs do not stop **gametogenesis** (sperm and egg formation continue normally). FALSE.

Step 4. Test (d): IUDs have a fixed effective life and *must be replaced* after that period. FALSE.

Step 5. Only statement (b) is correct.

> **Final Answer:** Option **(b)**: IUDs increase phagocytosis of sperms in the uterus.

♥ Three IUD types

Non-medicated (Lippes loop); copper-releasing (CuT, Cu7, Multiload 375) which add Cu^{2+} action; hormone-releasing (LNG-20, Progestasert) which thin the endometrium. All increase phagocytosis of sperms in the uterus.

EXPERT'S SOLUTION *: Meera Pillai, M.Sc Zoology, Banaras Hindu University*

Quick reading. Mark each statement true/false against the known mechanism of action of IUDs.

Step 1. (a) FALSE: inserted by trained personnel, not the user.

Step 2. (b) TRUE: increased phagocytosis of sperms is a core IUD mechanism.

Step 3. (c) FALSE: gametogenesis is unaffected; IUDs act locally in the uterus.

Step 4. (d) FALSE: IUDs have a service life and need replacement.

Step 5. Exactly one true statement: (b).

Why this matters. IUDs act *locally* (phagocytosis, Cu^{2+} ions, hormone effect), never on gamete *production*: this single idea rules out (c) instantly.

Final Answer: Statement (b) is correct: option **(b)**.

Q 3.8 **Following statements are given regarding MTP. Choose the correct option given below:**
(i) MTPs are generally advised during first trimester
(ii) MTPs are used as a contraceptive method
(iii) MTPs are always surgical
(iv) MTPs require the assistance of qualified medical personnel
(a) ii and iii (b) ii and iii (c) i and iv (d) i and ii

SOLUTION

Correct option: (c) i and iv.
Concept used. Medical Termination of Pregnancy (MTP), also called induced abortion, is the intentional ending of a pregnancy before full term. In India it is legalised under specified conditions and regulated to avoid misuse, especially against female foeticide.

Step 1. Statement (i): MTPs are relatively safe and generally advised in the *first trimester* (up to 12 weeks); later terminations are far riskier. TRUE.

Step 2. Statement (ii): MTP is *not* a contraceptive. A contraceptive prevents pregnancy; MTP ends an already established pregnancy. FALSE.

Step 3. Statement (iii): MTPs are *not always surgical*: early pregnancies can be terminated with drugs (non-surgical / medical MTP). FALSE.

Step 4. Statement (iv): MTP must be performed by *qualified medical personnel* under regulated conditions. TRUE.

Step 5. Accepted set = {i, iv}, which is option (c).

> **Final Answer:** Option **(c)**: statements i and iv are correct.

✗ Common Mistake

The single biggest error here is treating MTP as a contraceptive (statement ii). Contraception *prevents* pregnancy; MTP *ends* one. They are not interchangeable.

EXPERT'S SOLUTION *: Aditya Bhat, Ph.D Molecular Biology, NCBS Bangalore*

Strategic angle. Score every statement, then map the true set to an option.

Step 1. (i) first-trimester advice: TRUE (safer early).

Step 2. (ii) MTP as contraception: FALSE (it ends, not prevents, pregnancy).

Step 3. (iii) always surgical: FALSE (drug-based MTP exists early).

Step 4. (iv) needs qualified personnel: TRUE (legally regulated).

Step 5. True set {i, iv} matches option (c). Options (a) and (b) rely on false statements ii and iii.

Why this matters. Distinguishing "prevent" from "terminate" is the recurring distinction examiners test in this chapter.

> **Final Answer:** i and iv: option **(c)**.

Q 3.9 **From the sexually transmitted diseases mentioned below, identify the one which does not specifically affect the sex organs:**

(a) Syphilis

(b) AIDS

(c) Gonorrhea

(d) Genital warts

SOLUTION

Correct option: (b) AIDS.

Concept used. Sexually Transmitted Diseases (STDs), or VD/RTI, spread mainly through sexual contact. Most produce local signs in the genital region, but AIDS (caused by HIV) attacks the body's immune system (helper T-lymphocytes) rather than the sex organs themselves.

Step 1. Syphilis (a): bacterial STD producing genital sores (chancre). Affects sex organs.

Step 2. Gonorrhea (c): bacterial STD causing genital discharge and inflammation. Affects sex organs.

Step 3. Genital warts (d): caused by HPV, produces growths on the genitals. By definition affects sex organs.

Step 4. AIDS (b): HIV destroys helper T-cells, crippling immunity throughout the body. The damage is systemic, *not* confined to the sex organs.

Step 5. The odd one out is AIDS.

> **Final Answer:** Option **(b)** AIDS: it damages the immune system, not the sex organs specifically.

☞ Exam Tip

NCERT lists two STDs that are *not* confined to the sex organs: AIDS (immune system) and Hepatitis-B (liver). If either appears in an "odd one out" STD question, it is almost always the answer.

EXPERT'S SOLUTION *: Tara Reddy, M.Sc Microbiology, JNU*

Structural observation. Sort the four diseases by their target tissue, then pick the one whose target is not the genitals.

Step 1. Syphilis, gonorrhea, genital warts: target tissue = reproductive tract / genital skin.

Step 2. AIDS: target tissue = immune cells (helper T-lymphocytes), a body-wide system.

Step 3. "Does not specifically affect the sex organs" selects the disease with a non-genital target: AIDS.

Why this matters. Grouping diseases by the organ they damage turns "odd one out" STD questions into a one-step sort.

> **Final Answer:** AIDS: option **(b)**.

Q 3.10 **Condoms are one of the most popular contraceptives because of the following reasons:**

(a) These are effective barriers for insemination
(b) They do not interfere with coital act
(c) These help in reducing the risk of STDs
(d) All of the above

SOLUTION

Correct option: (d) All of the above.
Concept used. Condoms are barrier contraceptives made of thin rubber/latex that cover the penis (or vagina) so that the ejaculated semen does not enter the female reproductive tract. We test each listed reason for popularity.

Step 1. Reason (a): the condom forms a physical barrier so sperms are not deposited in the vagina, preventing insemination. TRUE.

Step 2. Reason (b): condoms are used only during coitus and do not require surgery, hormones or a device inside the body, so they do not interfere with the coital act and self-use gives privacy. TRUE.

Step 3. Reason (c): by covering the genitals they prevent contact with body fluids, so they reduce the risk of STDs (including HIV). TRUE.

Step 4. All three reasons are correct, so the combined option (d) is the answer.

Final Answer: Option **(d)**: all three reasons are valid.

♥ Dual protection

Condoms are unique among common contraceptives because they prevent pregnancy *and* reduce STD transmission at the same time. This "dual protection" is why public-health programmes promote them heavily.

EXPERT'S SOLUTION *: Vivaan Kapoor, M.Sc Biotechnology, AIIMS Delhi*

Strategic angle. For an "all of the above" candidate, disprove it by finding one false sub-statement; if none is false, it is correct.

Step 1. (a) barrier to insemination: TRUE: that is the defining action of a condom.

Step 2. (b) no interference with coitus, easy self-use: TRUE.

Step 3. (c) lowers STD risk: TRUE: it blocks fluid contact.

Step 4. No false sub-statement exists, so "all of the above" stands. Answer (d).

Why this matters. "All of the above" is correct only when every sub-option survives scrutiny. One genuine false sub-statement would have changed the answer.

Final Answer: All of the above: option **(d)**.

Q 3.11 **Choose the correct statement regarding the ZIFT procedure:**
(a) Ova collected from a female donor are transferred to the fallopian tube to facilitate zygote formation
(b) Zygote is collected from a female donor and transferred to the fallopian tube
(c) Zygote is collected from a female donor and transferred to the uterus
(d) Ova collected from a female donor and transferred to the uterus

SOLUTION

Correct option: (b) Zygote is collected from a female donor and transferred to the fallopian tube.
Concept used. ZIFT (Zygote Intra Fallopian Transfer) transfers a zygote or early embryo (up to the 8-blastomere stage) into the fallopian tube of a female who cannot otherwise conceive. Two facts fix the answer: the unit transferred is a *zygote* (not an ovum), and the destination is the *fallopian tube* (not the uterus).

