QUESTION – BIOLOGY

FORM -4

GENETICS

1. The figure below is a structural diagram of a portion from a nucleic acid strand.

--- S --- P --- S --- P --- S --- P --- S

C G U C

(a) Giving a reason, name the nucleic acid to which the portion belongs.

(2 marks)

Name _____

Reason _____

(b) Write down the sequence of bases of a complimentary strand to that shown above

(1 mark)

2. State two structural differences between ribonucleic acid (RNA) and deoxyribonucleic acid (DNA) (2 marks)

3. Name a disorder of human blood that is caused by mutation (1 mark)

4. State the function of deoxyribonucleic acid (DNA) molecule (1 mark)

5. Give a reason why it is only mutation in genes of gametes that influence evolution

(2 marks)

6. In an experiment, red flower were crossed with plants with white flower. All the plants in the F1 generation had pink flowers.

(a) Give a reason for the appearance of pink flower in the F1 generation (1 mark)

(b) If the plants from F1 generation were selfed, state the phenotype ratio of the F2 generation (2 marks)

7. State two characteristics that researchers select in breading programmes.

(2 marks)

8. Give an example of sex- linked trait in humans on; (2 marks)

Y chromosome _____

X chromosome _____

9. In an experiment, a variety of garden peas having a smooth seed oat was crossed with a variety with a wrinkled seed coat. All the seeds obtained in the F1 had a smooth seed coat. The F1 generation was selfed. The total number of F2 generation was 7324.

(a) Using appropriate letter symbols, work out the genotype of the F1 generation.

(4 marks)

(b) From the information above, work out the following for the F2 generation

(i) Genotype ratio (2 marks)

(ii) Phenotype ratio (1 mark)

(iii) Wrinkled number (1 mark)

10. In a certain plant species, some individual plant may have white, red or pink flower. In an experiment a plant with white parent plant were pure lines. All the plants from F1 generation were pink. Using letter R to represent the gene for red colour and letter W for white colour;

(a) Work out the genotype of F1 generation (3 marks)

(b) If the plants from F1 generation were selfed, what would be the phenotypic ratio of the F2 generation? (3 marks)

(c) What is the genetic explanation for the absence of plants with red and white in the flower F1 generation? (2 marks)

11. In a breeding experiment, plants with red flower were crossed. They produced 123 plants with red flowers and 41 with white flowers.

1. Identify the recessive character. Give a reason
2. What were the genotypes of the parent plants that give rise to the plants with red and white flowers?
3. If the white flowers were selfed, what would be the genotypes of their offspring?

12. (a) Name two disorders in humans caused by gene mutation (2 marks)

(b) Describe the following chromosomal mutations

(i) Inversion (2 marks)

(ii) Translocation

(c) In mice the allele for black fur is dominant to the allele for brown fur. What percentage offspring would have brown fur from a cross between heterozygous black mice and brown mice? Show your working. Use letter B to represent the allele for black colour.

(4 marks)

13. (a) What is meant by the term allele? (1 mark)

(b) Explain how the following occur during gene mutation

(i) Deletion (1 mark)

(ii) Inversion (1 mark)

(c) What is a test- cross? (1 mark)

14. In maize the gene for purple colour is dominant to the gene for white colour. A pure breeding maize plant with purple grains was crossed with a heterozygous plant.

(a) (i) Using letter G to represent the gene for purple colour, work out the genotypic ratio of the offspring (5 marks)

(ii) State the phenotype of the offspring (1 mark)

(b) What is genetic engineering? (1 mark)

15. Define the following terms as used in genetics.

(i) Alleles

(ii) Genotype

(iii) Phenotype

16. A farmer mated his dark red cow with a white bull. The cow gave birth to a light red calf

(a) State why the calf is light red and not dark red or white

(b) If a light red bull is mated with a dark red cow, work out using appropriate letter symbols the probability of getting a light offspring

17. (a) What is meant by linked genes?

(b) (i) In fruit flies (Drosophila) the gene for red eyes ® is dominant over the one for white – eye (r). If a true breeding white – eyed male, all the offspring will be red eyed. However, if a true – breeding white- eyed female is mated with a true- breeding red- eyed male, all the female offspring will be red – eyed. Explain this apparent contradiction.

(ii) Work out the ratio of the expected phenotypes if a red- eyed female offspring from the cross- described in (i) above is mated with red- eyed males.

18. (a) Explain the term variation with reference to the study of genetics.

(b) Using relevant examples distinguish between discontinuous variation and continuous variation

(c) What is the importance of genetic variation?

(d) Describe one example where genetic variations has helped a species to survive

19. The diagram below shows the base sequence of part of a nucleic acid stand. Observe it and answer the questions that follow

G T T A G C T G A

(a) What do the letters G, T , C and A represent?

(b) Giving your reasons state whether it is part of DNA or an RNA strand.

(c) Show the complementary DNA strand

(d) Show the complimentary RNA strand

20. In human couples the sex of a baby is determined by the man. Explain this statement.

EVOLUTION

4. State the difference between Lamarckian and Darwinian theories of evolution
5. Two populations of the same species of birds were separated over a long period of time by an ocean. Both populations initially fed on insects only. Later it was observed that one population fed entirely on fruits and seeds. Although insect were available. Name this type of evolutionary change.
6. Explain why Lamarck's theory of evolution is not accepted by biologists today
7. State three pieces of evidence that support the theory of evolution. (3 marks)
8. state two advantages of natural selection to organisms (2 marks)
9. Give a reason why each of the following is important in the study of evolution

   (i) Fossils records

(ii) Comparative anatomy

10. Describe how natural selection brings about adaptation of a species to its environment (6 marks)

11. Explain how the process of evolution may result to the formation of new species

12. What is meant by

    a. organic evolution (1 mark)

    b. continental drift (1 mark)

13. Explain continental drift as an evidence of evolution (3 marks)

14. (a) What is a test- cross? (2 marks)

    (b) Give a reason why organisms become resistant to drugs (1 mark)

15. Distinguish between the following terms

    a. Homologous structures

    b. Analogous structures (4 marks)

16. (a) What is meant by natural selection?

