

6.

- (a) Discuss the above diagram. In your discussion identify
- the factors that can cause obesity, and
 - the factors which can help in the prevention of obesity.
- (b) Jill considers herself to be quite obese and cites this as reason for having very few friends. Discuss this and offer advice on the forming of relationships.

(10 + 10 = 20 marks)

END OF PAPER

TERTIARY ENTRANCE EXAMINATION, 1986 - QUESTION/ANSWER BOOKLET

HUMAN BIOLOGY

Please place one of your student identification labels in this box

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STUDENT NUMBER - In figures

In words

TIME ALLOWED FOR THIS PAPER

Reading time before commencing: Ten minutes
Working time for paper: Three hours

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

See Page 2

INSTRUCTIONS TO CANDIDATES

PART 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 a '2B' PENCIL. Do NOT use a ball point or ink pen.

PART II

Questions 41-47 80 marks

This part consists of 7 diagram and short answer questions. These should be answered in the spaces provided in the Question/Answer Booklet. Write your answers in blue or black ball point or ink pen.

PART III

Questions 48-51 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 36-46 of the Question/Answer Booklet in blue or black ball point or ink pen. Draw any diagrams in pencil.

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

SEE PAGE 2

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER**TO BE PROVIDED BY THE SUPERVISOR**

This Question/Answer Booklet comprising PART I Pages 3 - 16
 PART II Pages 17 - 33
 PART III Pages 34 - 35
 Essay sheets for PART III Pages 36 - 46
 Space for rough work Page 47
 Separate Multiple Choice Answer Sheet

TO BE PROVIDED BY THE CANDIDATE**Standard Items**

Pens, pencils, eraser, ruler

Special Items

A '2B' 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.

SEE PAGE 3

PART I

MARK YOUR ANSWERS TO QUESTIONS 1-40 ON THE SEPARATE MULTIPLE CHOICE ANSWER SHEET, USING A '2B' PENCIL.

IN EACH QUESTION CHOOSE THE BEST ALTERNATIVE.

1. Which of the following fields of study in Human Biology is correctly described ?

- (a) Physiology - body functions
- (b) Archaeology - study of fossils
- (c) Palaeontology - inheritance
- (d) Biochemistry - study of development

2. Which of the following statements is INCORRECT ?

- (a) Bacteria can survive outside living cells.
- (b) Some fungi can cause disease in humans.
- (c) All bacteria are pathogenic.
- (d) Viruses can only multiply inside cells of living organisms.

3. Which of the following is NOT a sexually transmitted disease ?

- (a) AIDS
- (b) Syphilis
- (c) Cholera
- (d) Gonorrhoea

4. The cortical surface area of the brain is greatly increased by

- (a) fissures.
- (b) the meninges.
- (c) the frontal lobes.
- (d) convolutions.

5. Excessive carbon monoxide pollution is dangerous because carbon monoxide

- (a) combines with haemoglobin.
- (b) is a cumulative poison.
- (c) destroys ozone in the upper atmosphere.
- (d) is a carcinogen.

SEE PAGE 4

Questions 6-8 refer to Figure 1.

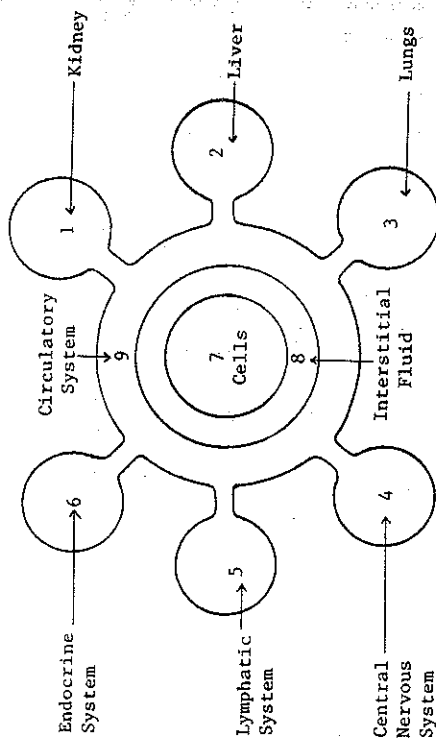


Figure 1. Diagrammatic representation of relationships between various organ systems and fluid compartments of the human body.