Step 1. Check the transferred unit. ZIFT moves a *zygote / early embryo*, not an ovum. This rules out (a) and (d), which transfer ova.

Step 2. Check the destination. ZIFT delivers to the *fallopian tube*, not the uterus. This rules out (c), which goes to the uterus.

Step 3. Only statement (b) has both correct: zygote → fallopian tube.

Final Answer: Option **(b)**: zygote from a donor, transferred to the fallopian tube.

☞ **Exam Tip**
Decode the abbreviation: **Z**IFT = **Z**ygote **I**ntra **F**allopian **T**ransfer. The first letter gives the unit (zygote) and "Fallopian" gives the site. The full form is the answer key.

EXPERT'S SOLUTION *: Sanya Chatterjee, Ph.D Molecular Biology, NCBS Bangalore*

Structural observation. Split each option into (transferred unit, destination) and match against the meaning of ZIFT.

Step 1. ZIFT = Zygote → Fallopian tube (from the expanded abbreviation).

Step 2. Tabulate options: (a) ovum → tube; (b) zygote → tube; (c) zygote → uterus; (d) ovum → uterus.

Step 3. Only (b) reads zygote → fallopian tube, matching ZIFT exactly.

Why this matters. Expanding the abbreviation into (unit, site) converts a confusing ART MCQ into a direct two-field match.

> **Final Answer:** Zygote to fallopian tube: option **(b)**.

Q 3.12 **The correct surgical procedure as a contraceptive method is:**

(a) Ovariectomy

(b) Hysterectomy

(c) Vasectomy

(d) Castration

SOLUTION

Correct option: (c) Vasectomy.

Concept used. A surgical contraceptive must *block gamete transport while keeping the reproductive organs and hormones intact*. **Vasectomy** (a small part of the **vas deferens** is cut and tied through a scrotal incision) does exactly this: sperms can no longer travel out, but the testes and hormone production are untouched. The other options remove organs and are therefore not contraceptive procedures.

Step 1. Vasectomy (c): cuts/ties the vas deferens. Sperms are not delivered, but testosterone and the testes remain. This is a recognised **sterilisation** contraceptive. CORRECT.

Step 2. Ovariectomy (a): surgical removal of the ovaries. This ends hormone production and is a treatment, not a contraceptive method.

Step 3. Hysterectomy (b): surgical removal of the uterus, done for disease, not for contraception.

Step 4. Castration (d): removal of the testes (or ovaries); it destroys reproductive and hormonal function and is not used as contraception.

> **Final Answer:** Option **(c)** Vasectomy: blocks sperm transport while keeping organs and hormones intact.

☞ Exam Tip

A contraceptive surgery *interrupts* gamete transport but keeps the organs. Any option that *removes* an organ (-ectomy, castration) is automatically wrong. Only vasectomy/tubectomy

qualify.

EXPERT'S SOLUTION *: Dev Banerjee, M.Sc Zoology, Banaras Hindu University*

Strategic angle. A contraceptive surgery should *interrupt*, not *remove*. Test each option against that.

Step 1. Vasectomy: interrupts the vas deferens, organs intact → contraceptive. KEEP.

Step 2. Ovariectomy: removes ovaries → not contraceptive (organ-removing). REJECT.

Step 3. Hysterectomy: removes uterus → disease treatment, not contraception. REJECT.

Step 4. Castration: removes gonads → destroys reproduction, not a contraceptive method. REJECT.

Step 5. Only the interrupting procedure, vasectomy, survives.

Why this matters. The discriminator "interrupt vs remove" isolates the one contraceptive procedure from three organ-removal distractors.

Final Answer: Vasectomy: option **(c)**.

Q 3.13 **Diaphragms are contraceptive devices used by the females. Choose the correct option from the statements given below:**
(i) They are introduced into the uterus
(ii) They are placed to cover the cervical region
(iii) They act as physical barriers for sperm entry
(iv) They act as spermicidal agents
(a) i and ii (b) i and iii (c) ii and iii (d) iii and iv

SOLUTION

Correct option: (c) ii and iii.
Concept used. Diaphragms are reusable barrier contraceptives made of rubber. They are inserted into the vagina to *cover the cervix* before coitus, forming a physical barrier that stops sperms from entering the uterus through the cervix.

Step 1. Statement (i): diaphragms are placed in the *vagina to cover the cervix*, *not* introduced into the uterus (that describes an IUD). FALSE.

Step 2. Statement (ii): they are placed to *cover the cervical region*. TRUE.

Step 3. Statement (iii): they act as a *physical barrier* that blocks sperm entry through the cervix. TRUE.

Step 4. Statement (iv): the diaphragm itself is not a *spermicide*; spermicidal creams/jellies are used *along with* it but are a separate agent. FALSE.

Step 5. Accepted set = {ii, iii}, which is option (c).

Final Answer: Option **(c)**: statements ii and iii are correct.

✗ Common Mistake

Statement (i) confuses a diaphragm with an IUD. IUDs go *inside the uterus*; diaphragms sit in the vagina *over the cervix*. Keep the two sites distinct.

EXPERT'S SOLUTION *: Neha Singh, M.Sc Biotechnology, AIIMS Delhi*

Strategic angle. Validate each statement against the device's site (cervix) and mode (barrier).

Step 1. (i) into the uterus: FALSE: that is an IUD, not a diaphragm.

Step 2. (ii) covers the cervical region: TRUE: this is its position.

Step 3. (iii) physical barrier to sperm: TRUE: this is its mode of action.

Step 4. (iv) spermicidal agent: FALSE: spermicide is a separate cream used with it.

Step 5. True set {ii, iii} ⇒ option (c).

Why this matters. Site (cervix vs uterus) plus mechanism (barrier vs chemical) cleanly separates diaphragms from IUDs and spermicides.

Final Answer: ii and iii: option **(c)**.

Solve the Regular NCERT Exercises →

Very Short Answer Type Questions

Q 3.14 **Reproductive health refers only to healthy reproductive functions. Comment.**

SOLUTION

Concept used. Reproductive health is defined by the WHO as total well-being in all aspects of reproduction, that is, *physical, emotional, behavioural and social* well-being,

not merely the proper working of the reproductive organs.

Step 1. The statement is incomplete. Healthy reproductive *functioning* (normal organs, hormones and cycles) is only one part of reproductive health.

Step 2. Reproductive health also includes freedom from STDs, awareness of safe sex, access to contraception, the right to unbiased counselling, and emotional and social well-being regarding reproduction.

Final Answer: False as stated: reproductive health means physical, emotional, behavioural and social well-being in reproduction, not just healthy organ function.

♥ Anchor for the whole chapter

This four-part definition (physical, emotional, behavioural, social) underlies every later topic: contraception, MTP, STD prevention and ART all serve one or more of these four dimensions.

EXPERT'S SOLUTION *: Riya Mehta, M.Sc Botany, Delhi University*

Quick reading. Judge the claim against the official definition, then state what it leaves out.

Step 1. Official definition: total well-being (physical + emotional + behavioural + social) in reproduction.

Step 2. The claim restricts this to "functions" only, so it omits the emotional, behavioural and social dimensions, plus protection from STDs and access to information.

Step 3. Hence the comment: the statement is too narrow; it captures one component and misses the rest.

Why this matters. The four-part definition is the backbone of the whole chapter; misreading it as "organs only" causes errors in many later questions.

Final Answer: Incomplete statement: reproductive health is multi-dimensional well-being, not only healthy functioning.

Q 3.15 Comment on the Reproductive and Child Health Care programme of the government to improve the reproductive health of the people.

