

TERTIARY ADMISSIONS EXAMINATION, 1985

HUMAN BIOLOGY

Please place one of your Candidate
Identification labels in this box

--	--	--	--	--	--	--	--	--	--

CANDIDATE'S NUMBER - In figures

In words

TIME ALLOWED FOR THIS PAPER

Reading time before commencing: Ten minutes
For working of paper: Three hours

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

TO BE PROVIDED BY THE SUPERVISOR

This Question/Answer Booklet comprising
PART I Page 3 - 17
PART II Pages 18 - 33
PART III Pages 34 - 35
Essay sheets for PART III Pages 36 - 45
Space for rough work Page 46

Separate Multiple Choice Answer Sheet

TO BE PROVIDED BY THE CANDIDATE

Standard Items

Pens, pencils, eraser, ruler

Special Items

An 'HB' pencil for the Separate Multiple Choice Answer Sheet

** IMPORTANT NOTE TO CANDIDATES **

No other items may be taken into the examination room.

It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. Please check carefully and, if you have any unauthorised material with you, hand it to the supervisor BEFORE reading any further.

INSTRUCTIONS TO CANDIDATES

See Page 2

SEE PAGE 2

INSTRUCTIONS TO CANDIDATESPART I

Questions 1-40 80 Marks

This part consists of multiple choice questions, which should be answered on the separate Multiple Choice Answer Sheet. USE AN 'HB' PENCIL.

DO NOT USE A BALL POINT OR INK PEN.

PART II

Questions 41-46 80 Marks

This part consists of 6 diagram and short answer questions. These should be answered in the spaces provided in the Question/Answer Booklet.

PART III

Questions 47-50 40 Marks

This part consists of 4 essay questions. Answer ANY TWO questions in Part III.

The essays for Part III should be written on pages 36 - 45 of the question paper in blue or black ball point or ink pen.

At the end of the examination carefully check that you have placed your Candidate Identification Label, and that you have written your candidate number in figures and words in the spaces provided on the front cover of this Question/Answer Booklet.

SEE PAGE 3

SEE PAGE 4

PART 1

MARK YOUR ANSWERS TO QUESTIONS 1-40 ON THE SEPARATE MULTIPLE CHOICE ANSWER SHEET, USING AN 'HB' PENCIL.

IN EACH QUESTION CHOOSE THE BEST ALTERNATIVE.

- During the process of expiration the
 - diaphragm lowers
 - ribs move upward and outward
 - size of the thoracic cavity increases
 - pressure inside the thoracic cavity increases
- The cerebral cortex or outer part of the cerebrum is mainly concerned with
 - control of both the sympathetic and parasympathetic nervous systems
 - control of the pituitary and other endocrine glands
 - conscious sensory awareness, voluntary movement and association
 - connecting the left and right cerebral hemispheres
- The specific protein produced by the body's defence system against an invading organism is called
 - an antigen
 - an antibody
 - a pathogen
 - an immune complex
- Urea is
 - synthesized in the liver
 - formed by deamination of waste carbohydrates
 - transported from the kidney to the bladder by the urethra
 - manufactured mainly in the kidney
- Which of the following structures secretes both estrogen and progesterone?
 - the corpus luteum
 - the pituitary
 - follicle cells
 - the hypothalamus

6. Which of the following pairs of sexually transmitted diseases are caused by viruses and are therefore difficult to treat?

- a) herpes and syphilis
- b) acquired immune deficiency syndrome and herpes
- c) syphilis and gonorrhoea
- d) acquired immune deficiency syndrome and gonorrhoea

7. During a normal birth

- a) oxytocin causes the cervix to widen
- b) the baby adopts the breech position
- c) both the amnion and chorion remain intact
- d) the placenta is expelled before the baby

8. Physiological tolerance to drugs

- a) is produced only to hard drugs such as heroin
- b) develops when the drug no longer produces harmful effects
- c) is when the drug is socially acceptable in the community
- d) develops when increasingly large doses of the drug are required to produce the same effect

9. The sex of an embryo is determined by the

- a) nucleus of the ovum which is fertilized
- b) time at which conception occurs
- c) type of spermatozoon which fertilizes the ovum
- d) autosomal chromosomes

10. After a meal of fish and chips, the hepatic portal vein would be expected to carry an increased concentration of which of the following substances?

- a) glycerol and fatty acids
- b) bile
- c) glucose
- d) plasma proteins

11. Which of the following statements about circulation through the heart is INCORRECT?

- a) The pulmonary arteries carry deoxygenated blood to the lungs.
- b) The chambers on the right hand side of the heart contain oxygenated blood.
- c) The semilunar valves prevent blood flowing backwards into the ventricles.
- d) The pulmonary veins deliver blood to the left atrium.

SEE PAGE 5

Question 12 refers to Figure 1 below.

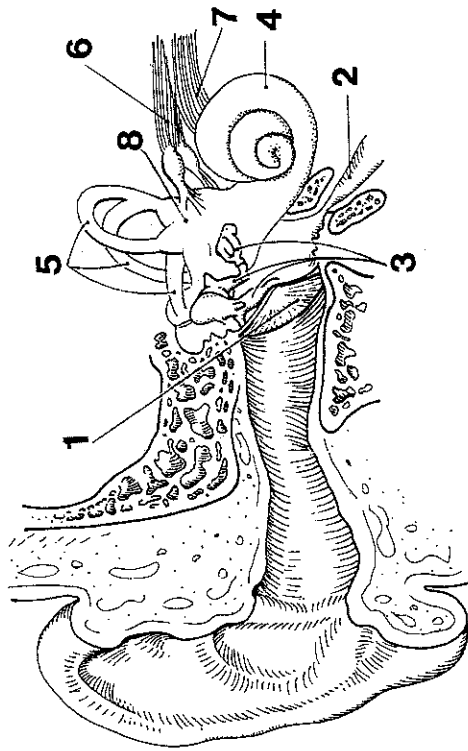


Figure 1. Diagram of a Frontal Section through the Ear.

