

Answers to Exam Practice Questions

1. Mitosis produces two genetically identical diploid cells, while meiosis produces four genetically different haploid cells.
Mitosis does not require chromosomes from another organism, so some organisms can reproduce this way efficiently. A disadvantage is that all offspring are genetically identical, so a disease could potentially wipe out the population.
Meiosis produces genetic variety, so the population is more likely to survive. A disadvantage is that it requires a second organism, so they may need to devote a lot of resources to finding a suitable mate.
2. Crossing over is the process which occurs during meiosis I when the tetrads line up and exchange portions of their chromatids. This greatly increases genetic variety.
3. The two types of cell regulators are internal and external. Internal regulators would help ensure that necessary events have occurred before the cell proceeds to the next phase of mitosis. External regulators would respond to events outside the cell (such as contact with another cell) in order to speed up or slow down the rate of cell division.
4. Cancer is uncontrolled cell division. Cancerous cells do not possess, or fail to respond to cell cycle regulators. Many forms of cancer have been linked to a defect in gene p53.
5. Non-disjunction occurs when homologous chromosomes fail to separate during meiosis, resulting in an abnormal number of chromosomes in the gametes. One type of Down syndrome occurs because of the presence of an extra chromosome number 21 (trisomy 21).
Turners syndrome = XO (only one X chromosome)
Klinefelters syndrome = XXY
6. Cells divide in order to allow the organism to grow, and to replace damaged or dead cells. They are prompted to do so because of internal regulators (under hormonal control), or external regulators (to heal a wound, etc.)
7. a)

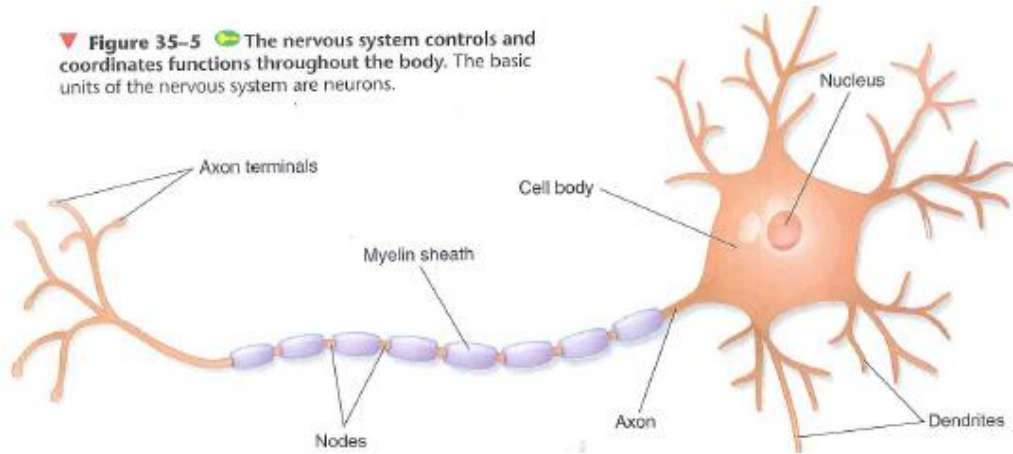
8. Phenotype is the physical characteristic that is expressed i.e blue eyes, brown hair, tall pea plants. The genotype are the alleles or the genetic makeup that represent that characteristic i.e AA = blue eyes Aa= blue eyes aa = green eyes etc
9. The principle of dominance states that some alleles are dominant and some are recessive. It relates to genetic inheritance because if the dominant allele is present that that trait will always be expressed even if one recessive allele is present.
10. The principle of segregation is that the two alleles segregate or separate from each other so that each gamete carries only a single copy of each gene. It relates to genetic inheritance because each offspring in the F1 generation receives an allele from each parent.
11. The principle of independent assortment states that genes for different traits can segregate independently during the formation of gametes. Independent assortment helps account for the many genetic variations observed in plants, animals and other organisms.
12. In incomplete dominance the heterozygous phenotype is somewhere in between the two homozygous phenotypes. For example a cross between a pink flower and a white flower that are incompletely dominant will create offspring with pink flowers. In co-dominance both alleles contribute to the phenotype. For example a cross between a white feathered and a black feathered chicken whose alleles are co-dominant creates an offspring with black and white spots.
13. A) true breeding plants meaning if they are allowed to self-pollinate they would produce offspring identical to themselves.
 B) hybrids are the offspring of crosses between parents with different traits
 C) P is the parent generation. F1 is the first filial generation or the offspring from the P generation. F2 are the offspring from the F1 generation.
 D) Genes are the chemical factors that determine traits
 E) Alleles are the different forms of the gene
14. Base pairing is how the different nucleotides in DNA (or DNA and RNA) pair up: A and T, G and C.
15. T A C C G T A G T C A G T A C G A T A G C T A G C A T A G C T A (DNA)
 A U G - G C A - U C A - G U C - A U G - C U A - U C G - A U C - G U A - U C G - A U (RNA)
 start
16. The process of creating a protein begins with transcription. In transcription, mRNA is made from the gene on the DNA. RNA polymerase binds to the promoter of the gene and a complimentary mRNA strand is made. The mRNA is then processed with introns being removed and the exons fuse together. The mRNA then leaves the nucleus through the pores and goes to the ribosome for translation. The ribosome scans the mRNA for the start codon (AUG) and then assembles on the mRNA. tRNA brings the appropriate amino acids to the ribosome where the anticodon of the tRNA matches up with the codon of mRNA. When a stop codon is reached, the polypeptide is released. It then goes to the rough ER for modification where some amino acids are removed. The modified polypeptide then travels to the Golgi body where there is more modification, often multiple polypeptides are put together, to make the final protein. If the protein is destined to be shipped out of the cell, the protein is sent out of the Golgi through a secretory vesicle with then goes to the cell membrane to be released.