6. The synthesis of urea occurs in

- (a) 1.
- (b) 2.
- (c) 1 and 2.
- (d) 2 and 5.

7. Water loss from the body involves

- (a) 1 and 3.
- (b) 2 and 4.
- (c) 3 and 5.
- (d) 5 and 6.

8. Interstitial fluid forms directly from

- (a) 1.
- (b) 5 and 7.
- (c) 7 and 9.
- (d) 5, 7 and 9.

SEE PAGE 5

9. Which of the following statements is CORRECT?

- (a) Human races originated from a small population of hominids which lived on the Eurasian-African land mass around 200 000 years ago.
- (b) All the major land masses were occupied by humans by about 12 000 years ago and since then there has been no interaction between human groups.
- (c) Some living races today resemble the original stock from which humans evolved.
- (d) As early humans developed culture, and so had control over the environment, they were able to populate once uninhabitable areas.

10. A substance would be considered to be a drug if

- (a) a person developed a craving for it.
- (b) it had a medicinal use.
- (c) it gave a person a pleasant feeling.
- (d) it affected the functioning of the body.

11. In an experiment to determine the upper hearing threshold of a group of students, an investigator called for 30 volunteers from a secondary school to listen to sounds emitted from a signal generator. The assembled volunteers were then asked to raise their hands if they heard a noise coming from the signal generator. The design of this experiment could be improved by

- (a) testing each student individually.
- (b) controlling for sex and age.
- (c) testing a larger number of students.
- (d) all of the above.

SEE PAGE 6

Questions 12 and 13 refer to Table 2.

HOMINID	CRANIAL CAPACITY	FOREHEAD
1	800 cc	slight
2	1450 cc	often receding
3	1050 cc	slight
4	1400 cc	rounded

Table 2. Features of hominid skulls.

12. The data presented in Table 2 indicate that

- (a) hominid 1 is *Homo sapiens sapiens* and hominid 2 is *Homo erectus*.
- (b) hominid 1 is *Homo habilis* and hominid 3 is *Homo sapiens sapiens*.
- (c) hominid 3 is *Homo erectus* and hominid 4 is *Homo sapiens neanderthalensis*.
- (d) hominid 2 is *Homo sapiens neanderthalensis* and hominid 3 is *Homo erectus*.

13. The hominid from Table 2 which lived in Europe 90 000 years before the present was.

- (a) hominid 1.
- (b) hominid 2.
- (c) hominid 3.
- (d) hominid 4.

14. Which of the following is an **INCORRECT** statement about Australian Aborigines?

- (a) Access to water restricted their movement within the continent.
- (b) They developed formal agriculture and domestication of animals.
- (c) Fire was important to their survival.
- (d) Closely related families lived together as groups and a number of these groups locally made up a tribe.

SEE PAGE 7

15. Immunization against polio results in active immunity. This means that

- (a) antibodies against the polio virus are always in the person's bloodstream.
- (b) the person's body has the ability to manufacture antibodies against the polio virus should infection occur.
- (c) frequent booster injections of polio virus antibody are necessary.
- (d) polio virus antibodies are stored in the lymph nodes for release if infection occurs.

Question 16 refers to Figure 2.

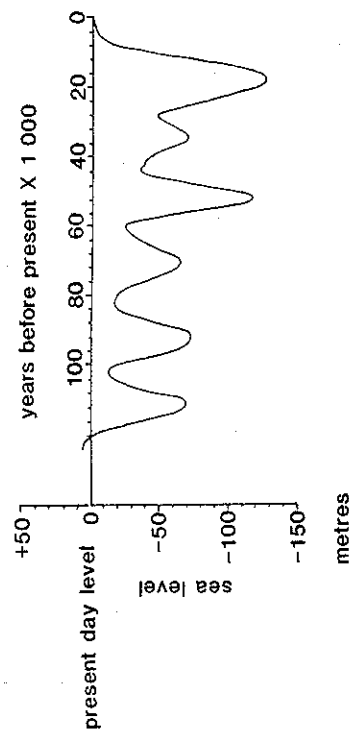


Figure 2. Changes in sea level for the Australian continent during the last 125 000 years.