12. Which of the labelled structures on Figure 1 are concerned with maintaining balance?

- a) 1, 2 and 3
- b) 3, 4 and 7
- c) 4, 5 and 8
- d) 5, 6 and 8

13. If a person was rescued from a swimming pool and his/her breathing had stopped, first aid using expired air resuscitation would involve all four steps listed below.

1. Watch for chest movements.
2. Seal your lips on the patient's mouth, pinch his/her nostrils closed, then breathe out.
3. Make sure the patient's airway is clear.
4. Place the patient on his/her side in the coma position.

Which would be the correct sequence of events for expired air resuscitation?

- a) 1 4 3 2
- b) 4 2 3 1
- c) 2 1 4 3
- d) 3 2 1 4

SEE PAGE 6

Questions 14 and 15 refer to Figure 2 below.

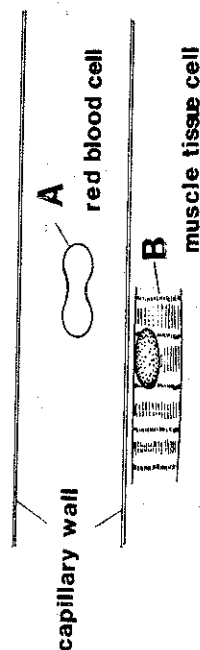


Figure 2. Diagram of a Red Blood Cell (A) Inside a Capillary which is within Muscle Tissue (B).

14. Which of the following statements about Figure 2 is correct?
- Oxygen would move from A to B by active transport and carbon dioxide would move from B to A by diffusion.
 - Carbon dioxide would move from B to A by active transport and oxygen would move from B to A by diffusion.
 - Both oxygen and carbon dioxide would move between A and B by diffusion.
 - Both oxygen and carbon dioxide would move between A and B by osmosis through a series of semi-permeable membranes.
15. As blood passes through arterioles, capillaries and then venules in muscle tissue, the red blood cells would
- release carbamino-haemoglobin to the muscle tissue
 - produce more oxyhaemoglobin
 - release carbonic anhydrase enzyme to the muscle tissue
 - increase their concentration of bicarbonate ions

16. Gastric enzymes are produced by chief cells in the stomach wall. To which tissue type would such cells belong?

- epithelial
- connective
- squamous
- muscle

SEE PAGE 7

17. Which of the following factors would NOT have made a useful contribution to the beginning of agriculture around 10,000 years ago?

- availability of plant species suitable for cultivation
- the development of a system of written communication using clay tablets
- evolution of social culture to a point of division of labour and co-operation
- development of physical culture providing appropriate tools

18. During a period of vigorous exercise which of the following processes would NOT occur in the exercising muscle?

- conversion of glycogen to glucose
- conversion of glucose to carbon dioxide and water
- production of creatine phosphate
- breakdown of ATP to ADP to supply energy for muscle contraction.

Question 19 refers to Table 1.

Table 1. Concentration of Substances in Blood Plasma Compared with Urine.

Concentrations in g/L

Substance	Plasma	Urine
Proteins	80	0
Urea	0.3	20
Glucose	1	0
Sodium Chloride	7.0	6.5

19. From the data in Table 1, deduce which substance is being removed most efficiently from the blood plasma by the kidneys.

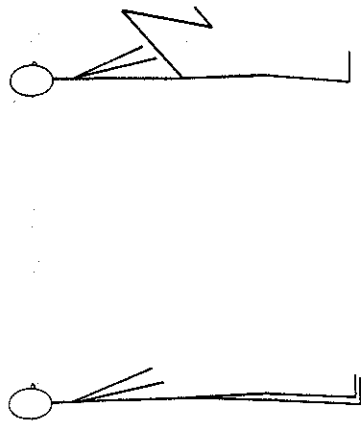
- glucose
- sodium chloride
- urea
- proteins

20. Which of the following methods of "contraception" operates largely by preventing implantation rather than by preventing fertilization?

- diaphragm
- intra-uterine device
- the "pill"
- condom

SEE PAGE 8

Questions 21 and 22 refer to Figure 3 below.



Position A

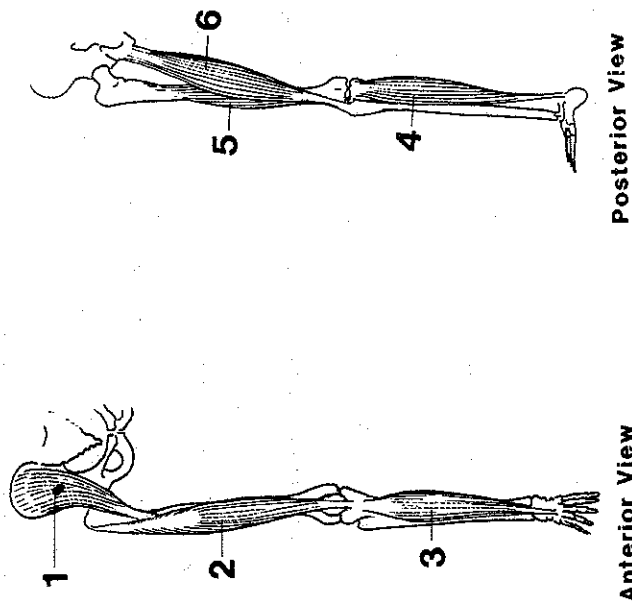
Position B

Figure 3. Positions of the Right Lower Limb.
Upright standing position (A) and after raising the right foot from the ground (B).