SOLUTION

Concept used. The **Reproductive and Child Health Care (RCH)** programme is a Government of India initiative to create a reproductively healthy society through awareness, services and support, building on the earlier "family planning" programme of 1951.

Step 1. Aims and tools: spread awareness via audio-visual and print media, schools and parents; provide sex education; build knowledge of reproductive organs, adolescence, safe sex, STDs and contraception.

Step 2. Outcomes: it provides medical help and care to mothers and infants, encourages a smaller family through contraception, works to detect and discourage **sex-selective abortion** and child marriage, and improves overall reproductive health and lower mortality.

> **Final Answer:** RCH is a national programme using awareness, education and medical services to build a reproductively healthy and informed society.

✗ Common Mistake

Do not reduce RCH to "family planning" or "population control". It is a broad reproductive-health programme: awareness, sex education, maternal-infant care and anti-foeticide action are all part of it.

EXPERT'S SOLUTION *: Ankit Gupta, M.Sc Microbiology, JNU*

Strategic angle. Split the comment into "what it does" (actions) and "what it achieves" (outcomes).

Step 1. Actions: awareness campaigns, sex education, counselling, provision of contraceptives and maternal-infant care.

Step 2. Outcomes: informed population, smaller families, fewer STDs, reduced maternal and infant mortality, control of female foeticide.

Step 3. Comment: RCH is a broad, largely successful national effort, though its reach still varies across regions.

Why this matters. Naming both the actions and the outcomes gives a complete two-mark answer rather than a one-sided one.

> **Final Answer:** A national, multi-pronged programme of awareness, education and medical care that has improved reproductive health.

Q 3.16 The present population growth rate in India is alarming. Suggest ways to check it.

SOLUTION

Concept used. **Population growth rate** is the rate at which a population increases, driven by a high birth rate relative to death rate. It is checked mainly by reducing the birth rate through education, delayed marriage and contraception.

Step 1. Motivate smaller families: promote the small-family norm with statutory rise in marriageable age (21 for males, 18 for females) and incentives for couples with fewer children.

Step 2. Spread awareness and access: sex education, counselling, and easy availability of **contraceptive** methods (barrier, IUD, pills, sterilisation) so that births are planned.

> **Final Answer:** Raise marriage age, promote the small-family norm with incentives, and spread sex education plus easy contraceptive access.

♥ The ethical constraint

Growth rate = births − deaths, but we cannot ethically raise the death rate. So every population-control measure in this chapter works by lowering the *birth* rate, never by raising deaths.

EXPERT'S SOLUTION *: Pooja Sharma, M.Sc Zoology, Banaras Hindu University*

Strategic angle. Growth = births − deaths; we cannot ethically raise deaths, so every measure must lower the birth rate.

Step 1. Delay reproduction: enforce the legal marriage ages, which shortens the reproductive span.

Step 2. Reduce births per couple: promote and supply contraceptives, with incentives for small families.

Step 3. Change attitudes: education and counselling so couples *choose* fewer children.

Why this matters. Anchoring every suggestion to "lowers the birth rate" keeps the answer focused and complete.

> **Final Answer:** Lower the birth rate via late marriage, contraception access, incentives and education.

Q 3.17 STDs can be considered as self-invited diseases. Comment.

SOLUTION

Concept used. Sexually Transmitted Diseases (STDs) spread mainly through unprotected sexual contact. Most cases can be avoided by simple precautions, which is why they are called largely preventable, "self-invited" infections.

Step 1. The phrase means most STDs arise from avoidable behaviour: unprotected sex, sex with unknown/multiple partners, and not using condoms.

Step 2. They are preventable: avoid sex with unknown or multiple partners, always use condoms, and seek early diagnosis and treatment. Following these, infection is largely avoidable, hence "self-invited".

> **Final Answer:** Largely true: most STDs result from avoidable unsafe sexual behaviour and can be prevented by safe practices.

✗ Common Mistake

Write "largely" self-invited, not "always". STDs also reach innocent victims: a foetus/newborn from an infected mother, or a patient via an infected blood transfusion. The "self-invited" label fits the behaviour-linked majority, not every case.

EXPERT'S SOLUTION *: Yash Joshi, M.Sc Biotechnology, AIIMS Delhi*

Quick reading. Test the claim: are STDs avoidable by the individual's own choices?

Step 1. Transmission route: chiefly unprotected sexual contact, a controllable behaviour.

Step 2. Prevention is in the person's hands: condom use, single known partner, hygiene, early treatment.

Step 3. Since prevention depends largely on personal choices, the "self-invited" label is justified for most cases (with care: infants/transfusion cases are exceptions).

Why this matters. Recognising STDs as behaviour-linked explains why the chapter stresses prevention over cure.

> **Final Answer:** Justified for most cases: STDs are largely preventable by safe sexual behaviour.

Q 3.18 Suggest the reproduction-related aspects in which counselling should be

provided at the school level.

SOLUTION

Concept used. Sex education in schools gives correct information so that adolescents make informed, healthy choices and avoid myths.

Step 1. Knowledge aspects: reproductive organs, adolescence and related changes, the menstrual cycle, and safe and hygienic sexual practices.

Step 2. Protective aspects: STDs and AIDS and their prevention, myths/misconceptions about sex, available contraceptive options, and the evils of sex abuse and sex-selective practices.

> **Final Answer:** Counsel on reproductive organs, adolescence, menstrual hygiene, safe sex, STDs/AIDS prevention, myths, contraception and sex abuse.

☞ **Exam Tip**

Memorise the list as two buckets: "know your body" (organs, adolescence, menstruation) and "protect your body" (safe sex, STDs, myths, contraception, abuse). One mark per point in the answer.

EXPERT'S SOLUTION *: Diya Kapoor, M.Sc Botany, Delhi University*

Strategic angle. Group the topics into "know your body" and "protect your body".

Step 1. Know your body: reproductive organs, adolescent changes, menstrual cycle and hygiene.

Step 2. Protect your body: safe sex, STD/AIDS prevention, dispelling myths, contraceptive choices, awareness against sex abuse.

Why this matters. A two-bucket grouping makes the answer easy to recall and complete in the exam.

> **Final Answer:** Body awareness (organs, adolescence, menstruation) plus protection (safe sex, STDs, contraception, anti-abuse awareness).

Q 3.19 Mention the primary aim of the "Assisted Reproductive Technology" (ART) programme.

SOLUTION

Concept used. **Assisted Reproductive Technologies (ART)** are special clinical techniques (IVF, ZIFT, GIFT, ICSI, artificial insemination, embryo transfer) that help couples who cannot conceive naturally because of **infertility**.

Step 1. Many couples are infertile due to physical, congenital, immunological or other reasons and cannot produce a child by natural means.

Step 2. The primary aim of the ART programme is to *enable such infertile couples to have children* by assisting fertilisation and/or implantation through medical techniques.

> **Final Answer:** To help infertile couples have a child by using assisted clinical techniques to achieve pregnancy.

♥ ART is not population control

ART works *against* infertility: it helps couples *have* children. It is the opposite of contraception and is unrelated to population stabilisation, a distinction examiners deliberately test.

EXPERT'S SOLUTION *: Krishna Rao, Ph.D Molecular Biology, NCBS Bangalore*

Quick reading. One-line aim, justified by the population it serves.

Step 1. Target group: couples unable to conceive naturally (infertile).

Step 2. Means: clinical assistance with fertilisation/implantation (IVF, ZIFT, GIFT, ICSI, etc.).

Step 3. Aim therefore: give these couples a chance to bear a child.

Why this matters. ART addresses infertility specifically: it is not a contraceptive or population programme, a distinction examiners test.

> **Final Answer:** Enabling infertile couples to have children through assisted clinical techniques.

Q 3.20 What is the significance of progesterone-estrogen combination as a contraceptive measure?