16. From the data given in Figure 2, the most likely time(s) for *Homo sapiens* to migrate into or out of Australia would have been

- (a) 17 000 and 51 000 years ago.
- (b) 125 000 years ago.
- (c) 44 000 years ago.
- (d) before 60 000 years ago.

SEE PAGE 8

Questions 17 and 18 refer to Figure 3.

**ROAD TRAFFIC ACCIDENTS
PERSONS KILLED
DAY OF WEEK & TIME OF DAY : 1984**

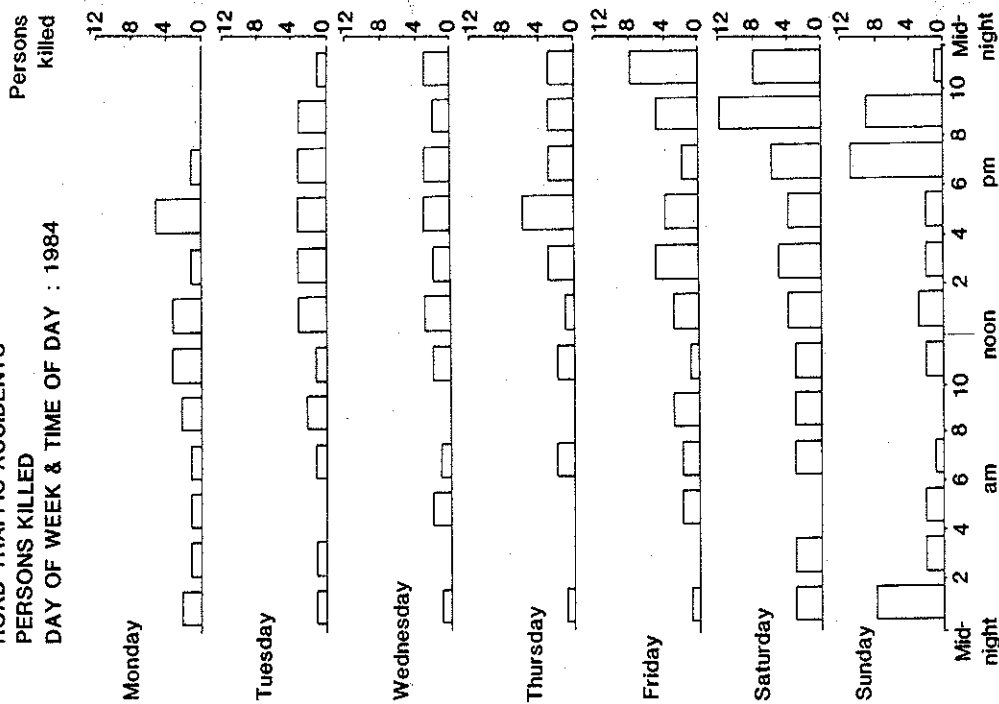


Figure 3. An analysis of deaths from traffic accidents in Western Australia during 1984. The graphs show persons killed on each day of the week and at different times during each day.

SEE PAGE 9

17. From Figure 3 it can be concluded that the LEAST fatalities occur between 6pm and midnight on

- (a) Monday.
- (b) Tuesday.
- (c) Thursday.
- (d) Friday.

18. From the data presented for Saturday and Sunday after 6pm it could reasonably be inferred that

- (a) less people use the roads at these times.
- (b) alcohol is a major factor in traffic accidents.
- (c) young people are more likely to be involved in traffic accidents than older people.
- (d) more people are killed on Sunday than Saturday.

19. An outbreak of disease which spreads from country to country is said to be

- (a) pandemic.
- (b) contagious.
- (c) endemic.
- (d) virulent.

20. A vector is

- (a) a disease-causing microorganism.
- (b) an insect which becomes infected with a disease.
- (c) a person who does not suffer from a disease but may transmit it to others.
- (d) an organism which transmits a disease from one person to another.