21. The movements of the right lower limb which have occurred in moving from position A to position B (shown in Figure 3) include

- a) flexion at the hip and flexion at the knee
- b) flexion at the hip and extension at the knee
- c) extension at the hip and flexion at the knee
- d) extension at the hip and extension at the knee

Questions 22 and 23 refer to Figure 4 below.



Anterior View

Posterior View

Figure 4. Muscles of the Lower Limb.

22. Which of the muscles labelled 1-6 in Figure 4 contract to move the lower limb at the hip, knee and ankle joints from position A to position B? (shown in Figure 3 page 8)

- a) 1, 5, 4
- b) 6, 2, 4
- c) 1, 5, 3
- d) 6, 2, 3

23. Which pairs of the muscles shown in Figure 4 contract in opposition to each other to maintain an upright posture?

- a) 1 & 2
- b) 2 & 4
- c) 3 & 4
- d) 3 & 5

24. The pattern of inheritance of many human characteristics does not appear to follow simple Mendelian rules. One reason for this is that

- human geneticists cannot control the types of mating which take place
- many of our characteristics are determined by more than one gene locus
- small family size and long generation time make statistical analysis of human pedigrees very difficult
- we are a very complex multicellular organism and this makes the study of our Mendelian characteristics very difficult

25. The percentage of deaths due to cancer in Australia was 9.0% in 1923 and 18.6% in 1975.

Which of the following is LEAST likely to be an explanation for these statistics?

Between 1923 and 1975 there was an

- improvement in methods of diagnosing cancer
- increase in many chemical pollutants in the environment
- increase in the average life span
- increase in the population of Australia

Question 26 refers to Table 2.

Table 2. Deaths during Infancy (first 9 months)

Related to Types of Feeding.

Statistics gathered in a third world country during the 1950s.

Food	No. of Infants	Total Deaths	Death rate
Wholly breast fed	9,000	9	0.1%
Partially breast fed	3,000	45	1.5%
Fed artificial formula	6,000	270	4.5%

26. From Table 2, the death rate amongst infants fed an artificial formula is

- 6.0 times greater than that for partially breast fed infants
- 30.0 times greater than that for wholly breast fed infants
- 4.0 times greater than that for partially breast fed infants
- 45.0 times greater than that for wholly breast fed infants

Question 27 refers to Figure 5 below.

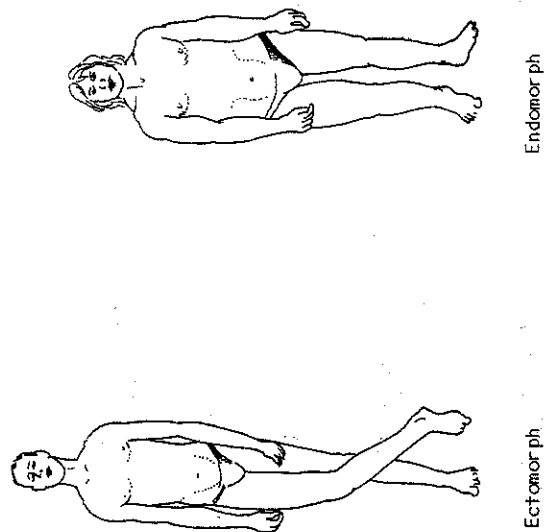


Figure 5. Two Different Somatotypes

27. Which of the following statements about somatotypes A and B shown in Figure 5 is correct?

- Somatotype A would be best adapted to a cold climate because it provides a small surface area to volume ratio to reduce heat loss.
- Somatotype B would be best adapted to a cold climate because it would reduce heat loss to the environment.
- Somatotype B would be best adapted to a hot climate because there is a large surface area to volume ratio to aid evaporative cooling.
- Somatotype A would be best adapted to a hot climate because it would reduce dehydration due to sweating.

28. Which of the following statements about pregnancy is INCORRECT?

- During late pregnancy women urinate more often because the expanding uterus exerts pressure on the bladder.
- The lungs of the fetus are collapsed until birth.
- The chorion is made from the mother's cells.
- The umbilical vein carries oxygenated blood from the placenta to the fetus.

Questions 29 refers to Figure 6 below.