    (b) Explain the role played by mutation in evolution (5 marks)

17. Define the following terms

    a. Hybrid

    b. Hybrid vigour

18. The peppered moth exists in two varieties, which are genetically controlled. The dark variety is found predominantly in industrial cities and the white variety is found predominantly in rural areas. Explain how this pattern of distribution supports the theory of evolution by natural selection (6 marks)

19. Explain what is meant by the following concepts

    a. Special creation (2 marks)

    b. Organic evolution (2 marks)

RECEPTION, RESPONSE AND CO-ORDINATION

20. State one structural and one functional differences between motor and sensory neurons

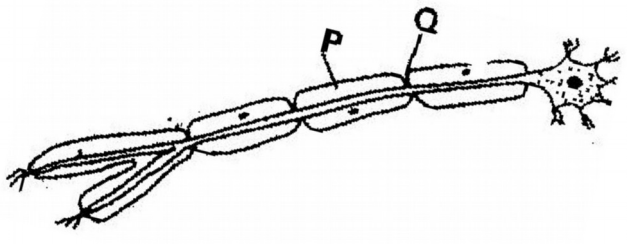
    Structural differences

    Functional differences (2 marks)

21. The table below shows two mammalian hormones. For each hormone, state the site of production and its function in the body.

Hormone	Site of production	Function
Oestrogen		
Aldosterone		

22.



(i) With an arrow, indicate on the diagram the direction of the impulse through the neurone

(1 mark)

(ii) State the functions of parts labeled P and Q (2 marks)

23. (a) How are structures of the human eye adapted to their functions (14 marks)

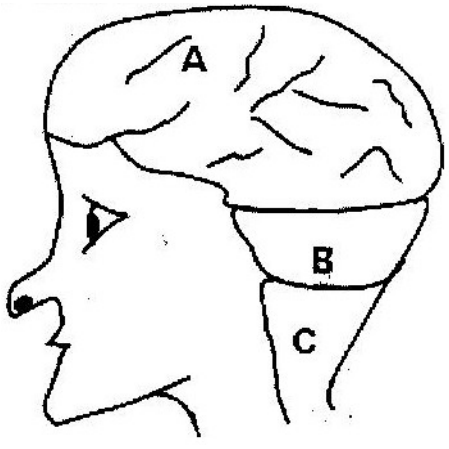
(b) State three defects of the eye and how each can be corrected (6 marks)

24. State the changes that occur in a nerve axon to produce an action potential

(3 marks)

25. In an accident a victim suffered brain injury. Consequently he had loss of memory. Which part of the brain was damaged? (1 mark)

26. The diagram below shows surface view of a human brain



(a) Name the parts labeled B and C (2 marks)

(b) State three functions of the part labeled A (3 marks)

(c) State what would happen if the part labeled B was damaged. (1 mark)

27. What is the function of the following cells in the retina of the human eye?

(2 marks)

(a) Cones

(b) Rods

28. (a) State the functions of the following parts of the mammalian ear

(i) Tympanic membrane (3 marks)

(ii) Eustachian tube (1 mark)

(iii) Ear ossicles (2 marks)

(b) Describe how semi- circular canals perform their functions (2 marks)

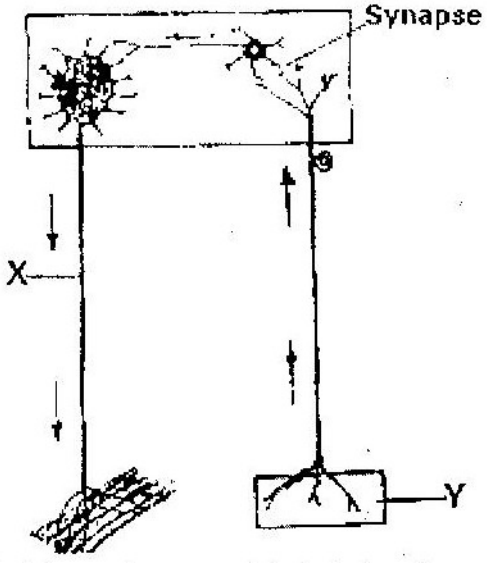
29. State the importance of tactic response among some members of Kingdom Protista?

(1 mark)

(a) What name is given to response to contact with surface exhibited by tendrils and climbing stems in plants? (1 mark)

(b) State three biological importances of tropisms to plants (3 marks)

30. The diagram below represents a reflex arc in human



(a) Name the parts labeled X and Y (2 marks)

X _____

Y _____

(b) Name the substance that is responsible for the transmission of an impulse across

the synapse (1 mark)

31. (a) State the function of the ciliary muscles in the human eye. (1 mark)

(b) State two functional differences between the rods and cones in the human eye

(2 marks)

32. State the function of each of the following parts of human ear (4 marks)

a. Ear ossicles

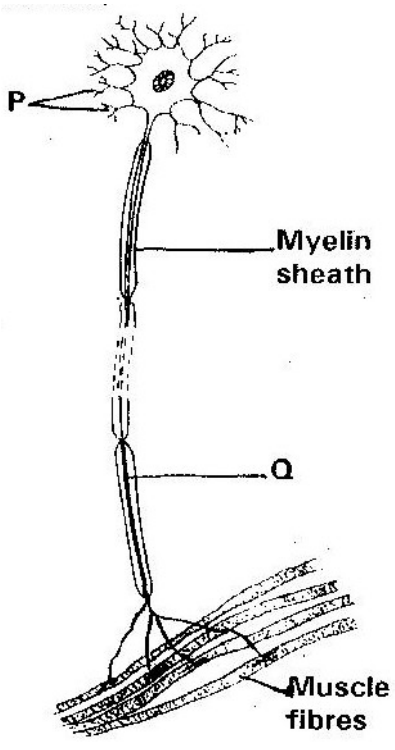
b. Cochlea

c. Semi- circular canals

d. Eustachian tube

33. (a) Where in the human body are relay neurons found? (1 mark)