21. Shivering is an effective means of combating cold because

- (a) it causes vasoconstriction which greatly reduces heat loss from the skin.
- (b) it promotes piloerection which traps a layer of air next to the skin.
- (c) its rapid sequence of weak muscle contractions convert chemical energy into heat.
- (d) it makes people engage in voluntary exercise and this warms them up.

22. Primary cancerous growths may appear in any tissue as a direct result of

- (a) lack of fibre in the diet.
- (b) exposure to asbestos.
- (c) uncontrolled cell division.
- (d) ultraviolet radiation.

SEE PAGE 10

Question 23 refers to Figure 4.

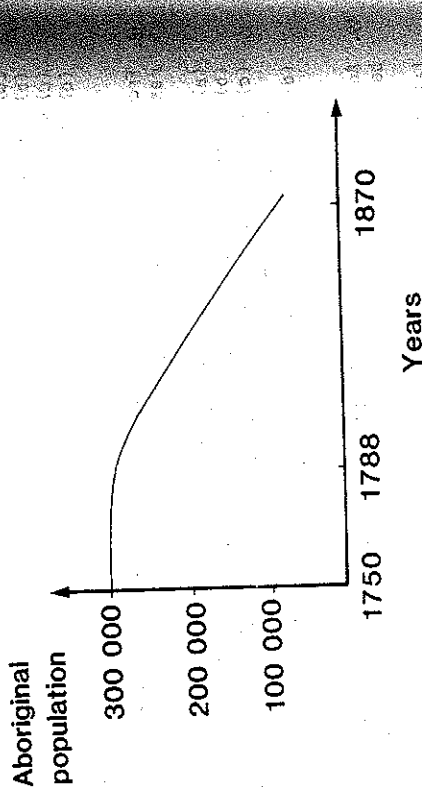


Figure 4. The estimated population of Aborigines in Australia from 1750 to 1870. European settlement of Australia began in 1788.

23. Which of the following factors probably had the MOST influence on the decline of the Aboriginal population?

- (a) Disease
- (b) Drought
- (c) Clearing land for agriculture
- (d) Extinction of traditional food animals

24. To reduce the risk of cardiovascular disease it is recommended that we should

- (a) abstain from consumption of alcohol.
- (b) reduce intake of saturated fats.
- (c) eat less green vegetables and more fruit.
- (d) consume more fluids, especially water.

SEE PAGE 11

25. Which of the following is an INCORRECT statement of characteristics shared by all primates?

- (a) Opposability of the 1st digit but generally unspecialised limb structure
- (b) Nails and friction ridges
- (c) Increased field of vision
- (d) Rhythmical sexual cycle

26. During accommodation for near vision

- (a) the ciliary muscle relaxes and the lens flattens.
- (b) the shape of the lens remains constant.
- (c) the lens becomes more spherical.
- (d) an increase in aqueous humour pressure causes the lens to bulge.

27. "Flight-or-fight" activities are controlled by the

- (a) parasympathetic division of the autonomic nervous system.
- (b) cerebral cortex.
- (c) central nervous system.
- (d) sympathetic division of the autonomic nervous system.

28. Fossilisation of bone occurs best in

- (a) acidic soil.
- (b) alkaline soil.
- (c) neutral soil.
- (d) river beds.

29. The Neolithic revolution occurred

- (a) when Australian Aborigines inhabited the vicinity of Cape York.
- (b) 13 000 years before the present.
- (c) when man changed from nomadic to a village lifestyle.
- (d) before the domestication of animals and the construction of villages.

30. Which of the following can be correctly inferred about an animal with small incisors and canines, but large molars?

- (a) Teeth were used as defence weapons.
- (b) Large amounts of food were eaten.
- (c) The animal was mainly carnivorous.
- (d) The mandible must have been U-shaped.

SEE PAGE 12

Questions 31 and 32 refer to Table 3.

Characteristics Shared	Gorillas	Humans	Chimpanzees	Other Primates
Bones and teeth				
Limb length	legs < arms	legs > arms	legs < arms	legs = arms
Canine teeth	large	small	large	large
Thumbs	short	long	short	long
Frontal sinus	present	present	present	none
Soft parts of the body				
Head hair	short	long	short	short
Calf muscles	small	large	small	small
Buttocks	thin	fat	thin	thin
Chromosomes				
Total number	48	46	48	42 or more
Structure of chromosomes 5 & 12	different from other primates	different from other primates	different from other primates	-
Molecules				
Haemoglobin	1 amino acid different from humans	-	identical to humans	many amino acids different from humans

Table 3. Body characteristics shared by some primates.

