

## **ANIMAL REPRODUCTION ANSWERS**

1. Sexual reproduction is the formation of a new organism from a single-celled zygote formed by the joining of two gametes. Usually two parents are involved. However asexual reproduction forms a new organism without the joining of cells such as gametes. Usually one parent is involved.

2. The new organism would most resemble its parent after asexual reproduction, because the new organism has identical chromosomes to the parent, whereas in sexual reproduction, the new organism has only half of each parent's chromosomes.

3. Advantage of sexual reproduction - Greater genetic variation of offspring and therefore greater chance of survival in changing environments

Disadvantage of sexual reproduction - Energy expended in finding a mate in many organisms

Advantages of asexual reproduction - No energy expended in finding a mate; High chance of survival if the offspring remains near parent and in a stable environment

Disadvantage of asexual reproduction - Less genetic diversity gives offspring a lesser chance of survival if the environment changes.

4. No. Hermaphrodites which have the female and male reproductive organs within the same body are not necessarily capable of producing female and male gametes simultaneously, and therefore cannot necessarily self-fertilise. However there are some organisms which have both gametes produced at the same time, and one parent can sexually reproduce offspring.

5. (a) Binary Fission - A bacterial cell can simply produce more cytoplasm, replicate its DNA, and then form a membrane down the mid-section of the enlarged cell to form 2 'daughter' cells.

5. (b) Budding - Yeast and hydras can form a small extension on the parent's body. This part then separates from the rest and develops into a new individual, which eventually becomes either an independent organism or remains attached as part of a colony.

5. (c) Spore Formation - Ferns and the malaria-producing Plasmodium produce special cells with coverings that are resistant to extremes of temperatures and dryness. These spores may develop into a new organism.

5. (d) Fragmentation - If the parent bodies of Starfish or Flatworms are broken into smaller pieces, each piece may form a new individual.
5. (e) Regeneration - Many plants can grow a new plant whilst still connected to the parent plant. Examples are runners in strawberries and grasses, rhizomes in ferns, tubers in potatoes, and plants grown from cuttings.
5. (f) Parthenogenesis - This occurs in bees, wasps, some cockroaches, and liver flukes inside a host. It involves the development of a new organism from an unfertilised ovum. For example, in honeybees, the female or queen honeybee is inseminated just once in her lifetime. The sperm she receives is stored in a little pouch attached to the genital tract, and closed off by a muscular valve. As the queen lays eggs, she can either open this valve permitting sperm to fertilise them (to become female queens or female workers), or keep the valve closed so that the eggs develop without fertilisation (to become male drones).
6. The two 'daughter' cells produced by binary fission will each contain some cytoplasm and some of the chromosomes of the parent cell. The parent cell does not die in the formation of these daughter cells.
7. 2 bacterial cells.
8. Plant examples may include algae, fern and many flowering plants. An animal example is hydra.
9. Internal fertilisation is the joining of the male and female gametes to form a zygote inside the body of the female (e.g. reptiles, birds, mammals). External fertilisation is the joining of the male and female gametes to form a zygote outside of the organism's body and usually in a watery environment (e.g. amphibians, fish).
10. Organisms which use internal fertilisation are usually terrestrial organisms such as mammals and birds. The watery protected environment required for fertilisation is inside the body of the female organism usually.
11. Many fertilised eggs and young fish will be eaten by predators, damaged by water motion, and so on.
12. (a) A frog life cycle consists of fertilised egg, tadpole (with gills), and adult frog (with lungs).

12. (b) The life cycle continues again and again with each generation where the adult forms eggs and the cycle continues.

13. (a) A gamete is a reproductive cell which contains a haploid (monoploid) number of chromosomes which is half that of the parent cell, and is usually formed by meiosis. Two gametes (e.g. sperm and ovum) must join in a process termed fertilisation to form a single-celled zygote which has the diploid or full number of chromosomes, and can then develop into a new organism.

13. (b) A gonad is the reproductive organ which forms the gametes. Usually there are a male organ (e.g. testis) and a female organ (e.g. ovary). Gonads may also be glands which produce sex hormones.