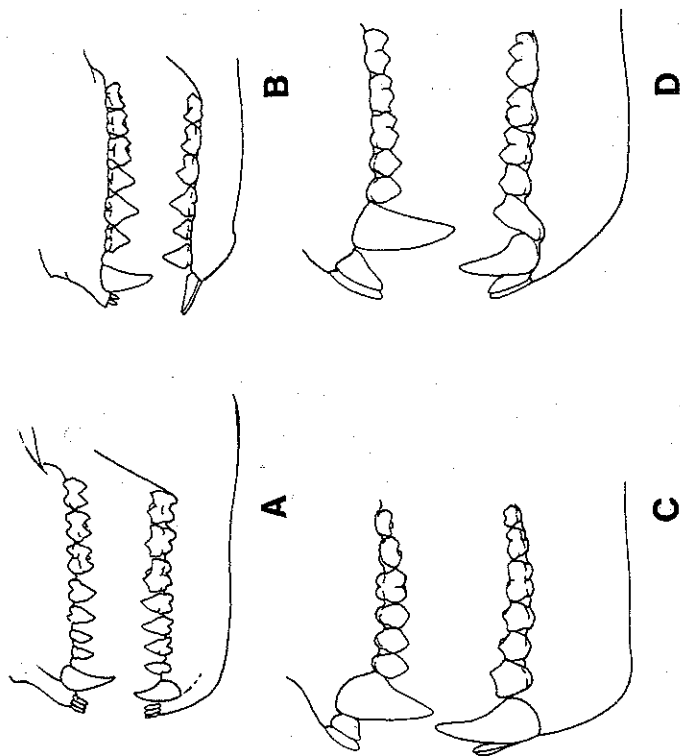


Figure 6. Diagrams of Primate Teeth and Jaws.

29. The species shown in Figure 6 most closely related to Man would be that with

- a) Jaw A
- b) Jaw B
- c) Jaw C
- d) Jaw D

SEE PAGE

13

30. Identical (monozygotic) twins were born joined at the lower abdomen. One twin had male reproductive organs, the other twin no reproductive organs. The babies were separated and the twin without reproductive organs was given a labia and vagina surgically. Which of the following statements about this child is correct?

- a) The child would develop the external physical characteristics of an adult female without further treatment.
- b) Hormone treatment would be required at a later date for the child to grow into a fertile female.
- c) Hormone treatment would be required at a later date for the child to develop the external physical characteristics of an adult female.
- d) The child would have a 50% chance of having a 46XX karyotype.

31. The earliest migration of humans to Australia (to later become the Australian Aborigines) was most likely

- a) by raft from Polynesian Islands such as Hawaii, about half a million years ago
- b) by sea from Indonesia about 50,000 years ago
- c) across Wallace's Line from New Guinea to Queensland during the last interglacial period
- d) across the land bridge from New Zealand and Tasmania, about 100,000 years ago

32. In response to increased heat production during exercise

- a) general vasoconstriction occurs
- b) the core temperature is maintained by the pons
- c) piloerection occurs
- d) skin arterioles dilate

SEE PAGE

14

33. Which of the following CANNOT produce an active immunity to a disease organism?

- a) a dose of the disease
- b) proteins in colostrum
- c) an injection of dead bacteria
- d) an injection of weakened virus

34. Which of the following pairings concerning environmental pollutants is INCORRECT?

- a) lead and cadmium - poisons which accumulate within the body
- b) sulphur dioxide and nitrogen oxides - acid rain
- c) ozone - photochemical smog
- d) D.D.T. - rapidly eliminated from the body

35. Down's Syndrome is usually caused by

- a) a mistake during meiosis
- b) a gene mutation
- c) drugs taken during pregnancy
- d) poor nutrition

36. Which of the following statements concerning the effects of the constituents of cigarette smoke is INCORRECT?

- a) Nicotine causes the blood pressure to increase.
- b) Carcinogens in tar increase the risk of cancer.
- c) Carbon dioxide raises blood pH.
- d) Carbon monoxide reduces the oxygen carrying capacity of blood.

Question 37 refers to Figure 7 below.

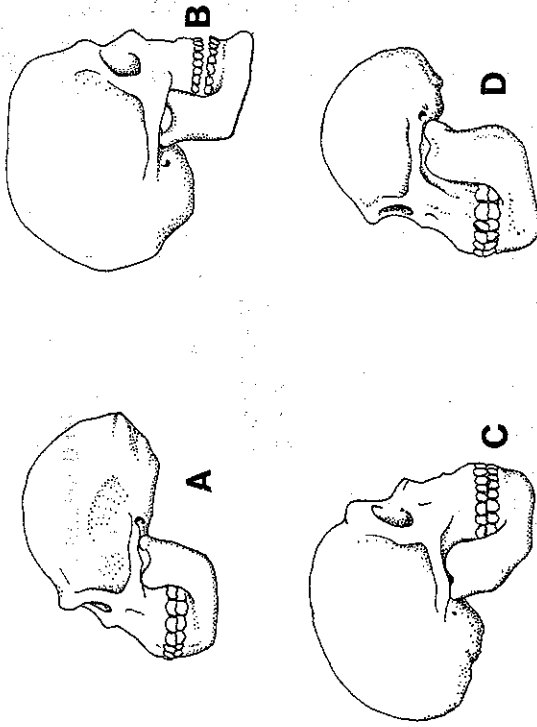


Figure 7. Diagram of Skulls of the Family Hominidae.

37. Which of the following would be the most likely evolutionary sequence towards Homo sapiens sapiens?

- a) D → A → C → B
- b) A → B → D → C
- c) D → C → A → B
- d) B → D → C → A

Questions 39 and 40 refer to Figure 9 below.