31. Which of the following characteristics would be of LEAST use to biologists studying our evolutionary relationship to gorillas, chimpanzees and other primates?

- (a) Bones and teeth
- (b) Chromosomes
- (c) Molecules
- (d) Soft parts of the body

SEE PAGE 13

32. Which of the following most accurately reflects our relationships within the primate order?

- (a) Limb length
- (b) Canine teeth
- (c) Thumbs
- (d) Frontal sinus

Question 33 refers to Figure 5.

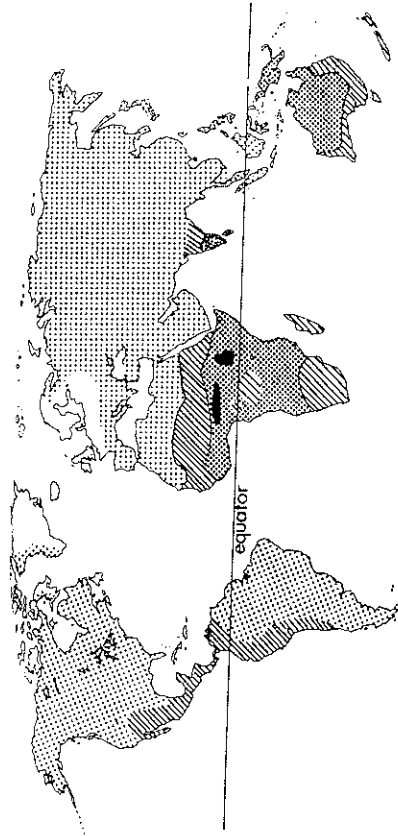


Figure 5.

33. The world map in Figure 5 shows various regions shaded. From the variation in the intensity of the shading between regions you can conclude that this map illustrates the world distribution of

- (a) primates.
- (b) skin colour.
- (c) indigenous races.
- (d) average stature in men.

SEE PAGE 14

Questions 34 and 35 refer to the following investigation.

In an experiment to discover the distribution of touch receptors over the human body, blind-folded subjects were touched four times - once with one point and three times with two points. They were asked each time to say whether they had been touched with one or two points to see if they could tell the difference. The experiment was then repeated three more times with the distance between the points reduced for each trial. Four parts of the body were tested in this way and the responses of one subject are given in Table 4.

Trial number	Number of points used	Distance apart of points	Subject's Response			
			Lower back	Thumb	Sole of foot	Forehead
1	2	2.0 cms	2	2	2	2
	1	0	1	1	1	1
	2	2.0 cms	2	2	2	2
	2	2.0 cms	2	2	2	2
2	2	1.5 cms	2	2	2	2
	2	1.5 cms	2	2	2	2
	1	0	1	1	1	1
	2	1.5 cms	2	2	2	2
3	1	0	1	1	1	1
	2	1.0 cm	2	2	1	2
	2	1.0 cm	1	2	1	2
	2	1.0 cm	1	2	1	2
4	2	0.5 cm	1	2	1	1
	2	0.5 cm	1	2	1	1
	2	0.5 cm	1	1	1	1
	1	0	1	1	1	1

Table 4. The responses given by one subject during a "two-point discrimination" investigation to map the distribution of touch receptors over the human body.

SEE PAGE 15

34. From the data given in Table 4 the part of this subject's body with the greatest concentration of touch receptors is the

- lower back.
- thumb.
- sole of the foot.
- forehead.

35. The purpose of touching the subject with one point was to

- find out how close touch receptors can be.
- determine the reliability of the procedure.
- stop the subject from guessing.
- exactly determine "two-point discrimination" thresholds.