(b) The diagram below represents a neurone



(i) Name the neurone (1 mark)

(ii) Name the parts labeled P and Q (2 marks)

34. (a) Name the hormone that is responsible for apical dominance (1 mark)

(b) What is thigmotropism? (1 mark)

35. Describe the structure and functions of the various parts of the human ear

(20 marks)

36. Nocturnal animals such as the owl are capable of seeing fairly well at night

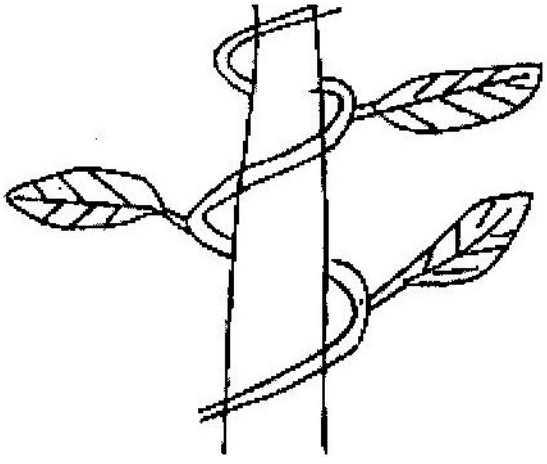
What two retinal adaptations have made this possible? (2 marks)

37. State two functions of the human ear? (2 marks)

38. State four differences between co- ordination of the human eye's internal response to light and that of tropic movement of the flowering plant in response to light.

(4 marks)

39. The figure below shows a stem of a plant growing round a tree trunk



(i) What is the name of the response, which causes the twisted growth?

(1 mark)

(ii) Explain how the twisting process is accomplished (2 marks)

(iii) Identify the state of leaves if the plant is autotrophic (2 marks)

40. Euglena is positively phototactic. Of what biological significance is this characteristics?

(1 mark)

41. State the function of acetylcholine (2 marks)

42. Where in the human body is the relay neurone located? (1 mark)

43. State three effects of nicotine to human health (3 marks)

44. state the part of the eye involved in

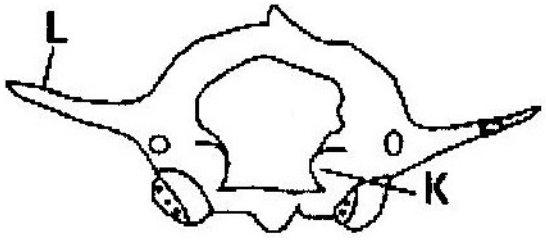
(i) Colour vision

(ii) Maintaining shape of the eyeball

(iii) Change in diameter of the lens

SUPPORT AND MOVEMENT IN PLANTS AND ANIMALS

(b) The diagram below represents in a mammalian bone



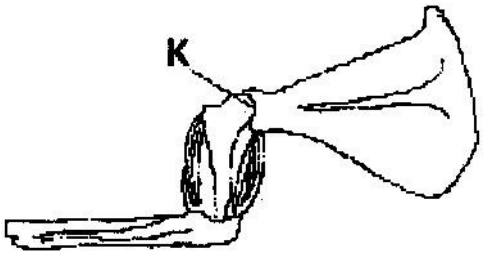
(a) State the function of the part labeled K and L (2 marks)

(b) State the region of the body in which the bone is found (1 mark)

(c) State two ways in which skeletal muscle fibres are adapted to the function

(2 marks)

(d) The diagram below shows the arrangement of bones and muscles in a human arm.



(i) Name the parts of the bone labeled K (1 mark)

(ii) How do the muscles work to extend the arm? (3 marks)

(e) State three structural differences between biceps muscles and muscles of the gut

	Biceps	Gut muscles
(i) (ii) (iii) (iv)		

(f)

(a) Name the bone (1 mark)

(b) Name the type of joint formed by the bone at its anterior end with the adjacent bone

(1 mark)

(g) Give a reason why the lumbar vertebrae have long and abroad transverse processes

(2 marks)

(h) (a) Name the three types of skeletons found in multicellular animals

(3 marks)

(b) Describe how the cervical, lumbar and sacral vertebrae are suited to their functions (17 marks)

(i) A bone obtained from a mammal is represented by the diagram below

(a) Name the bone (1 mark)

(b) Which bones articulate with the bone shown in the diagram at the notch?

(2 marks)

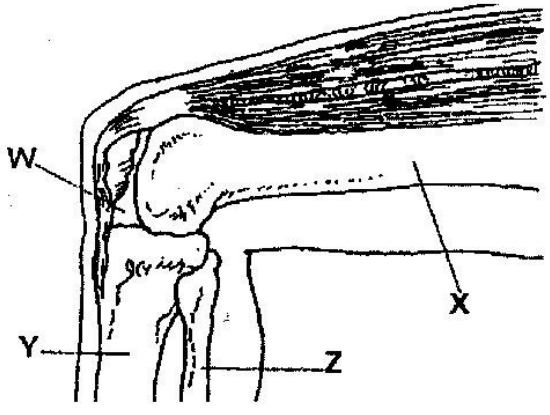
(j) (a) Name the cartilage between the bones of the vertebral column

(1 mark)]

(b) State the function of the cartilage in (a) above (1 mark)

(k) How are xylem vessels adapted for support? (1 mark)