SOLUTION

Concept used. The **progesterone-estrogen combination** (oral pills) is a hormonal contraceptive. The hormones act on the ovary and reproductive tract to stop pregnancy by three linked actions.

Step 1. They *inhibit ovulation* by suppressing the release of the gonadotropins FSH and LH, so no ovum is released.

Step 2. They alter the **endometrium** so it is unsuitable for **implantation**, and thicken cervical mucus to retard sperm entry. Together these make conception very unlikely.

> **Final Answer:** It prevents ovulation, makes the endometrium unfit for implantation and thickens cervical mucus, so it is a highly effective contraceptive.

☞ Exam Tip

List the three actions in order: (1) no ovulation, (2) hostile endometrium, (3) thick cervical mucus. Examiners award one point per action for this VSA.

EXPERT'S SOLUTION *: Aditi Verma, M.Sc Biotechnology, AIIMS Delhi*

Strategic angle. Trace where the hormones act: ovary, then uterus, then cervix.

Step 1. Ovary: suppressed FSH/LH $\Rightarrow$ no ovulation.

Step 2. Uterus: endometrium changed $\Rightarrow$ implantation blocked.

Step 3. Cervix: mucus thickened $\Rightarrow$ sperm entry retarded. Three independent blocks make it very reliable.

Why this matters. A method acting at three points is far more reliable than a single-action method, which is the "significance" the question asks for.

> **Final Answer:** Triple action (no ovulation, unfit endometrium, thick cervical mucus) gives a highly effective contraceptive.

Q 3.21 **Strict conditions are to be followed in medical termination of pregnancy (MTP) procedures. Mention two reasons.**

SOLUTION

Concept used. **Medical Termination of Pregnancy (MTP)** is regulated by law in India to protect women's health and to prevent its misuse, particularly for illegal **sex-selective abortion**.

Step 1. Reason 1: to prevent misuse: unregulated MTP is often used for *illegal female foeticide* after illegal sex determination. Strict conditions discourage this.

Step 2. Reason 2: to protect the woman: MTPs (especially after the first trimester, or done by untrained persons) are unsafe and can be fatal, so they must be done by qualified personnel under defined limits.

> **Final Answer:** (1) To stop misuse for illegal sex-selective abortion; (2) to protect the woman from unsafe, possibly fatal procedures.

☞ **Exam Tip**

Give one *social* reason (curb illegal female foeticide) and one *medical* reason (protect maternal health). Two reasons from the same angle are usually marked as one point.

EXPERT'S SOLUTION *: Siddharth Pillai, Ph.D Molecular Biology, NCBS Bangalore*

Quick reading. Two reasons: a social one and a medical one.

Step 1. Social: regulation curbs illegal female foeticide that follows illegal sex determination.

Step 2. Medical: it ensures the procedure is timely (first trimester) and done by trained personnel, avoiding life-threatening complications.

Why this matters. Pairing one social and one medical reason gives the two distinct points the question asks for.

> **Final Answer:** Prevent illegal sex-selective abortion; safeguard maternal health.

Q 3.22 **Males in whom testes fail to descend to the scrotum are generally infertile. Why?**

SOLUTION

Concept used. In males the **testes** normally descend into the **scrotum**, which is held at about $2\,^{\circ}\mathrm{C}$ *below* core body temperature. **Spermatogenesis** (sperm formation) requires this lower temperature.

Step 1. If the testes do not descend (a condition called **cryptorchidism**), they remain in the abdomen at full body temperature.

Step 2. At this higher temperature normal **spermatogenesis** is impaired, so few or no functional sperms are produced. With no viable sperms, the male is generally infertile.

> **Final Answer:** Undescended testes stay at body temperature, which prevents normal sperm formation, so the male is generally infertile.

☞ **Scrotum = thermostat**

The scrotum keeps the testes about 2 °C below core body temperature. **Spermatogenesis** fails at full body temperature. This single fact answers any "why are undescended testes infertile" question.

EXPERT'S SOLUTION *: Kavya Desai, M.Sc Zoology, Banaras Hindu University*

Cause-and-effect. Connect "no scrotum" to "no sperm" through temperature.

Step 1. Scrotum function: keeps testes about 2°C cooler than the body.

Step 2. Spermatogenesis needs this cooler temperature.

Step 3. Undescended testes ⇒ body temperature ⇒ spermatogenesis fails ⇒ infertility.

Why this matters. The scrotum's role is precisely thermoregulation for sperm formation; this single fact answers the "why".

> **Final Answer:** High intra-abdominal temperature blocks spermatogenesis, causing infertility.

Q 3.23 Mention two advantages of lactational amenorrhea as a contraceptive method.

SOLUTION

Concept used. **Lactational amenorrhea** is the natural absence of menstruation (and ovulation) during the period of intense breast-feeding, up to about six months after childbirth.

Step 1. Advantage 1: it is a *natural* method with *no side effects*: no drugs, devices or hormones are introduced into the body.

Step 2. Advantage 2: it has *no extra cost* and needs no external aid; it works simply

through the act of intense breast-feeding, which also benefits the infant.

Final Answer: (1) Natural, with no side effects; (2) free and needs no device or drug while breast-feeding.

✗ Common Mistake

State the limit too: lactational amenorrhea is reliable only up to about six months after childbirth and only with *intense* breast-feeding. Presenting it as a long-term method is wrong.

EXPERT'S SOLUTION *: Rahul Iyer, M.Sc Biotechnology, AIIMS Delhi*

Quick reading. Two advantages: safety and zero cost.

Step 1. Safety: no chemicals or devices, so no side effects.

Step 2. Cost/convenience: free, automatic with breast-feeding, also nourishes the baby.

Step 3. Caveat (not asked but worth knowing): reliable only up to about six months and only with intense feeding.

Why this matters. Both advantages flow from it being a *natural* method, the recurring theme of natural-contraception questions.

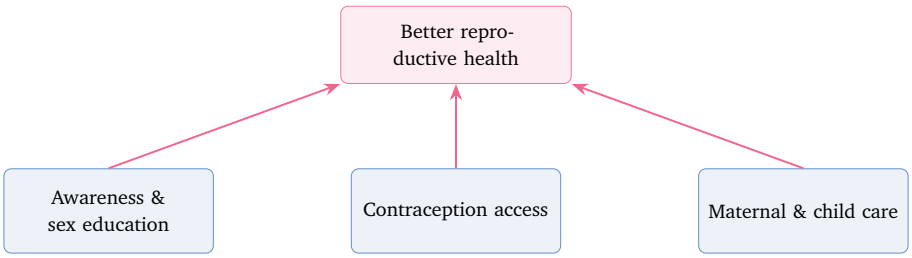
Final Answer: No side effects (natural) and no cost (no device/drug).

Short Answer Type Questions

Q 3.24 Suggest some important steps that you would recommend to be taken to improve the reproductive health standards in India.

SOLUTION

Concept used. Improving reproductive health standards needs a combination of awareness, education, medical support and social reform, exactly the strategy of the RCH programme.



Step 1. **Awareness and education**: use audio-visual and print media, schools and parents to give correct information on reproduction, adolescence, safe sex and STDs, and to remove myths.

Step 2. **Services and access**: make a range of **contraceptives** freely available; provide care to pregnant mothers and infants; offer infertility help (ART).

Step 3. **Social reform**: enforce the statutory marriage age, ban and detect sex-selective abortion, discourage child marriage, and provide unbiased counselling.

> **Final Answer:** Spread awareness/sex education, ensure contraceptive access and maternal-child care, and enforce social reforms (marriage age, anti-foeticide laws).

☞ Exam Tip

For "suggest steps" answers, organise points under headings (education / services / law). Bulleted, labelled points score higher than a single paragraph.

EXPERT'S SOLUTION *: Ishita Banerjee, M.Sc Botany, Delhi University*

Strategic angle. Build the answer as three pillars: *inform*, *provide*, *regulate*.