17. Many proteins are enzymes which catalyze and regulate chemical reactions. A gene that codes for an enzyme to produce pigment can control the color of a flower. Another gene could control the production of red blood cells.
18. Most mutations have little to no effect on the individual, however mutations that cause drastic changes in the protein structure or the gene activity can result in genetic disorders or various forms of cancer.
19. No not all mutations are bad there could be a mutation that produces proteins when new or altered activities that can be useful to the organism in different or changing environments.
20. Gene mutations are a result of a change in a single or a few nucleotides whereas a chromosomal mutation changes the number or structure of the chromosomes and can affect one or many genes.
21. DNA can be used to identify criminals because if samples are left at a crime scene they can be taken and compared to different suspects to determine which suspects DNA matches the samples. The process would begin with a DNA extraction taking the DNA and isolating it from a sample the DNA is then cut into pieces using restriction enzymes it can then be speperated and run through a gel electrophoresis. This will create bands on a gel and you can compare the bands from the sample to each suspect. If the bands match a certain suspect they are the criminal.
22. Sex linked chromosomes affect inheritance patterns because many sex linked genes are located on the X chromosome. Therefore there is a much greater chance for a male to inherit a sex linked trait because he only has one X chromosome whereas a female has two X chromosomes, so all X linked alleles are expressed in males, even if they are recessive. If females a recessive X linked allele can be passed on to offspring but not be expressed if a dominant allele is present on the other X chromosome. Yes a daughter can inherit a sex-linked chromosomal disorder such as color-blindness from her father. When creating offspring one sex chromosome comes from the mother the other from the father so if you are female one of your X chromosomes came from your father.
23. A) transformation is a process in which one strain of bacteria is changed by a gene or genes from other strain of bacteria.
 B) Complementary DNA strands: a double stranded DNA synthesized from a messenger RNA (mRNA)
 C) Genes are the chemical factors that determine traits
 D) protein: a macromolecule that contains carbon, hydrogen, oxygen and nitrogen needed by the body for growth and repair and to make up enzymes
 E) introns vs exons: an intron is a sequence of DNA that is not involved in coding for a protein an exon is an expressed sequence of DNA which codes for a protein
 F) bacteriophage is a virus that infects bacteria
 G) enzymes are proteins that act as biological catalyts
 H) amino acids are compounds with an amino group (-NH₂) on one end and a carboxyl group (-COOH) on the other end.
 I) Transcription is a process in which part of the nucleotide sequence of DNA is copied to a complementary sequence in RNA.
 J) Codons are the three nucleotide sequence on mRNA that codes for a single amino acid.
24. The purpose of Darwin's voyage on the HMS Beagle was to collect samples and make observations that led him to propose a hypothesis about the way life changes over time.