(l) The diagram below represents bones at a joint found in the hind limb of a mammal



(a) Name the bones labeled X, Y, and Z (3 marks)

X _____

Y _____

Z _____

(b) (i) Name the substance found in the place labeled W (1 mark)

(ii) State the function of the substance named in (b) (i) above

(c) Name the structure that joins the bones together at the joint (1 mark)

(d) State the differences between ball and socket joint and the one illustrated in the diagram above (1 mark)

(e) Name the structure at the elbow that performs the same functions as the patella (1 mark)

(m) (a) State a characteristic that is common to all cervical vertebrae

(b) Name two tissues in plants that provide mechanical support (2 marks)

(n) (a) Name the three types of muscles found in mammals and give an example of where each on of them is found

(b) State the difference between ball and socket and hinge joint (1 mark)

(o) State three functions of an insects exoskeleton (3 marks)

(p) State the function of the following fins of a fish

a. Dorsal fin (1 mark)

(b) Pectoral and pelvic fins (1 mark)

(c) Caudal fin (1 mark)

(q) State the diagnostic features of the cardiac muscles (3 marks)

The following figure is a part of a pelvic girdle known as the innominate bone

(a) Make a complete drawing of the girdle (1 mark)

(b) Name the bones that articulate with the pelvic girdle. In each case name the part that articulates with (2 marks)

(r) Distinguish between tendons and ligaments (2 marks)

(s) Explain what antagonistic muscles are and give an example (4 marks)

(t) (a) Name three types of strengthening tissues found in plants (3 marks)

(b) Explain how the tissue in (a) above are adapted to their functions (3 marks)

(u) (a) Name the three main types of joint (3 marks)

(b) Give an example of where each type of joint name in (a) above is found in the human body (3 marks)

(v) What makes young herbaceous plant remain upright? (2 marks)]

(w) Name three types of muscles found in the human body, state where each type is located and how each is adapted to its functions. (12 marks)

Applied genetics

1 A strain of barley (A) has a high yield of seeds but a long stem which is subject to 'lodging' (a flattening of areas of the crop). Another strain (B) has a short, sturdy stem but a lower yield. The genotype of variety A is **HHss** (high yield, long stem) and the genotype of B is **hhSS** (low yield, short stem)

(a) Show how a plant breeder would cross these varieties to produce a high yielding, short stemmed variety.

(b) Explain why this variety would not breed true.

2 Choose from the list of words below, to complete the following sentence.
In genetic engineering, a …..A …..from one organism is introduced into the ….. B …..

of an unrelated organism.
chromosome, nucleus, gene, protein, genome

3 What name is given to an enzyme which is used to cut a DNA molecule at specific sites?

4 What bacterial cell structures are used to carry the genes intended for genetic engineering?

5 Name three useful products that can be obtained by genetic engineering.

6 Outline the steps involved in using bacteria to produce human insulin.

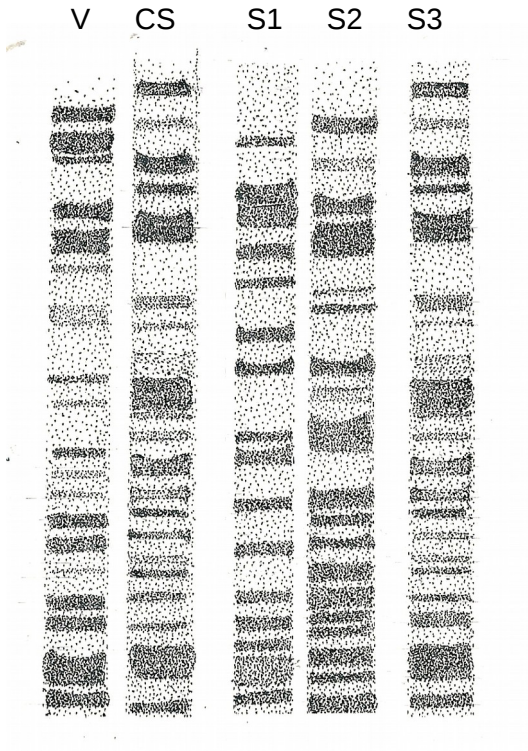
7 Give three examples of genetic engineering that are intended to improve crop plants.

8 DNA can be split into fragments using restriction enzymes.
(a) Outline the technique used to separate these fragments.
(b) What property of the DNA fragments allows this separation?

9 The illustration shows the separation of DNA fragments produced from blood samples taken at the scene of a crime, plus those of three suspects.

Rule horizontal lines through the DNA bands from the crime scene, to cross the three suspects profiles.
(a)Which suspect is most likely to be guilty?
(b) Explain why you think so.

V Victim
CS Sample taken from crime scene
S1 Suspect 1
S2 Suspect 2
S3 Suspect 3



10 What is the special characteristic of (a) stem cells, (b) embryonic stem cells?

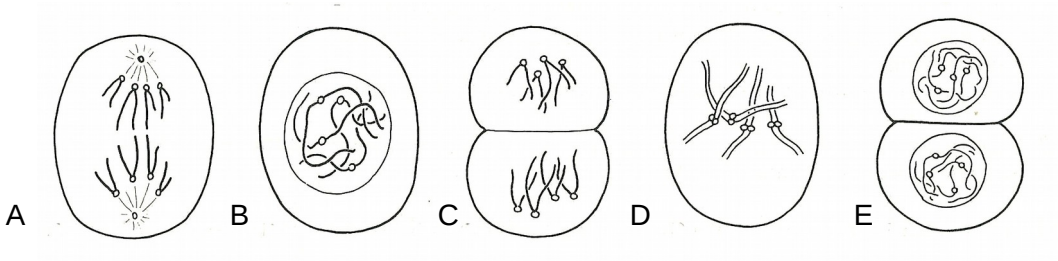
11 What are the possible sources of human embryonic stem cells?