14. Gametes have half (or haploid) the number of chromosomes of the parent cell, and are usually formed by meiosis. Body cells have a diploid number of chromosomes and are formed by mitosis.

15. A human sperm cell contains a head (with a nucleus containing a haploid number of chromosomes, and an egg-piercing point), a middle piece (with mitochondria to produce energy), and a tail (for locomotion). A sperm has little cytoplasm and therefore has a short life.

16. Seminiferous Tubules in Testis - Epididymis - Vas Deferens - Semen producing glands (Seminal glands, Prostate gland, Cowper's gland) - Urethra

17. (a) Testes are the male gonads which produce sperm in the human male from puberty till death. The testes also produce the male sex hormone (testosterone) from foetus till death.

17. (b) The Epididymis is a coiled tube inside each testis which stores sperm temporarily.

17. (c) The Vas Deferens or sperm duct connects the end of the epididymis to the urethra, for passage of sperm.

17. (d) Through the Penis is a tube called the Urethra through which semen containing sperm, and urine pass at different times. The penis contains spongy tissue which engorges with blood to make the penis erect for sexual intercourse to allow the transfer of semen containing to enter the female.

18. The seminal fluid is produced by the seminal glands, prostate gland and Cowper's gland. Its purpose is to prevent dehydration of sperm, to lubricate the sperm for more effective movement, to provide limited glucose and fructose for energy for the sperm, and to neutralise the acids of the urethra and female vagina during and after sexual intercourse.

19. An ovum is a larger cell than a sperm as it contains more nutrients to sustain its much longer life of approximately 28 days. Its nucleus contains a haploid number of chromosomes.

20. Ovary - Fallopian Tube or Oviduct - Uterus - Cervix - Vagina.

21. (a) The Ovary is the human female gonad which releases one ovum approximately every 28 days alternately from puberty till menopause. It also produces female sex hormones (oestrogen and progesterone).

21. (b) The Fallopian Tube or Oviduct has a dual purpose. It is the tube through which the ovum tumbles on its travel to the uterus, and is also the location for fertilisation (conception) to take place.

21. (c) The Uterus is the womb. This is a very strong muscular organ (containing the myometrium) in which the unborn baby develops. During the menstrual cycle, the lining of the uterus (endometrium) thickens in anticipation of implantation of the embryo occurring, and sheds if implantation does not occur.

21. (d) The Cervix is the opening between the uterus and the vagina. It is plugged when a woman becomes pregnant, and dilates at childbirth to allow for the passage of the baby.

21. (e) The Vagina is an elastic muscular organ which secretes an acidic fluid to lubricate the movement of the penis in the vagina during sexual intercourse. The unfertilised ovum and the uterus lining pass out through the vagina during menstruation if the female is not pregnant.

22. (a) Puberty in humans is the time when the male and female begin producing increased amounts of sex hormones which change the secondary sexual characteristics (e.g. underarm and pubic hair, deep voices in males, breasts and enlarged hips in females). The gametes begin to be released at this time. In females, the menstrual cycle begins.

22. (b) Menopause is a time when the female sex hormones levels in females are reduced, and the woman's menstrual cycle ceases and she stops producing ova.

23. The Hypothalamus in the brain stimulates the pituitary gland in the brain to produce the hormone FSH (Follicle-Stimulating Hormone). FSH stimulates the growth of an egg follicle in the ovary. The follicle in the ovary secretes oestrogen which stimulates the repair of the uterus wall after menstruation and it also stimulates the pituitary gland to produce LH (Lutinizing Hormone). This prevents more than one follicle from developing. LH induces ovulation (release of the ovum) and the development of the follicle into the corpus luteum. The corpus luteum secretes progesterone. If a female becomes pregnant, the corpus luteum will secrete gonadotrophin which allows the corpus luteum to continue producing progesterone which stimulates the growth of the uterus wall, by inhibiting LH and FSH. If the woman does not become pregnant, the corpus luteum deteriorates, which leads to less production of progesterone and oestrogen, and menstruation will occur, and another menstrual cycle begins because The lower progesterone and oestrogen levels will stimulate the pituitary gland in the brain to produce FSH.