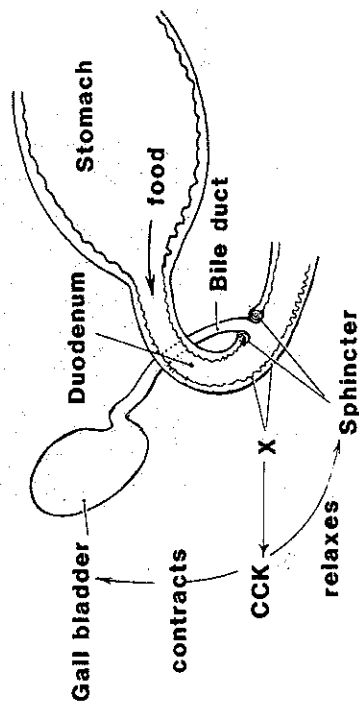


Figure 9. Control of CCK Secretion

39. The gall bladder stores and concentrates bile. When a fatty meal leaves the stomach, endocrine cells (labelled X in Figure 9) in the duodenal mucosa are stimulated to release a hormone CCK. This hormone simultaneously causes the contraction of the gall bladder and the relaxation of the sphincter at the mouth of the bile duct. The bile then pours into the duodenum and is mixed with the food mass. In this homeostatic process the receptor is

- a) CCK
- b) endocrine cells
- c) fats
- d) the gall bladder

40. The part of the steady-state control system which has not been described in question 39 is the

- a) effector
- b) stimulus
- c) modulator
- d) response

SEE PAGE 18

Question 38 refers to Figure 8 below.

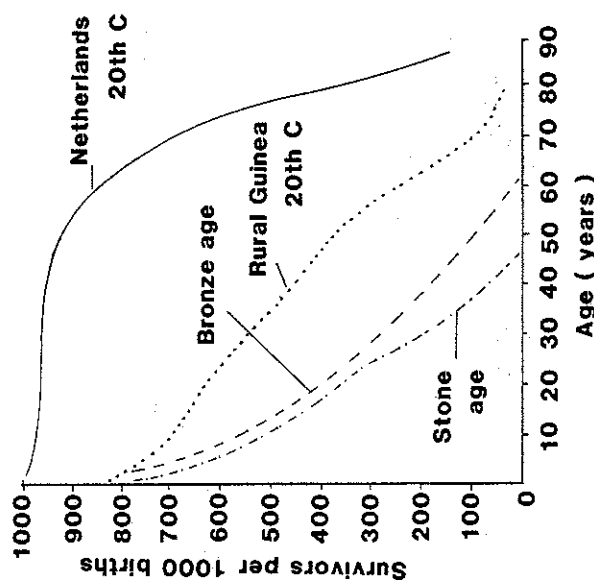


Figure 8. Survival Rates.

38. Use the information on the graph in Figure 8 to deduce which of the following statements is INCORRECT.

- a) In the Netherlands in the 20th Century, 90% of the population live to be older than 60 years.
- b) In the Bronze Age, the average life span was 40 years.
- c) In the Stone Age, less than half the population lived beyond the age of 20 years.
- d) In rural Guinea in the 20th Century, 30% of children die before the age of 10 years.

SEE PAGE 17

PART II ANSWER ALL QUESTIONS

QUESTION 41.

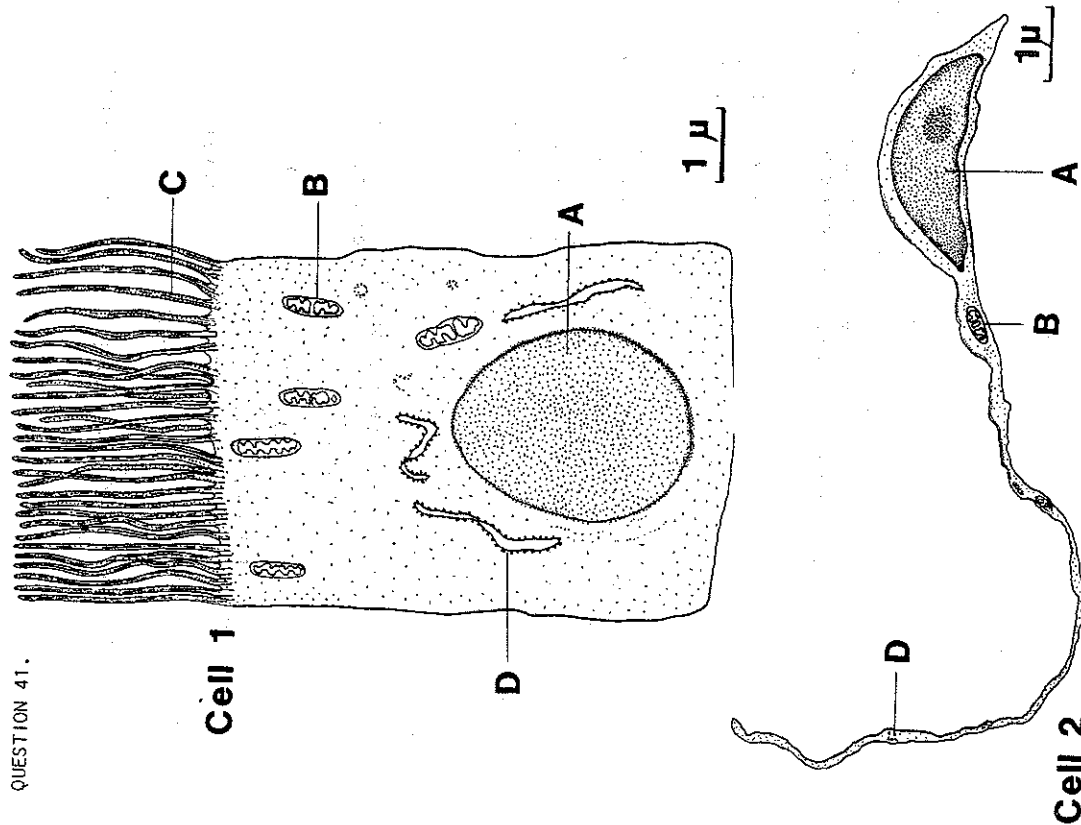


Figure 10. Diagram of Two Cells each from a Different Part of the Respiratory System.