12 What would be the advantage of using a patient's own stem cells e.g. blood stem cells, to treat his or her illness?

Cell division and chromosomes

1 A cell in the basal layer of the skin contains 46 chromosomes and divides by mitosis to produce new skin cells. After ten successive divisions, how many chromosomes will the basal cell have?

2 The drawings below depict stages in the mitotic division of a cell



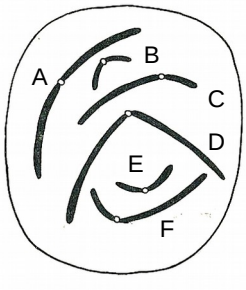
(a) Write the letters in the order in which these stages occur.
(b) How many pairs of chromosomes are there in the cell?
(c) What is the diploid number of chromosomes in these cells?

3 Choose the most appropriate word to complete the sentence.
When chromosomes replicate, they produce ……...
tissues, nuclei, chromatids, somatic cells

4 In which three of the following cells is mitosis unlikely to occur?
a sperm cell, an epithelial cell of a villus, a hair cell, a cell in the red bone marrow, a red blood cell, a lymphocyte, a cell in the basal layer of the skin

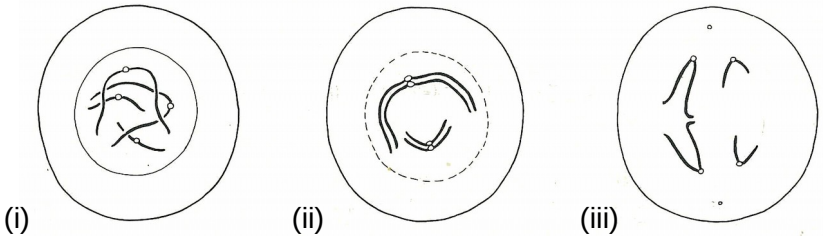
5 An animal has 36 chromosomes in each of its body cells. How many of these chromosomes came from its male parent?

6 Which pairs of chromosomes in the cell shown here are homologous?



7 Fill in the missing words.
The ….. A ….. of a cell contains a fixed number of chromosomes. Before mitosis, each chromosome ….. B ….. to produce two ….. C …...

8 The following drawings-show the sequence of events early in cell division.
(a) Is the division meiotic or mitotic?
(b) How do you know?



9 Give two examples in each case of organs or tissues in which you would expect

(a) meiosis, (b) mitosis to be taking place.

10 A fruit fly has four pairs of chromosomes in its cells. At meiosis, how many different combinations of maternal and paternal chromosomes are possible in the gametes?

11 From the list below, choose the most suitable words to complete the sentence.
Mutations are changes which occur in a ….. A …..or a ….. B …... If a mutation occurs in a cell which is going to form a ….. C …..., the mutation may affect the whole ….. D ….. which develops.

Down's syndrome results from a ….. E ….. mutation In the ….. F…..

Sickle cell anaemia results from a ….. G ….. mutation which affects ….. H ….. of the blood system.

cells, gene, gamete, chromosome, nucleus, ovum, organism

12 Exposure to ….. A ….., ….. B ….. or ….. C ….. may increase the rate of mutation
Suggest words or phrases for A - C

13 What kinds of mutation in disease-causing bacteria might make them more dangerous?

Heredity

NOTE: Alleles are alternative forms of a gene which occupies a particular position in a chromosome. Alleles affect the same characteristic (e.g. blood group) but not necessarily in the same way. $\mathbf{I^A}$, $\mathbf{I^B}$ and **i** are alleles of a gene which controls the ABO blood groups.

1 A plant with red flowers is crossed with a white-flowered plant of the same species. All the seeds, when grown, produce plants with red flowers. Assuming that the flower colour is controlled by a single pair of alleles, which allele is dominant and which is recessive?

2 If a dominant allele for tall plants is represented by the letter D, what letter should represent the corresponding recessive allele?

3 In cats, the allele (**S**) for short fur is dominant to the allele (**s**) for long fur.

(a) What is the genotype of a true-breeding, long-furred cat?
(b) What is the phenotype of a cat with the genotype **Ss**?
(c) In an **Ss** genotype, which allele is expressed in the phenotype?
(d) Which of the fo1lowing genotypes is (i) heterozygous (ii) homozygous dominant?
SS, **Ss**, **ss**

4 In rabbits, assume that the dominant allele (**B**) produces black fur. The allele (**b**) for white fur is recessive to **B**.

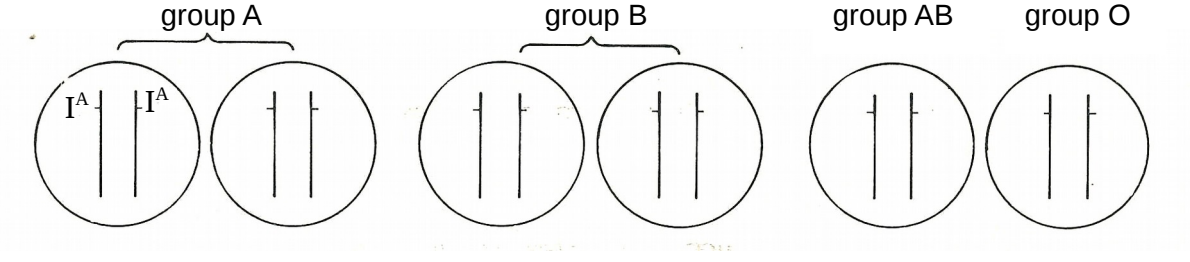
(a) What colour fur will each of the following rabbits have?