Step 1. Inform: mass media plus school sex education to spread accurate knowledge and break myths.

Step 2. Provide: contraceptive supplies, antenatal and postnatal care, infertility treatment, and counselling.

Step 3. Regulate: enforce marriage age, ban illegal sex determination, act against child marriage and foeticide.

Why this matters. Each pillar attacks a different cause of poor reproductive health, so together they raise the overall standard.

> **Final Answer:** Inform (education), provide (contraception + maternal care), regulate (marriage age, anti-foeticide) together raise reproductive health.

Q 3.25 **The procedure of GIFT involves the transfer of female gamete to the fallopian tube. Can gametes be transferred to the uterus to achieve the same result? Explain.**

SOLUTION

Concept used. **GIFT** (Gamete Intra Fallopian Transfer) places the female gamete (ovum, from a donor) into the **fallopian tube**, because the fallopian tube (ampulla) is the natural *site of fertilisation* in humans.

Step 1. Fertilisation in humans normally occurs in the **ampullary region of the fallopian tube**, not in the uterus. The early embryo then travels down and implants in the uterus.

Step 2. GIFT therefore places the gamete where fertilisation can naturally take place, the fallopian tube.

Step 3. If gametes were placed directly in the uterus, the environment is not suited to bring the gametes together for fertilisation, so the desired result (fertilisation → embryo) would not be achieved.

Step 4. Hence gametes *cannot* simply be transferred to the uterus for GIFT; the fallopian tube is essential.

> **Final Answer:** No. Fertilisation occurs in the fallopian tube, so gametes must go there; placing them in the uterus would not produce fertilisation.

♥ Links to Human Reproduction

This connects directly to the previous chapter: the ampulla of the fallopian tube is the normal fertilisation site. ART deliberately mimics natural anatomy rather than fighting it.

EXPERT'S SOLUTION *: Arjun Nair, Ph.D Molecular Biology, NCBS Bangalore*

Picture-first. Recall the natural path of the ovum and ask where fertilisation actually happens.

Step 1. Natural site of fertilisation: ampulla of the fallopian tube.

Step 2. GIFT mimics nature: it puts the gamete at that site.

Step 3. Uterus is the implantation site, *not* the fertilisation site, so gametes placed there would not fuse successfully. Answer: no.

Why this matters. ART techniques are designed around natural anatomy; knowing the true fertilisation site answers many ART questions.

Final Answer: No: fertilisation needs the fallopian tube; the uterus is for implantation, not fertilisation.

Q 3.26 **Copper ions-releasing IUDs are more efficient than non-medicated methods. Why?**

SOLUTION

Concept used. **Intra Uterine Devices (IUDs)** are of three types: non-medicated (e.g. Lippes loop), copper-releasing (e.g. CuT, Cu7, Multiload 375) and hormone-releasing (e.g. LNG-20). **Copper IUDs** add a chemical action to the physical action.

Step 1. All IUDs increase **phagocytosis** of sperms in the uterus (physical/cellular action) and make the uterus unsuitable for implantation.

Step 2. Copper IUDs additionally release Cu^{2+} ions, which *suppress sperm motility and the fertilising capacity of sperms*.

Step 3. Because copper IUDs combine the common phagocytic action *with* this extra spermicidal copper-ion action, fertilisation is far less likely, so they are more efficient than non-medicated IUDs.

Final Answer: Copper IUDs add the release of Cu^{2+} ions that suppress sperm motility and fertilising capacity, on top of the usual IUD action, so they are more efficient.

☞ **Exam Tip**

The key phrase examiners want is "Cu^{2+} ions suppress sperm motility and fertilising capacity". The efficiency gain comes from this *extra* chemical action stacked on the usual phagocytosis.

EXPERT'S SOLUTION *: Pranav Sharma, M.Sc Biotechnology, AIIMS Delhi*

Strategic angle. Compare the two devices by counting their modes of action.

Step 1. Non-medicated IUD: one main mode: increased phagocytosis of sperms and an unfavourable uterus.

Step 2. Copper IUD: the same mode *plus* Cu^{2+} ions that impair sperm motility and fertilising power.

Step 3. Two modes beat one, so the copper IUD is more efficient.

Why this matters. Efficiency rises when independent mechanisms stack; copper adds a second, chemical barrier.

> **Final Answer:** Extra Cu^{2+} spermicidal action makes copper IUDs more efficient than non-medicated ones.

Q 3.27 What are the probable factors that contributed to population explosion in India?

SOLUTION

Concept used. A **population explosion** is a sudden, steep rise in population size, caused when the **birth rate** stays high while the **death rate** falls sharply.

Step 1. Fall in death rate: better health care reduced the **Mortality Rate**, the **Maternal Mortality Rate (MMR)** and the **Infant Mortality Rate (IMR)**, so more people survived.

Step 2. Rise in survivors of reproductive age: with more individuals surviving to reproductive age, more births occurred.

Step 3. Social factors: high birth rate continued due to low literacy, early marriage, lack of awareness/availability of contraception and a preference for large families.

> **Final Answer:** A sharp fall in death rate, MMR and IMR with continued high birth rate (early marriage, low awareness, more reproductive-age survivors) caused the explosion.

☞ Exam Tip

Frame it as "death rate fell, birth rate stayed high". Then list one or two causes for each side. This structure earns full marks quickly.

EXPERT'S SOLUTION *: Sneha Kumar, M.Sc Zoology, Banaras Hindu University*

Strategic angle. Population explosion = widening gap between births and deaths. List what shrank deaths and what kept births high.

Step 1. Deaths fell: improved medical facilities lowered overall mortality, MMR and IMR.

Step 2. Births stayed high: early marriage, low literacy, limited contraceptive use, desire for more children.

Step 3. Result: a large positive (births − deaths) gap ⇒ explosion.

Why this matters. The births-vs-deaths gap framework links this directly back to MCQ 2 on IMR and MMR.

> **Final Answer:** Steep death-rate fall (better health care, lower MMR/IMR) plus persistently high birth rate.

Q 3.28 Briefly explain IVF and ET. What are the conditions in which these methods are advised?

SOLUTION

Concept used. **IVF** (In Vitro Fertilisation) is fertilisation *outside* the body (the "test-tube baby" programme). **ET** (Embryo Transfer) is the placement of the embryo formed by IVF into the female's body to continue development.

Step 1. **IVF**: ova from the wife/donor and sperms from the husband/donor are collected and made to fuse *in vitro* (in the laboratory) to form a zygote.

Step 2. **ET**: the resulting embryo is transferred to the female. If it has up to 8 blastomeres it is put into the **fallopian tube** (ZIFT); if it has more than 8 blastomeres it is put into the **uterus** (IUT), to complete development.

Step 3. **Conditions advised**: when a couple is infertile, e.g. the female cannot produce ova, the male has very low sperm count, or there is a blockage/inability for natural fertilisation.

> **Final Answer:** IVF = fertilisation in the lab; ET = transferring the resulting embryo to the fallopian tube (≤ 8 cells) or uterus (> 8 cells). Advised for infertile couples (no ova, low sperm count, blocked tubes).

☞ The 8-blastomere rule

Embryo with *up to 8 blastomeres* → fallopian tube (ZIFT); *more than 8 blastomeres* → uterus (IUT). The cell-number cut-off decides the transfer site every time.

EXPERT'S SOLUTION *: Aarav Mehta, Ph.D Molecular Biology, NCBS Bangalore*

Structural observation. Treat IVF and ET as two stages of one pipeline: make the embryo, then place it.

Step 1. Stage 1 (IVF): gametes fused in the laboratory → zygote → early embryo.

Step 2. Stage 2 (ET): ≤ 8 blastomeres $\rightarrow$ fallopian tube; > 8 blastomeres $\rightarrow$ uterus.

Step 3. Use when: female cannot form/release ova, male has very low sperm count, or normal fertilisation is impossible.