SEE PAGE 19

41. (Continued)

a) Identify the organelles labelled A, B, C, and D on Figure 10 and give the major function of each.

A	_____
Function	_____
B	_____
Function	_____
C	_____
Function	_____
D	_____
Function	_____

8 marks

b) From which part of the respiratory system do each of the cells in Figure 10 come? Relate the structure of each cell to its function.

Cell 1: Location	_____
Structure/function	_____
Cell 2: Location	_____
Structure/function	_____

4 marks

SEE PAGE 20

41. (continued)

- c) Smoking affects the functioning of the respiratory system. Explain two ways in which cells of the respiratory system can be affected by smoking.

2 marks

QUESTION 42.

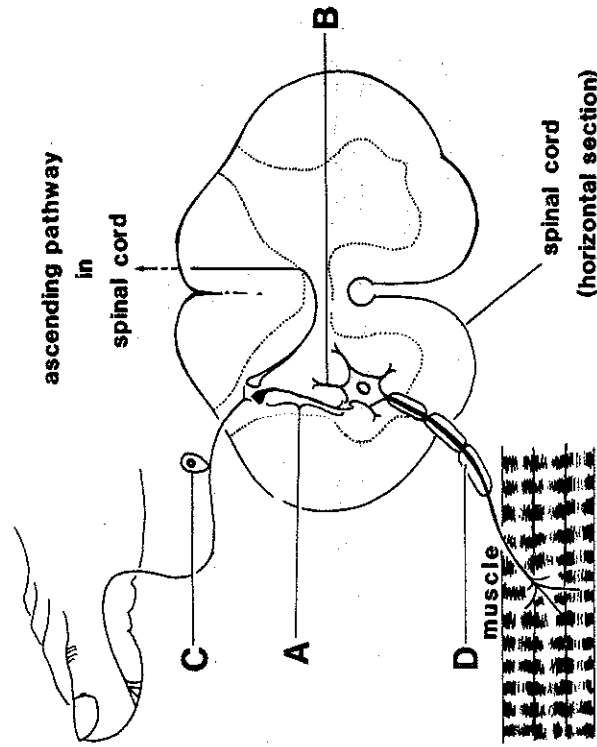


Figure 11. Stimulus - Response Pathway.

SEE PAGE 21

42. (continued)

This question focuses on homeostatic mechanisms.

- a) Name the structures labelled A, B, C and D on Figure 11.

A _____

B _____

C _____

D _____

4 marks

- b) Explain where a neurilemma would be located in Figure 11 and briefly outline its function.

2 marks

- c) Receptors in the foot, shown in Figure 11 would be stimulated by treading on a sharp piece of glass. Explain why the foot would be withdrawn before the sensation of pain was experienced by the person who trod on the sharp glass.

2 marks

SEE PAGE 22

42. (continued)

- d) Nerves and hormones both operate to control the internal environment of the body. Briefly explain THREE differences in the way that nerves and hormones act.

3 marks

- e) Severe sweating results in lower plasma volume and lower blood pressure, which in turn stimulates receptors (osmoreceptors and atrial baroreceptors) to register low water levels within the body.

- i) Explain the hormonal mechanism which would alter kidney function to increase water levels within the body, after severe sweating.

4 marks

- ii) What role would negative feedback play in re-establishing water levels within the body, after severe sweating?

2 marks

SEE PAGE 23

QUESTION 43.

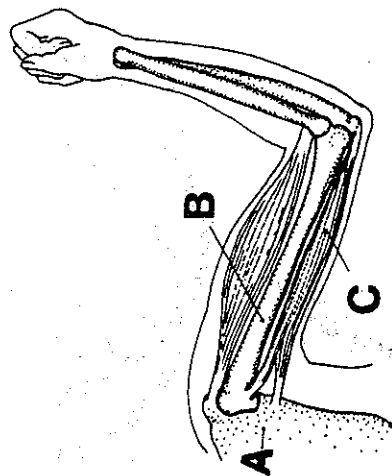


Figure 12. Posterior View of some Bones and Muscles of the Upper Limb.

- a) Name the structures labelled A, B and C on Figure 12.

A _____

B _____

C _____

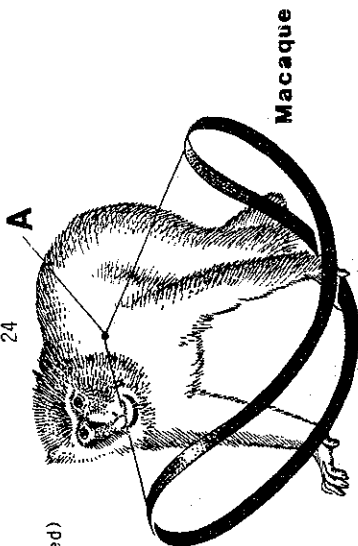
3 marks

- b) Explain how the arrangement of bones and joints in the human forearm allows the hand to rotate through 180 degrees.