	Rabbit 1	*Rabbit 2*	*Rabbit 3*	*Rabbit 4*
genotype	**BB**	**Bb**	**bB**	**bb**

(b) Which of them will breed true?
(c) Which rabbits are homozygous for coat colour?
(d) If rabbits 1 and 4 were mated together and had 12 babies, how many of these would you expect to be black?
(e) If rabbits 2 and 3 are interbred and produce several litters, totalling 48 babies, how many white babies would be predicted by the laws of genetics?
(f) If rabbits 3 and 4 are mated together on several occasions and have 50 babies altogether, how many of their babies would you 'expect' to be black?

NOTE: In this context, 'expect' implies the perfect Mendelian ratio. In practice you would not expect to achieve this ratio with as few as 50 offspring.

5 The alleles controlling the ABO blood groups are given the letters $\mathbf{I^A}$ (group A), $\mathbf{I^B}$ (group B) and **i** (group O). On the drawings below, write in the alleles on the chromosomes for each of the blood groups. (The first one has been done for you)



6 In shorthorn cattle, the coat colours red or white are controlled by a single pair of alleles. A calf which receives the allele for red coat from its mother and the allele for white coat from its father is called a 'roan'. It has an equal number of red and white hairs in its coat.

(a) Is this an example of codominance or of incomplete dominance?
(b) Give a reason for your answer.
(c) Give one example in each case of (i) codominance, (ii) incomplete dominance, in humans.

7 Give three examples of human disorders which are caused by the action of a single pair of alleles. In each case say whether the harmful allele is dominant or recessive to the non-harmful allele.

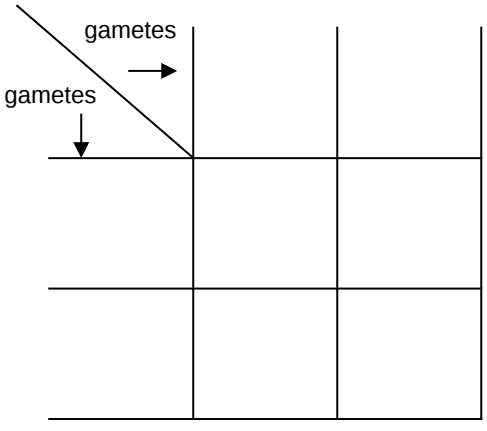
8 In humans, maleness or femaleness is determined by a pair of sex chromosomes called X and Y.

(a) What is the genotype for males?
(b) What is the genotype for females?

9 (a) In humans, is it the sperm or the ovum which determines the sex of the offspring?
(b) Give a reason for your answer.

10 In fruit flies, the allele (**n**) for ebony (black) body is recessive to the allele (**N**) for normal (grey) body.

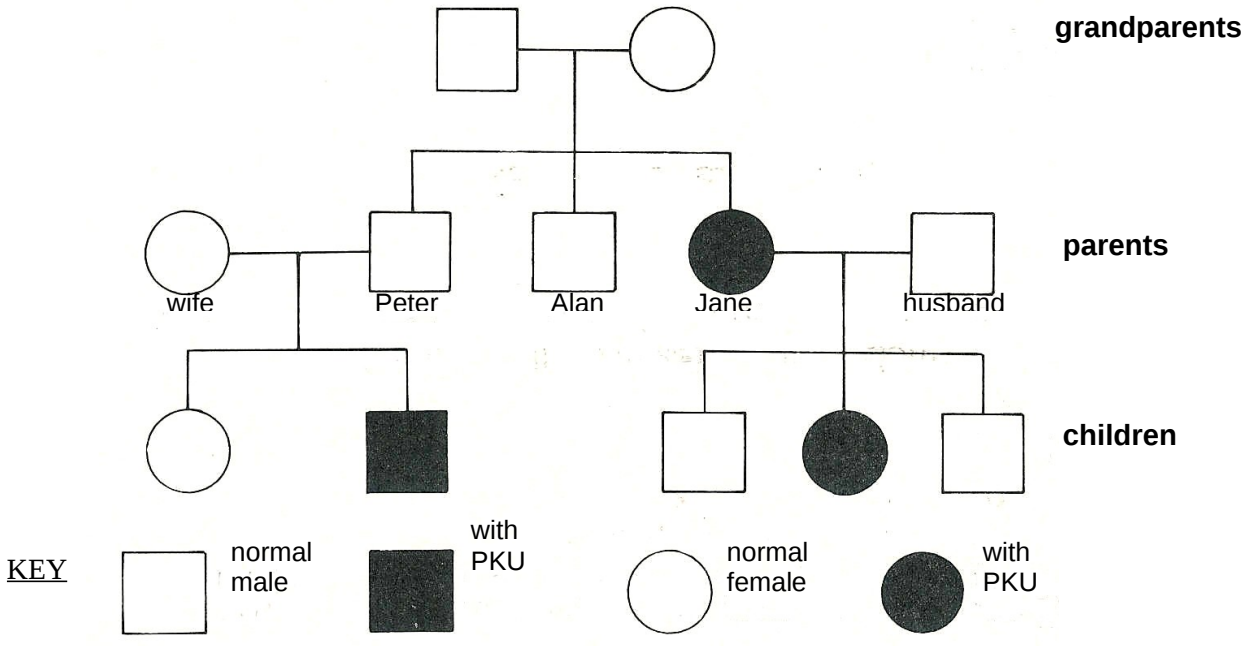
(a) Complete the Punnett square, for a cross between normal (grey-bodied) flies which are heterozygous for this allele (i.e. Nn genotypes).
(b) State the expected proportion of normal and ebony-bodied flies in a large sample of the offspring.
(c) State the proportion of the normal phenotypes which would be true breeding.



11 When a particular gene is said to be ‘sex-linked’, on which chromosome is that gene usually present?

12 The genetic disorder phenylketonuria (PKU) is caused by a recessive allele (**n**). The family

tree below shows the incidence of the disease over three generations.