Why this matters. Seeing IVF$\rightarrow$ET as one pipeline keeps the blastomere cut-off (8 cells) and the two destinations straight.

> **Final Answer:** IVF makes the embryo in vitro; ET places it (tube if ≤ 8 cells, uterus if > 8). For infertile couples.

Q 3.29 What are the advantages of natural methods of contraception over artificial methods?

SOLUTION

Concept used. **Natural methods** of contraception (periodic abstinence, withdrawal/coitus interruptus, lactational amenorrhea) work by avoiding the chance of the ovum and sperms meeting, without drugs or devices.

Step 1. **No side effects**: they introduce no hormones, chemicals or foreign devices into the body, so there are no physiological side effects.

Step 2. **No cost and no aids**: they need no purchase of pills, condoms or devices and require no surgery, only awareness of the fertile period and self-control.

Step 3. They are *ethically acceptable* to people who object to artificial methods on personal or religious grounds.

> **Final Answer:** Natural methods have no side effects, no cost, need no devices/surgery and are acceptable to those who reject artificial methods (but their failure rate is higher).

✗ Common Mistake

Do not present natural methods as "better overall". Their advantage is safety and cost; their major drawback is a much higher failure rate than IUDs, pills or sterilisation.

EXPERT'S SOLUTION *: Diya Joshi, M.Sc Biotechnology, AIIMS Delhi*

Strategic angle. The advantages all stem from one fact: nothing is put into the body.

Step 1. Nothing introduced $\Rightarrow$ no side effects.

Step 2. Nothing purchased ⇒ no cost, no devices.

Step 3. No medical intervention ⇒ acceptable to all, including on religious grounds.

Why this matters. A single root idea ("zero intervention") generates every advantage, which makes the answer easy to reconstruct.

> **Final Answer:** Zero intervention gives no side effects, no cost and wide acceptability (trade-off: higher failure rate).

Q 3.30 What are the conditions in which medical termination of pregnancy is advised?

SOLUTION

Concept used. **Medical Termination of Pregnancy (MTP)** is legally allowed only under specified medical and social conditions, mainly to safeguard the mother and in cases of unwanted or unsafe pregnancy.

Step 1. When continuing the pregnancy would *endanger the life or health* of the mother (or cause grave physical/mental injury).

Step 2. When the foetus is found to have *serious abnormalities* and would be severely handicapped.

Step 3. When pregnancy results from **rape** or from *failure of a contraceptive* used by a married couple (unwanted pregnancy).

> **Final Answer:** MTP is advised when the pregnancy risks the mother's life/health, when the foetus has serious abnormalities, or for pregnancy from rape or contraceptive failure.

♥ Why these grounds exist

These defined grounds are exactly why MTP cannot be used as a casual contraceptive (links to MCQ 8): the law permits it only for genuine maternal, foetal or unwanted-pregnancy reasons.

EXPERT'S SOLUTION *: Tara Singh, M.Sc Botany, Delhi University*

Quick reading. Three condition-types: maternal risk, foetal risk, unwanted pregnancy.

Step 1. Maternal risk: continued pregnancy threatens her life or health.

Step 2. Foetal risk: serious congenital abnormality detected.

Step 3. Unwanted pregnancy: from rape or contraceptive failure.

Why this matters. These three legal grounds also explain why MTP cannot be used casually as a contraceptive (links to MCQ 8).

> **Final Answer:** Maternal danger, serious foetal abnormality, or pregnancy from rape/contraceptive failure.

Q 3.31 Comment on the essential features required for an ideal contraceptive.

SOLUTION

Concept used. An **ideal contraceptive** is judged by how well it prevents pregnancy without harming the user or interfering with normal life and future fertility.

Step 1. It should be **user-friendly**, easily available and *effective* (reliably prevents pregnancy).

Step 2. It should have *no or least side effects* and should *not interfere with* the sexual act or the user's sexual drive.

Step 3. It should be **reversible**, so that normal fertility returns when the couple wishes to have a child.

> **Final Answer:** An ideal contraceptive is effective, user-friendly, reversible, with no/least side effects and no interference with sexual drive or the sexual act.

☞ Exam Tip

Memorise the four-word checklist: effective, user-friendly, side-effect-free, reversible. Each word is one mark in this SA.

EXPERT'S SOLUTION *: Yash Reddy, M.Sc Zoology, Banaras Hindu University*

Strategic angle. A contraceptive is "ideal" only if it balances reliability with safety and reversibility.

Step 1. Reliability: high effectiveness in preventing pregnancy.

Step 2. Safety: minimal side effects, no interference with sexual drive or the act.

Step 3. Convenience and reversibility: easy to use, available, and fertility returns on stopping.

Why this matters. No real contraceptive meets all criteria perfectly, which is why method choice depends on the couple's needs.

> **Final Answer:** Effective, safe (no side effects, no interference), user-friendly and reversible.

Q 3.32 All reproductive tract infections (RTIs) are STDs, but all STDs are not RTIs. Justify with example.

SOLUTION

Concept used. **Sexually Transmitted Diseases (STDs)** are infections transmitted through sexual contact. **Reproductive Tract Infections (RTIs)** are the subset of STDs whose infection is *localised in the reproductive tract / sex organs*. Some STDs, however, spread beyond the reproductive tract.

Step 1. RTIs are infections of the reproductive tract spread sexually, so by definition every RTI is also an STD. Example: gonorrhea and syphilis affect the genital tract: they are RTIs and STDs.

Step 2. But some STDs are *not* confined to the reproductive tract: **AIDS** (HIV) attacks the immune system and **Hepatitis-B** affects the liver. They spread sexually but the disease is not localised in the reproductive tract.

Step 3. Therefore all RTIs are STDs, but STDs like AIDS and Hepatitis-B are not RTIs.

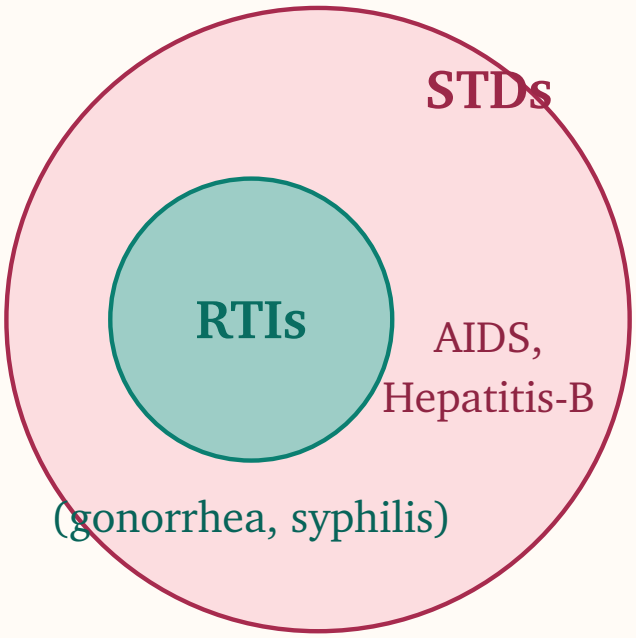
> **Final Answer:** Every RTI (e.g. gonorrhea, syphilis) is a sexually spread reproductive-tract infection, hence an STD; but STDs like AIDS and Hepatitis-B affect non-reproductive systems, so they are STDs that are not RTIs.

✗ Common Mistake

The statement is one-directional. RTI $\subset$ STD, never the reverse. Writing "all STDs are RTIs" inverts the subset relation and is the exact error the question is testing.

EXPERT'S SOLUTION *: Ananya Bhat, M.Sc Microbiology, JNU*

Structural observation. Draw the relationship as sets: RTI is a subset of STD.



Step 1. Inner circle (RTIs): gonorrhea, syphilis: sexually spread and confined to the reproductive tract.

Step 2. Outer region (STD but not RTI): AIDS, Hepatitis-B: sexually spread but systemic.