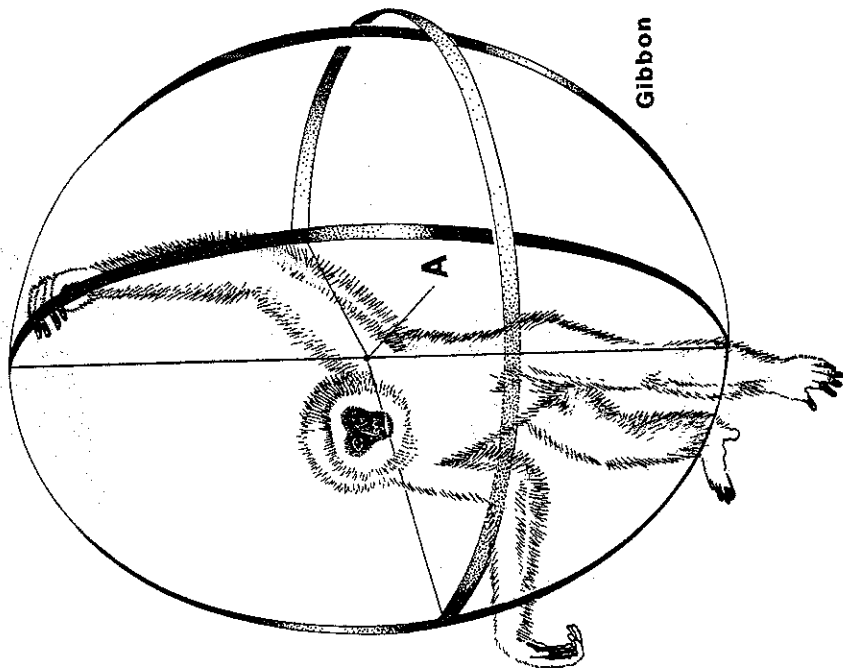
2 marks

SEE PAGE 24

43. (continued)



Macaque



Gibbon

Figure 13. Forelimb Movements in Two Primates.

SEE PAGE 25

43. (continued)

c) What type of joint is the joint labelled A on Figure 13?

1 mark

d) Figure 13 shows the different forelimb movements possible at joint A in the macaque and the gibbon. Relate these differences in movement to the mode of locomotion of the two primates.

2 marks

e) The macaque is an Old World Monkey. To what Superfamily does it belong?

1 mark

f) Humans can also move their forelimbs in a similar fashion to the gibbon, and yet they have a different mode of locomotion. Give TWO possible reasons why the forelimb movements at joint A are similar in gibbons and humans.

2 marks

SEE PAGE 26

QUESTION 45.

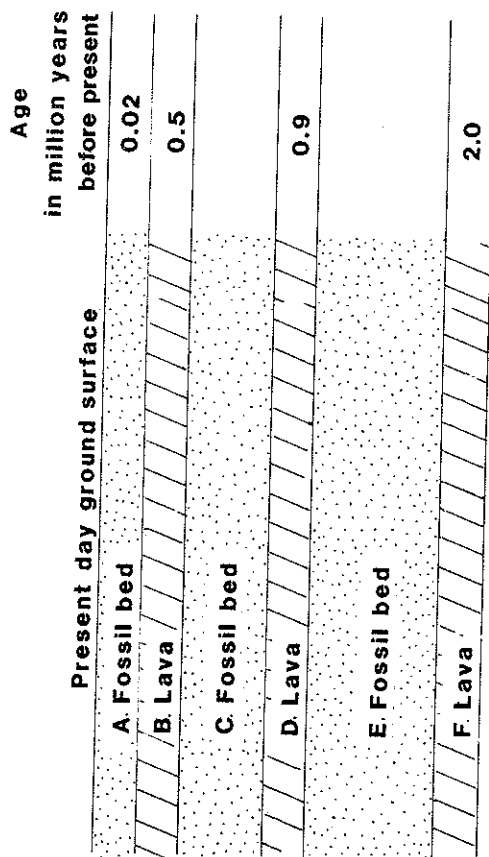


Figure 15. Diagrammatic Representation of Exposed Fossil Beds.

- a) i) Explain the principle on which the technique of absolute dating using radio-active isotopes is based.

2 marks

- ii) How would the absolute date of layer A in Figure 15 be determined?

2 marks

45. (continued)

- b) The ages of fossil beds C and E can be deduced from the absolute ages of beds B, D and F. Describe another method which could be used to determine the ages of layers C and E shown in Figure 15.

2 marks

- c) Describe two ways in which fossilization most often occurs. Explain why a very small proportion of animal remains are fossilized.

4 marks

QUESTION 46.

Every cell in the human body is dependent on enzymes for its proper functioning.

- a) Define the term enzyme.

2 marks

- b) In a classroom experiment, test tubes containing a particular enzyme and its substrate were placed in water baths at different temperatures. The reaction was stopped after a given time and the amount of product formed was measured. From the results, enzyme activities at temperatures between 15 and 45 degrees Celsius were calculated, and are shown in the Table 3 below.

TABLE 3. Enzyme Activity at Different Temperatures.

TEMPERATURE (degrees Celsius)	ENZYME ACTIVITY (international units)
15	12
20	18
25	28
27	35
31	42
34	77
37	95
39	90
41	76
45	24

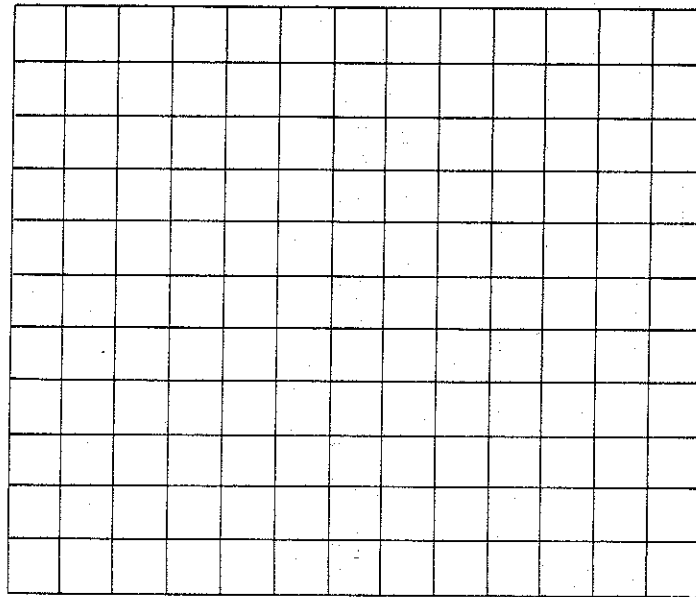
- 1) Plot a line graph in the space on page 31 to display the data in Table 3.