(a) What can you deduce about the genotypes of the grandparents?
(b) Explain your reasoning.
(c) What is the genotype of Jane's husband?
(d) Explain your reasoning.
(e) What are the chances that Peter is the carrier of the PKU allele that resulted in his having an affected son?
(f) If Jane had been normal, what are the possible genotypes of the grandparents?
(g) Is it possible that the allele for PKU is sex-linked?

13 One form of colour-blindness is a sex-linked inherited condition controlled by a recessive allele. Use the symbols **X** and **Y** for the sex chromosomes and **N** and **n** for the alleles for normal or defective colour vision to show the genotypes of

(a) a normal male
(b) a colour-blind male
(c) a normal (non-carrier) female
(d) a colour-blind female
(e) a normal (carrier) female.

14 Use the genotypes you have written for your answer to question 13 to show the chances of (a) a son being colour blind, (b) a daughter being a carrier, resulting from a marriage between a normal man and a carrier woman.

The senses

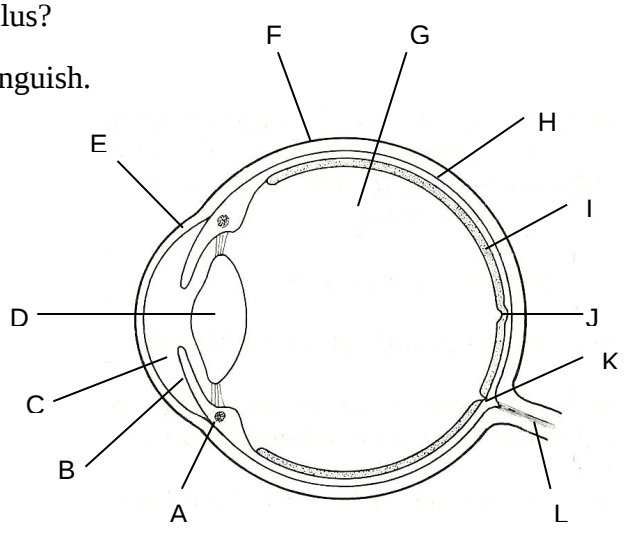
1 Complete the sentence below using the three most appropriate words from the list.
A …..(A) ….. such as touch, is detected by a ….. (B) ….. and we may make a ….. (C) ….. . .
response, change, organ, stimulus, movement, receptor, effector

2 List four stimuli which can be detected by the skin.

3 By what means do we become aware of a stimulus?

4 Name the four taste sensations that we can distinguish.

5 Give the names of the parts of the eye labelled in the diagram.



6 Which one of the following statements is incorrect?
When a bright light shines in the eye
(a) impulses travel in the optic nerve
(b) the radial fibres in the iris contract.
(c) the retina responds
(d) the pupil becomes smaller.

7 What is the cause of the blind spot in the field of vision?
(a) There are no nerves in the blind spot.
(b) There are only cones in the blind spot.
(c) There are no sensory cells in the blind spot.
(d) The image is not formed on the blind spot.

8 (a) Which region of the retina gives the most accurate interpretation of the image?
(b) What type of light-sensitive cell is present in this region?

9 Which parts of the eye refract ('bend') the light in such a way as to form an image on the retina?

10 (a) What do you understand by the term 'accommodation'?
(b) What part does the lens play in this process?

11 Which is the correct statement?
To focus a distant object
(a) the ciliary muscle contracts and the lens gets thicker
(b) the ciliary muscle relaxes and the lens gets thinner
(c) the ciliary muscle contracts and the lens gets thinner
(d) the ciliary muscle relaxes and the lens gets thicker.

12 What type of colour blindness is most common in men?

13 What kind of eye defect can give rise to short-sightedness?

14 What type of spectacle lens can help correct long-sightedness?

The skeleton, muscles and movement

1 Match the following biological names of bones to their everyday names,
Biological names: *humerus, femur, sternum, tibia, clavicle, scapula, pelvis*.
Everyday names: shoulder blade, shin bone, upper arm bone, hip girdle, collar bone, breast bone, thigh bone.

2 Which organs are protected by (a) the skull, (b) the rib cage, (c) the vertebrae?

3 What is the function, other than protection, of the ribs?

4 Give one example in each case of (a) a fixed joint, (b) a ball and socket joint, (c) a hinge joint.

5 Where does cartilage occur in a joint and what it its function?.

6 Name one inorganic component of bone,

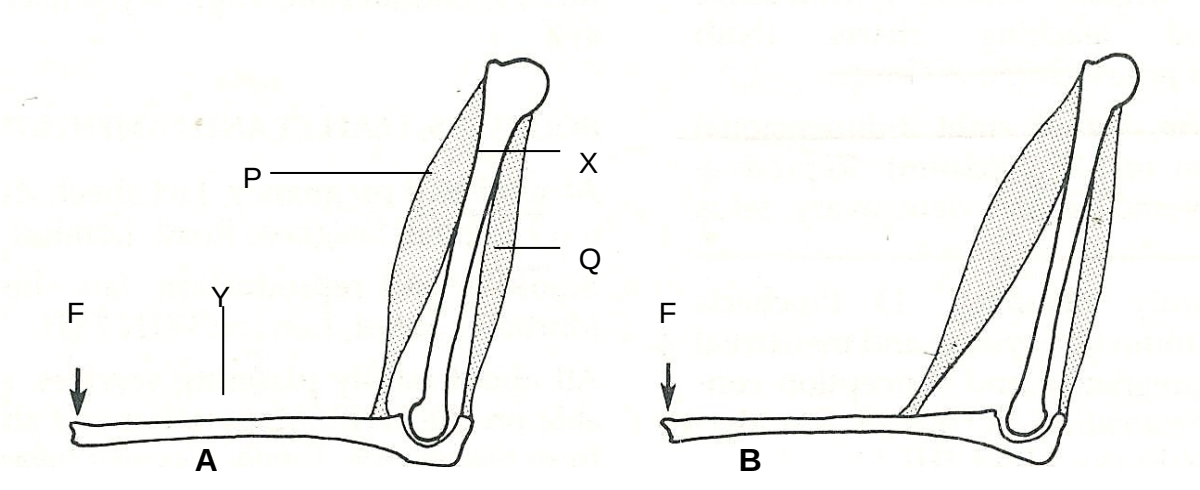
7 (a) Name three parts of the body where smooth (involuntary or unstriated) muscle may be found.
(b) In any one of your examples, say what the smooth muscle does.