Step 3. Subset relation: RTI $\subset$ STD, so "all RTIs are STDs" but "not all STDs are RTIs".

Why this matters. The set picture makes the one-directional "subset" statement obvious and exam-proof.

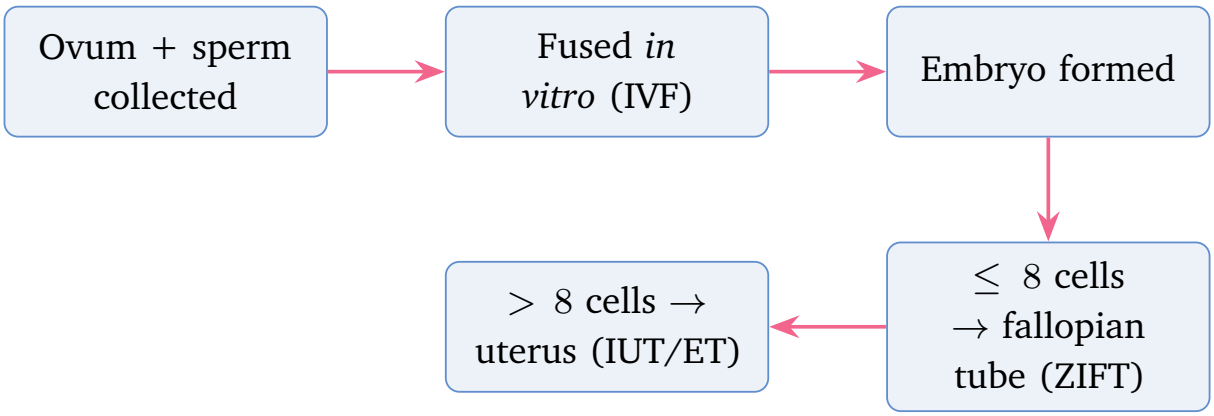
> **Final Answer:** RTI $\subset$ STD: gonorrhea/syphilis are both; AIDS and Hepatitis-B are STDs but not RTIs.

Long Answer Type Questions

Q 3.33 What are the Assisted Reproductive Techniques practised to help infertile couples? Describe any three techniques.

SOLUTION

Concept used. Assisted Reproductive Technologies (ART) are special clinical methods used when a couple is infertile (cannot conceive naturally). The main techniques are IVF with ET, GIFT, ICSI, IUI and artificial insemination. Each assists either fertilisation or implantation. Below, three are described in full.



Step 1. **IVF with Embryo Transfer (ET)** (the test-tube baby programme): ova from the wife (or a donor) and sperms from the husband (or a donor) are collected and induced to fuse *in vitro* to form a zygote. The embryo with up to 8 blastomeres is transferred into the **fallopian tube** (**ZIFT**); an embryo of more than 8 blastomeres is transferred into the **uterus** (**IUT**) to complete development. Advised when the female cannot conceive naturally despite normal gametes being available.

Step 2. **GIFT (Gamete Intra Fallopian Transfer)**: an ovum collected from a *donor* is transferred into the fallopian tube of a female who *cannot produce ova* but can provide a suitable environment for fertilisation and further development.

Step 3. **ICSI (Intra Cytoplasmic Sperm Injection)**: a single sperm is *injected directly into the cytoplasm of the ovum* in the laboratory to form the embryo. Used when the male has a *very low sperm count* or the sperms cannot fertilise the ovum on their own.

Step 4. Related methods (named for completeness): **Artificial Insemination (AI)** / **IUI**, where semen from the husband or a donor is artificially introduced into the vagina or uterus, used when the male has very low sperm count or inability to inseminate.

> **Final Answer:** ART includes IVF+ET, GIFT, ICSI, AI/IUI. IVF+ET: fertilise in vitro then transfer the embryo (tube if ≤ 8 cells, uterus if > 8). GIFT: donor ovum into a recipient's fallopian tube. ICSI: one sperm injected straight into the ovum.

☞ Exam Tip

For a 5-mark LA, name all the ART methods first (for the "what are" part), then describe exactly three in detail (for the "describe any three" part). Skipping the listing loses easy marks.

EXPERT'S SOLUTION *: Vivaan Desai, M.Sc Biotechnology, AIIMS Delhi*

Structural observation. Sort ART methods by *what they assist*: fertilisation (ICSI, IVF, GIFT) or delivery of the embryo (ET/ZIFT/IUT) or sperm delivery (AI/IUI). Then detail three.

Step 1. **IVF+ET**: collect ova and sperms; fuse them *outside* the body; grow to an early embryo; transfer to the fallopian tube if ≤ 8 blastomeres, else to the uterus. This bypasses problems of in-body fertilisation.

Step 2. **GIFT**: when a woman cannot *produce* ova, a donor ovum is placed into her fallopian tube so that fertilisation and development can proceed in her body.

Step 3. **ICSI**: when sperms are too few or too weak, one selected sperm is injected straight into the ovum's cytoplasm, forcing fertilisation that could not occur naturally.

Step 4. Also list **AI/IUI**: artificially introducing semen into the female tract when the male cannot inseminate or has very low sperm count.

Why this matters. Classifying each technique by the exact infertility problem it solves makes the descriptions precise and memorable.

> **Final Answer:** Listed: IVF+ET, GIFT, ICSI, AI/IUI. Detailed three: IVF+ET (fertilise in vitro, transfer embryo), GIFT (donor ovum to recipient's tube), ICSI (one sperm injected into ovum).

Q 3.34 Discuss the mode of action and advantages/disadvantages of hormonal contraceptives.

SOLUTION

Concept used. **Hormonal contraceptives** use **progestogens** alone or with **estrogen**, given as oral pills, injectables or implants. They act on the ovary, the endometrium and the cervix to prevent pregnancy.

Step 1. **Mode of action: ovary**: the hormones suppress the release of the gonadotropins **FSH** and **LH** from the pituitary, which *inhibits ovulation*, so no ovum is released.

Step 2. **Mode of action: endometrium**: they alter the **endometrium** so that it becomes *unsuitable for implantation* of any embryo.

Step 3. **Mode of action: cervix**: they make the cervical mucus thick, which *retards the entry of sperms* into the uterus.

Step 4. **Advantages**: highly effective and reliable; do not interfere with the sexual act;

reversible (fertility returns on stopping); also help regularise the menstrual cycle.

Step 5. **Disadvantages**: must be taken regularly/on schedule (a missed pill lowers protection); may cause side effects in some women such as nausea, weight change, breakthrough bleeding or breast tenderness; do *not* protect against STDs.

> **Final Answer:** Hormonal contraceptives block ovulation (suppress FSH/LH), make the endometrium unfit for implantation and thicken cervical mucus. Advantages: very effective, reversible, no coital interference. Disadvantages: strict schedule, possible side effects, no STD protection.

✗ Common Mistake

A frequent error is to write only "they stop ovulation". The full answer needs all three actions (ovary, endometrium, cervix). Listing only one loses marks in an LA.

EXPERT'S SOLUTION *: Aditya Iyer, Ph.D Molecular Biology, NCBS Bangalore*

Structural observation. Organise as three sites of action, then a balanced advantages/disadvantages ledger.

Step 1. Site 1, ovary: FSH/LH suppressed $\Rightarrow$ no ovulation.

Step 2. Site 2, uterus: endometrium altered $\Rightarrow$ implantation blocked.

Step 3. Site 3, cervix: mucus thickened $\Rightarrow$ sperm entry retarded.

Step 4. Ledger: $+$ very effective, reversible, no coital interference, cycle regulation; $-$ strict timing, side effects in some, no protection from STDs.

Why this matters. The three-site model also explains why hormonal pills are so reliable: failure needs all three blocks to be bypassed, which is unlikely.

> **Final Answer:** Three-site action (no ovulation, unfit endometrium, thick mucus); reliable and reversible but needs strict use and gives no STD protection.