36. Myopia, or nearsightedness, occurs when

- the eyeball is too long or the lens curvature is too great for light rays from a distant object to focus on the retina.
- the eyeball is too short or the curvature of the lens is not sufficient for light rays from a near object to focus on the retina.
- irregularities in the surface of the lens or cornea produce distortions of the image.
- opaque areas develop in the lens of the eye as protein within the lens denatures.

37. A primate fossil said to be of Miocene origin is younger than

- Pliocene fossils but older than Oligocene fossils.
- Palaeocene fossils but older than Eocene fossils.
- Oligocene fossils but older than Palaeocene fossils.
- Eocene fossils but older than Pliocene fossils.

38. Gonorrhoea and syphilis differ from most communicable diseases because

- they affect only the sex organs.
- both are difficult to cure.
- the symptoms are usually difficult to detect.
- an attack gives no immunity against a future infection.

SEE PAGE 16

39. Which of the following statements about gene pools is CORRECT?

- (a) Changes in gene frequencies affect the gene pool.
- (b) Gene pools are not affected by natural selection.
- (c) Human geographical races have identical gene pools.
- (d) Gene pools remain static within a population.

40. Taste receptor cells

- (a) are endocrine chemoreceptors.
- (b) are evenly distributed throughout the oral cavity.
- (c) differ from each other in the chemicals they detect.
- (d) are identical to smell receptor cells.

PART 11 ANSWER ALL QUESTIONS

QUESTION 41.

(a) Distinguish between "race" and "species".

1 mark

(b) List FIVE external characteristics that differ between members of different human groups.

i

ii

iii

iv

v

3 marks

(c) Races living in a cold climate have physical adaptations which help them survive in their environment. Explain ONE such adaptation.

2 marks

(d) What is the advantage of having a dark skin in a hot climate?

2 marks

SEE PAGE 18

SEE PAGE 17

41. (continued)

- (e) Within the Australian Aboriginal race there is considerable variation in body characteristics. Give two possible reasons why this is so.

i. _____

ii. _____

2 marks

QUESTION 42.

PARTICULARS	YEAR				
	1979	1980	1981	1982	1983
Accidents involving casualties					
Total	7025	6460	6364	6559	6248
Per 10 000 motor vehicles	98	87	82	81	77
Number of persons killed					
Total	279	293	238	236	203
Per 10 000 motor vehicles	3.9	3.9	3.1	2.9	2.5
Number of persons injured					
Total	9342	8386	8255	8363	8007
Per 10 000 motor vehicles	130	113	107	104	99

Table 5. Summary of Western Australian statistics for road accidents in which people were killed or injured during the years 1979 - 1984.

SEE PAGE 19

42. (continued)

- (a) Why is the number of accidents expressed in Table 5 as the number per 10 000 motor vehicles?

1 mark

- (b) Describe the trend in the death and injury rate from traffic accidents between 1979 and 1984.

2 marks

- (c) Give four possible reasons for this trend.

i. _____

ii. _____

iii. _____

iv. _____

4 marks

SEE PAGE 20

42. (continued)

Year	Age last birthday (years)									
	0-4	5-6	7-16	17-20	21-29	30-39	40-49	50-59	60 & over	
1979	6	5	25	54	74	38	19	15	43	
1980	9	7	30	56	68	43	20	22	38	
1981	5	0	15	40	63	29	26	21	39	
1982	6	2	36	40	65	33	13	18	23	
1983	8	2	15	26	63	32	15	15	27	
1984	8	3	16	40	54	28	22	19	31	

Table 6. Deaths from traffic accidents in Western Australia classified according to age.

(d) Are the figures in each column of Table 6 directly comparable? Explain.

1 mark

(e) Who is more likely to be killed in a traffic accident - a person in the 17-20 age group or a person in the 21-29 age group?

1 mark

(f) Give TWO reasons why persons in this age group are more likely to be involved in traffic accidents.

2 marks

SEE PAGE 21

QUESTION 43.