24. Briefly, the pregnant woman does not menstruate because the lining of the uterus, the endometrium, thickens and remains intact in preparation for the implantation and development of the embryo.

25. Copulation is the sexual intercourse between a male and a female. Fertilisation or conception is the joining of the sperm and ovum in the fallopian tube.

26. A zygote contains a diploid number of chromosomes as do other body cells except the gametes which are haploid. The zygote contains a fused nucleus which holds the chromosomes from sperm and ovum but the two sets of chromosomes remain distinct. The zygote then rapidly divides by mitosis to form a ball of cells called the embryo.

27. Fertilisation (conception) occurs in Fallopian tube - Zygote develops by mitosis into Embryo - Embryo implants into uterus wall - Placenta develops on uterus wall to filter blood - Umbilical cord develops between placenta and baby's navel to carry blood vessels - Amniotic sac containing amniotic fluid protects baby throughout the gestation - Embryo develops into foetus - Heart is the first major organ to develop - In ninth month, foetus turns upside down - After nine months, uterine contractions begin, cervix dilates, and baby is born head first followed by the umbilical cord and placenta - Umbilical cord is severed - Mother produces breast milk and her menstrual cycle begins again.

28. Oestrus is a time when a female animal other than a human demonstrates the intensity of the sex urge, and is said to be 'in heat'. Changes in the lining of the vagina and uterus occur. Oestrus occurs at the time of ovulation. For example, female cats and dogs have about two oestrous periods per year, whereas rats can have them every five days.

Female humans and apes do not have an oestrus. Their menstrual cycle is marked by periods of menstruation about every 28 days.

29. Identical twins are formed when one sperm fertilises one ovum. As the zygote divides by mitosis to form the ball of cells called the embryo, this ball splits into two parts and twin genetically identical embryos develop.

Fraternal or non-identical twins are formed when two ova are fertilised by two sperm.

Non-identical twins are as genetically alike as other siblings.

30. (a) Advantages - protection from environmental fluctuations of temperature, moisture and the like; if camouflaged, protected from predation.

Disadvantages - limited time and space for development of offspring; easy prey if left by parent and not camouflaged.

30. (b) Advantages - continued maternal nutrition of offspring for a short time; protection from predators and environmental changes; development after birth may continue within a pouch where the offspring may slowly become accustomed to external environment whilst being protected by its mother.

Disadvantages - need for mother to consume larger quantities of nutrients; space for only a small number of offspring.

30. (c) Advantages - longer time for development of offspring in a protected and nourishing environment.

Disadvantages - need for mother to consume larger quantities of food and to remain less active; only one or two offspring possible at a time; few opportunities during mother's lifetime to have offspring.

30. (d) Advantages - lengthy time period for development of young in a protected and nourishing environment.

Disadvantages - mother's less active lifestyle would require assistance of other animals to obtain food during gestation period, with greater chance of predation; difficulty in raising young if mother is again pregnant.

30. (e) Advantages - greater care of offspring for longer periods of time would be possible, while the mother is protected from predators and does not need to exert undue effort to obtain food, build nests and so on.

Disadvantages - mother is not sufficiently able to obtain food and build shelter if mate dies.

30. (f) Advantages - higher chance that some will survive to adulthood.

Disadvantages - short developmental period for offspring, open to predation and changing environmental conditions as this probably requires external fertilisation.

31. If the prospective male mates were to involve in combat, then the stronger mate would father the offspring, and hence his better adapted genes would be passed to the offspring.

If each parent had separate roles in the building of shelter, obtaining food, protection from predators and so on, then the gestation period could be longer with greater development of the young before and after birth.

If the mother nurtured the offspring after birth, then the developmental period could be greater to advance the young.

32. In general, the larger or more complex the organism, the longer is the gestation period. For example, the gestation time for an elephant is 624 days compared with 21 days for a rat.

Also, in some species, continued development may occur after birth in a pouch. The red kangaroo has a gestation period of only 31 days, while a rabbit without further pouch development also has a gestation period of 31 days.

33. Viruses cannot duplicate themselves. They must invade a host cell and use their host's cell processes to duplicate.