8 How does skeletal (striated) muscle differ from smooth (unstriated) muscle in its function?

9 Why does each skeletal muscle need an antagonistic partner?

10 Which bone forms the non-moving muscle attachment in (a) the hip joint, (b) the shoulder joint, (c) the ankle joint?

11



(a) Assuming that the bone X remains stationary, what will happen (i) when muscle P contracts, (ii) when muscle Q contracts?
(b) Assuming muscle P is equally strong in each case, which one of A and B will produce (i) the greater movement at F, (ii) the stronger force at F?

12 In a word, what process provides the energy for muscle contraction?

13 (a) What are the immediate effects of exercise on the functions of (i) the heart, (ii) the lungs, (iii) the liver?
(b) How do these changes help to meet the needs of exercise?

14 State four long-term benefits of exercise.

15 Which one of the following is most likely to contribute to good health when you are 45?
(a) Active participation in sport when you were at school. .
(b) Walking to work every day.
(c) Playing golf every week-end.
(d) Playing squash three times a week.

Variation and selection

1 What are the two main causes of heritable variation?

2 Classify the following variations as either (i) caused entirely by genetic effects or (ii) caused by a combination of genetic and environmental effects.

obesity, eye colour, tallness, ability to sing, maleness, masculinity, blood group, natural hair colour; sickle-cell anaemia, agility

3 Alleles are genes which occupy corresponding positions on….. A ….. chromosomes. They control the same ….. B ….. but not necessarily in the same way.

4 (a) What new combinations of characteristics might arise in the offspring when a tall plant with white flowers is crossed with a dwarf plant (of the same species) with red flowers?
(b) What selective advantage might either of the new varieties have?

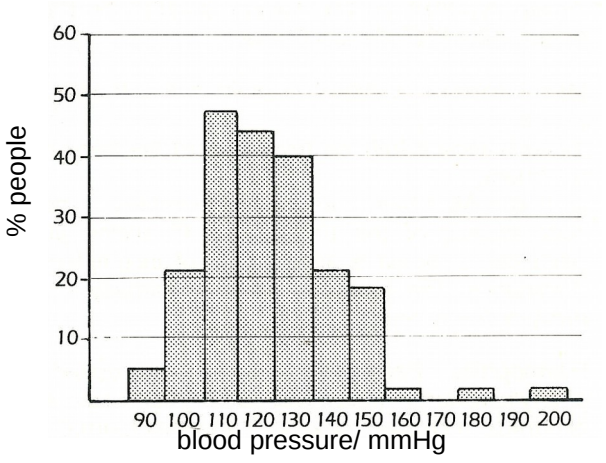
5 The genotypes of two guinea pigs, for two characteristics are represented as **AABB** and **aabb**. These guinea pigs are mated, and their offspring eventually mate with each other.
(a) What genotypes could emerge in the second generation?
(b) Which of these would be phenotypically different (i.e. be different in appearance) from the original pair?

6 Suppose that there are six pairs of alleles which control height and that each dominant allele adds 5cm to the stature. Suppose also that the average height of an adult (with equal numbers of recessive and dominant alleles) is 160cm
(a) What is (i) the tallest, (ii) the shortest person you would expect from this pattern?
(b) On this basis, what would be the minimum difference in height between any two people?
(c) Why is this minimum difference unlikely to be observed in reality?

7 The histogram shows the range and frequency of occurrence of particular blood pressures (systolic) in a group of women in the 30-39 age group.

(a) On this evidence, could you say that blood pressure is a discontinuous variable?

(b) Justify your answer.



8 Give two examples in each case of (a) continuous, (b) discontinuous variation in human populations.

9 Which one of the following statements is the least accurate?

(a) Discontinuous variation results entirely from genetic differences.

(b) Continuous variation can result from genetic differences.

(c) Discontinuous variation cannot be altered by environmental effects.

(d) Continuous variation results from environmental effects.

10 Explain why identical twins will have the same genotype.

11 When ….. A ….. and ….. B ….. put forward the theory of Natural Selection in 1858 they observed that there are ….. C ….. between the individuals of a species. They also observed that organisms produce more offspring than can possibly …. D …..to maturity. If the ….. E ….. are inherited and give the individuals an advantage over the other members of the species, they will live ….. F ….. and so leave more offspring with the same beneficial ….. G …..

12 A pair of mice has, on average, a litter of six babies. Assuming (i) that there are equal numbers of males and females in the litters, (ii) that the offspring breed freely amongst themselves, how many mice will there be after three generations?

13 (a) Give three examples of types of competition between members of an animal species in the same population.

(b) In each case suggest a variation that might help an individual to compete more effectively.

14 For a beneficial variation to have a selective advantage in the course of evolution, it must be ….. A ….. by the offspring.

15 Evolution is thought to come about as a result of ….. A ….. which produce new ….. B ….. These gradually replace the original population as a result of …..C …..

16 Which of the following statements is most acceptable from an evolutionary point of view?

(a) Apes and humans have evolved from a common ancestor.
(b) Humans have evolved from apes.
(c) Certain apes have gradually evolved into humans.
(d) Apes and humans are related.

17 What characteristics might a breeder select for in (i) a cereal crop, (ii) a farm animal?