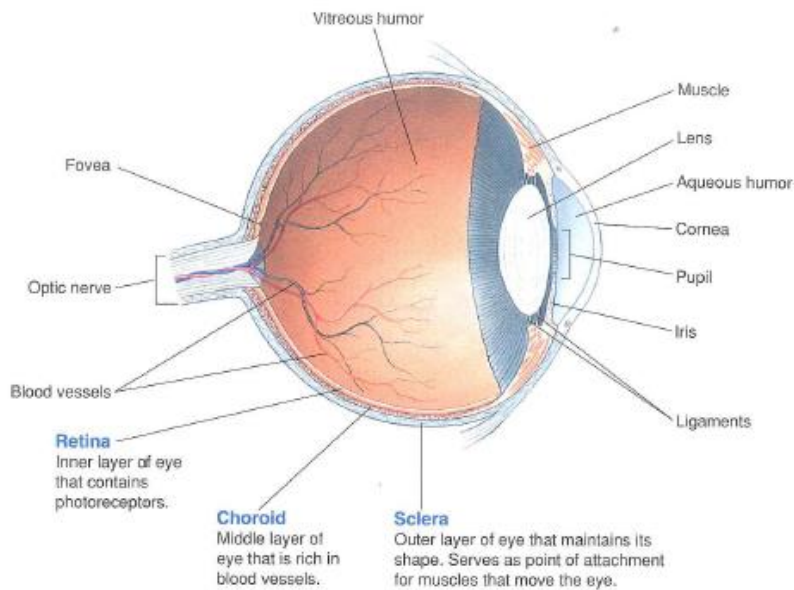
25. Horse breeders could use artificial selection to increase the life span of individuals in their herds, by selecting individuals who had a long life span and purposely breeding them together to create offspring that contain genes with those traits.
26. Fitness in evolutionary terms is an organisms ability to survive and reproduce in its specific environment. It relates to adaptation because fitness is the results of adaptations. An adaptation is any inherited characteristic that increases an organisms chance of survival. So successful adaptations enable organisms to become better suited to their environment and therefore better able to survive and reproduce.
27. The fossil record supports Darwin's conclusions because Darwin believed the earth was older than what people at the time thought it was and the fossils proved that the earth was millions rather than thousands of years old. It also helped to prove his theory that the earth had changed over time. By comparing fossils from older rock layers to fossils with younger layers, scientists could prove and documents the fact that life had changed over time.
28. The difference between homologous body structures and convergent evolution is that homologous body structures means that two (or more) species share the same basic structure but it produces different functions. For example a bat's wings and the hand of a human have the same basic bone structure, but have a radically different function. Convergent evolution is where two (or more) species have different basic structures but it produces different functions. For example a bats wing and an insectsw wing. They have the same basic function to allow flight, but they are completely different structures insects do no have bones at all.
29. It took Darwin so long to publish his work because he didn't think people would be on board with his theories. He was stunned and disturbed by his own discoveries and he knew they would challenge fundamental scientific beliefs of his day.
30. A) Population is a group of individuals of the same species that live in the same area.
B) species is a group of similar organisms that can breed and produce fertile offspring.
C) Gene Pool is the combined genetic information of all the members of a particular population.
D) Relative frequency of an alleluias the number of times an allele occurs in a gene pool compared with the number of times other alleles occur.
E) Genetic Equilibrium is a situation in which allele frequencies remain constant.
31. The conditions required to maintain Hardy-Weinberg equilibrium are:
- There must be random mating.
 - The population must be very large.
 - There can be no movement into or out of the population.
 - There can be no mutations.
 - There can be no natural selection.
- 32.

33. It is important for the body to maintain homeostasis because we need to keep internal conditions constant despite changes in the external environment.
34. Voluntary actions are controlled by the cerebrum. Voluntary actions are those conscious activities of the body i.e. walking, talking etc Involuntary actions are controlled by the brain stem which includes the pons and the medulla oblongata. Involuntary actions are those you are not conscious of i.e. breathing, blood pressure, heart rate etc

35. A)



b)



36. The two major types of hormones are steroid and non-steroid. Steroid hormones enter the cell by passing directly across the cell membrane. Once inside the cell it binds to the receptor creating the hormone-receptor complex (HRC). The HRC then enters the nucleus of the cell and binds to a DNA control sequence. The binding starts initiates the transcriptopn of specific gens to messenger RNA (mRNA) and the mRNA moves into the cytoplasm and directs proteins synthesis. Nonsteroid hormones cannot pass through the cell membrane of their target cells. The bind to the surface of the cell membrane and by attaching to the receptor activate enzymes, which then activate secondary messengers which carry the message to the hormone inside the cell.
37. The nervous and endocrine system both respond to particular situations. Their roles are differnt the nervous system carries specific messages from one cell to another and moves swiftly. The endocrine system does what the nervous system cannot. The endocrine system is made up of glands that release their products into the blood stream and the messages can get sent throughout the body. The nervous system can only send messages where the neurons are connected throughout the body.
38. Prostaglandins is a hormonelike substance which all cells have been shown to produce. They are modified fatty acids that are produced by a wide range of cells. They are called local hormones because they generally only affect nearby cells and tissues.