5 marks

MARK OUT THE SCALES AND DRAW THE GRAPH IN PENCIL.

If you need to use the spare grid on page 33 make sure you indicate clearly which graph has been cancelled.

46. (continued)



46. (continued)

11) Describe how and why the activity of this enzyme varied between 15 and 45 degrees Celsius.

2 marks

111) What was the percentage increase in enzyme activity between 27 and 37 degrees Celsius?

1 mark

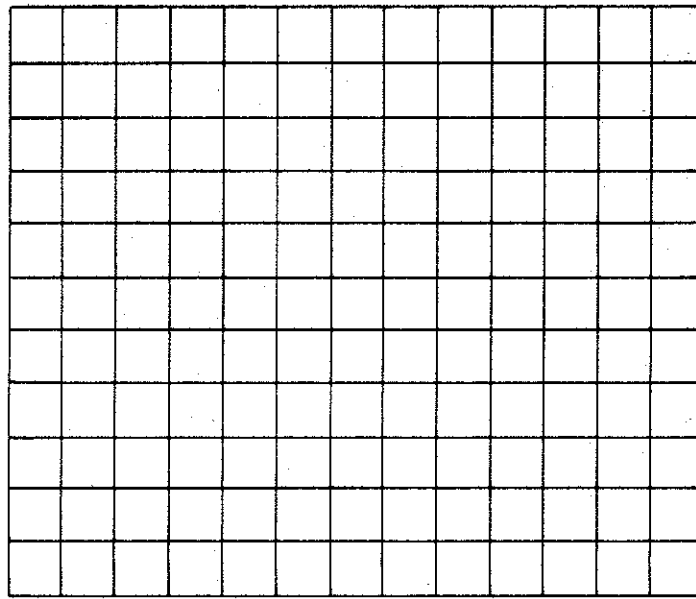
c) Another enzyme was isolated from a site along the human digestive tract and purified. The enzyme was identified as a protease. Given the fact that enzyme activity depends on the pH of the solution, design an experiment which would indicate whether the enzyme originated in the stomach or the small intestine. What results would you expect if the enzyme was an intestinal protease?

5 marks

SEE PAGE 33

46. (continued)

SPARE GRID



SEE PAGE 34

PART III

ANSWER ANY TWO QUESTIONS FROM THIS SECTION.

ILLUSTRATE YOUR ANSWER WITH DIAGRAMS, WHERE APPROPRIATE.

UP TO TWO MARKS MAY BE DEDUCTED FOR POORLY STRUCTURED ESSAYS. (e.g. ANSWERS IN POINT FORM OR DIAGRAMS NOT EXPLAINED IN THE TEXT OF THE ESSAY.)

DO NOT WRITE YOUR ANSWER IN PENCIL.

QUESTION 47.

- a) Relate the structures of arteries, veins and capillaries to their different functions within the circulatory system. 10 marks
- b) A car accident victim severs a femoral artery (major blood vessel in the lower limb) and rapidly loses a large volume of blood. What immediate physiological effects will the patient experience and how does the body begin to compensate for the blood loss? 7 marks
- c) Outline the first aid you would give to such an accident victim, stating reasons for your actions. 3 marks

QUESTION 48.

The genetic make up of an individual is determined by both parents.

- a) Discuss the MALE reproductive system in terms of how the information in a diploid cell is reorganized to produce gametes and how male gametes are brought into contact with female gametes to produce a zygote. 15 marks
- b) Between conception and birth, what factors other than its genetic make-up could affect the characteristics of an offspring? 5 marks

QUESTION 49.

As Primates, members of the genus Homo possess physical features in common with other members of this Order of mammals. However, two of the characteristics which distinguish them from other Primates are their habitually upright, bipedal mode of locomotion and their relatively large brains.

- a) The skeleton of Homo sapiens has many features which are adaptations to an upright bipedal mode of locomotion. Discuss these features, explaining the function of each. 10 marks
- b) What are the advantages of an upright form of locomotion and how may these have influenced the evolution of the early hominids? 4 marks
- c) "The fossil record suggests that the evolution of a bipedal mode of locomotion and a large increase in cranial capacity did not occur simultaneously in the hominids." Discuss the evidence for this statement. Suggest ways in which evolution of these characteristics may have been inter-related. 6 marks

QUESTION 50.

- a) Contrast the pattern of population growth and age structure of the population in an industrialized country (such as the U.S.A. or Australia) with a third world country (such as India or Ethiopia). What are the implications of the differences for government planners in each type of country? 10 marks
- b) i) How does the nature of life-threatening disease vary between industrialized and third world countries? 6 marks
- ii) Propose education measures which might reduce premature death in each type of country. 4 marks

END OF PAPER

1985