Q 3.35 **STDs are a threat to reproductive health. Describe any two such diseases and suggest preventive measures.**

SOLUTION

Concept used. **Sexually Transmitted Diseases (STDs)** spread mainly through unprotected sexual contact and damage reproductive health, sometimes fatally. We describe two and then list prevention.

Step 1. **AIDS** (Acquired Immuno Deficiency Syndrome): caused by the **HIV** virus. HIV destroys helper **T-lymphocytes**, progressively crippling the **immune system**, so the patient suffers repeated infections. It spreads by unprotected sex, infected blood, shared needles and from infected mother to child. There is no complete cure, so it is largely *fatal*.

Step 2. **Gonorrhea**: caused by the bacterium *Neisseria gonorrhoeae*. It produces inflammation, pain and discharge in the genital tract and, if untreated, can cause *infertility* (blocked tubes/ducts). It spreads through sexual contact and from mother to newborn.

Step 3. **Preventive measures**: avoid sex with unknown or multiple partners; always use **condoms** during coitus; avoid shared needles and ensure blood is screened; get early diagnosis and complete treatment; spread awareness through education.

> **Final Answer:** AIDS (HIV destroys immune T-cells, no cure) and Gonorrhea (bacterial genital infection causing infertility). Prevent by avoiding unknown/multiple partners, using condoms, safe blood/needles, and early treatment plus awareness.

♥ Links to Human Health and Disease

AIDS reappears in the immunity chapter as the classic immunodeficiency disease. Recognising HIV's target (helper T-cells) ties this chapter to that one.

EXPERT'S SOLUTION *: Sneha Banerjee, M.Sc Microbiology, JNU*

Picture-first. Describe each disease by (cause, effect, spread), then a single shared prevention list.

Step 1. AIDS: cause = HIV; effect = destroys helper T-cells → immune collapse, largely fatal; spread = unsafe sex, blood, needles, mother to child.

Step 2. Gonorrhea: cause = *Neisseria gonorrhoeae*; effect = genital inflammation, possible infertility; spread = sexual contact, mother to newborn.

Step 3. Prevention (common to both): no sex with unknown/multiple partners, condom use, screened blood and clean needles, early treatment, education.

Why this matters. A (cause, effect, spread) template makes any STD describable in three crisp lines under exam pressure.

Final Answer: AIDS (HIV, immune destruction) and gonorrhea (bacterial, infertility); prevent via safe sex, condoms, clean blood/needles, early treatment and awareness.

Q 3.36 **Do you justify the statutory ban on amniocentesis in our country? Give reasons.**

SOLUTION

Concept used. **Amniocentesis** is a prenatal test in which a sample of **amniotic fluid** is drawn and the foetal cells/chromosomes are analysed. It can detect genetic disorders and chromosomal abnormalities, but it also reveals the *sex* of the foetus.

Step 1. Legitimate use: amniocentesis genuinely helps detect serious **genetic disorders** (e.g. Down's syndrome, haemophilia) and chromosomal/metabolic abnormalities before birth.

Step 2. The problem: it also discloses the foetus's **sex**. In our society this has been widely misused for illegal **female foeticide** (selective abortion of female foetuses).

Step 3. Consequence: large-scale female foeticide skews the **sex ratio** and is socially and ethically harmful.

Step 4. Justification: yes, the statutory ban on amniocentesis *for sex determination* is justified, because the social harm of female foeticide outweighs convenience; it is allowed only for genuine medical diagnosis under regulation.

Final Answer: Yes, the ban (on its use for sex determination) is justified: amniocentesis was misused for illegal female foeticide, skewing the sex ratio; it is permitted only for genuine genetic diagnosis.

☞ Exam Tip

Always state your stand explicitly ("Yes, the ban is justified") *and* give reasons on both sides (medical benefit vs misuse). "Do you justify" questions need an opinion plus reasons, not just facts.

EXPERT'S SOLUTION *: Karan Chatterjee, M.Sc Zoology, Banaras Hindu University*

Strategic angle. Weigh the benefit (genetic diagnosis) against the harm (sex-selective abortion), then take a clear stand.

Step 1. Benefit: detects serious genetic/chromosomal disorders prenatally: medically valuable.

Step 2. Harm: misused to identify and abort female foetuses, skewing the sex ratio.

Step 3. Net judgement: ban its use for sex determination (harm dominates), but permit it strictly for genuine medical diagnosis. Hence the ban is justified.

Why this matters. The reasoning generalises: a technology with a useful purpose can still be banned for a harmful misuse while remaining legal for its proper use.

> **Final Answer:** Justified: misuse for female foeticide outweighs convenience; legal only for genuine genetic diagnosis.

Q 3.37 Enumerate and describe any five reasons for introducing sex education to school-going children.

SOLUTION

Concept used. **Sex education** in schools provides scientifically correct information about reproduction and sexuality so that adolescents grow up informed, safe and free of myths.

Step 1. **Correct knowledge of reproductive organs and adolescence**: children learn the right facts about reproductive anatomy and the bodily and emotional changes of **adolescence**, reducing fear and confusion.

Step 2. **Removal of myths and misconceptions**: it dispels false beliefs about sex, menstruation and reproduction that otherwise spread through unreliable sources.

Step 3. **Awareness of STDs and AIDS**: it teaches how STDs (including AIDS) spread and how to prevent them, protecting future health.

Step 4. **Knowledge of safe sexual practices and contraception**: it informs about responsible behaviour and available **contraceptive** options, helping prevent unwanted pregnancy.

Step 5. **Protection against sex abuse and sex-related crimes**: it makes children aware of **sexual abuse**, helping them recognise, resist and report it, and discourages sex-selective practices.

> **Final Answer:** Five reasons: (1) correct knowledge of reproductive organs/adolescence; (2) removal of myths; (3) awareness of STDs/AIDS; (4) safe-sex and contraception knowledge; (5) protection against sex abuse and crimes.

♥ Why early education works

Adolescence is when myths take root and risky behaviour begins. School-level sex education intervenes *before* misinformation causes harm, which is why it is far more effective than later correction.

EXPERT'S SOLUTION *: Riya Pillai, M.Sc Botany, Delhi University*

Strategic angle. Group the five reasons as: know (facts), unlearn (myths), protect (STDs/abuse), choose (contraception).

Step 1. Know: accurate facts on reproductive organs and adolescent changes.

Step 2. Unlearn: replace myths and misconceptions with science.

Step 3. Protect (health): STD/AIDS awareness and prevention.

Step 4. Choose: knowledge of safe practices and contraception against unwanted pregnancy.

Step 5. Protect (safety): recognise and resist sexual abuse and sex-selective practices.

Why this matters. Each reason maps to a real adolescent risk; early, correct education is the cheapest prevention.

> **Final Answer:** Know facts, unlearn myths, prevent STDs, enable safe contraceptive choices, and guard against sexual abuse.

Read the Full Chapter Revision Notes →

Key Takeaways

- Reproductive health is total physical, emotional, behavioural and social well-being in reproduction, not merely healthy organ function; India's national programme began in 1951 and grew into the RCH programme.
- Population is checked by lowering the birth rate: late marriage, the small-family norm with incentives, sex education and easy contraceptive access. Population explosion follows a steep death-rate fall (lower MMR/IMR) with a persistently high birth rate.
- Contraceptives: natural (no side effects, higher failure), barrier (condom, diaphragm:

condoms also cut STD risk), IUDs (phagocytosis; copper adds Cu^{2+} spermicidal action), hormonal pills (block ovulation, unfit endometrium, thick mucus), and surgical sterilisation (vasectomy/tubectomy).

- MTP is legal only under defined conditions (maternal risk, foetal abnormality, rape, contraceptive failure) and is not a contraceptive; statutory regulation curbs illegal sex-selective abortion (amniocentesis misuse).
- Infertility is treated by ART: IVF+ET, GIFT, ZIFT, ICSI and AI/IUI, each chosen for the specific cause of infertility.

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