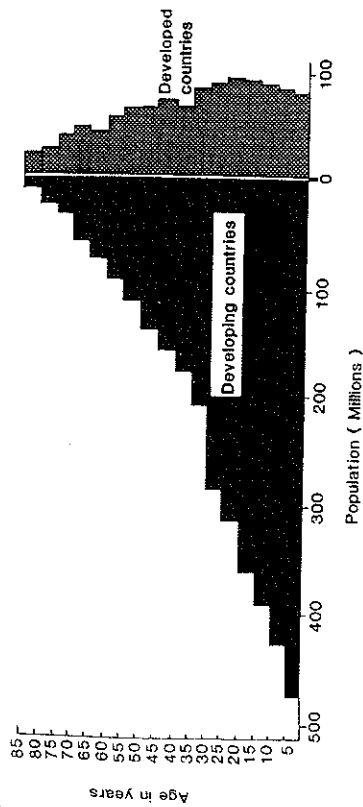


Figure 6. The age distribution of world population in 1980.

(a) In 1980, approximately how many people in the world were aged five years or less?

1 mark

(b) In the developed countries the proportion of people aged 20 years or less is declining. Give TWO reasons why this trend is occurring.

i

ii

2 marks

(c) Although developing countries have a much greater proportion of the world's population than developed countries, the number of people aged 65 and over is about the same in each. Give TWO reasons why this should be so.

i

ii

2 marks

SEE PAGE 22

43. (continued)

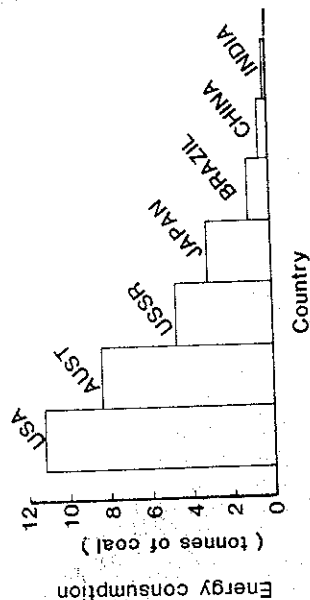


Figure 7. Annual energy consumption per head of population for a number of countries.

- (d) Explain why the average person in a developing country uses less energy per annum than a person in a developed country like the USA.

2 marks

- (e) What would the consequences be if all developing countries were to increase their energy consumption to the same level as the USA or Australia?

2 marks

SEE PAGE 23

QUESTION 44.

- (a) Draw a simple labelled diagram (IN 2B PENCIL) of a nephron and its collecting tubule. Clearly show the blood supply to all parts of the nephron and indicate with arrows the direction of blood flow.

6 marks

*problems
of increasing
populations
+ energy use.
to greenhouse
energy supplies*

SEE PAGE 24

44. (continued)

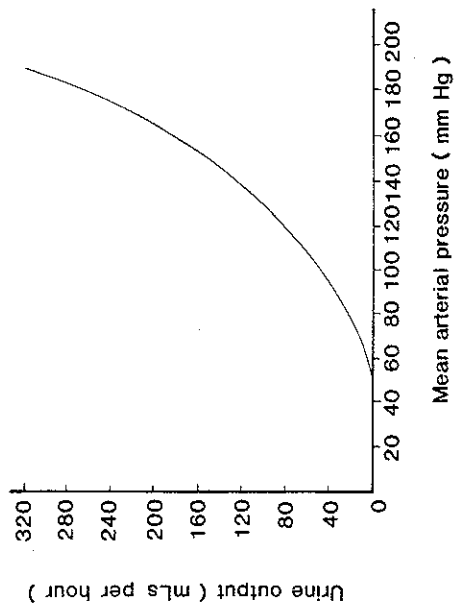


Figure 8. The relationship between urine output and blood pressure.

- (b) Describe the relationship between urine output and arterial pressure. Use what you know about kidney functioning to explain why this relationship exists.

2 marks

SEE PAGE 25

44. (continued)

- (c) What is tubular reabsorption ?

Why is it necessary ?

Why is tubular reabsorption an active process ?

Name THREE compounds that are actively reabsorbed.

4 marks

SEE PAGE 26

45. (continued)

Examine the illustrations of the full skeleton and skeletal features belonging to a quadrupedal primate, gorilla and human in Figure 9.

(a) State ONE feature of the quadrupedal skeleton illustrated in Figure 9, which is suited for quadrupedal walking and explain how it assists this mode of locomotion.

1 mark

(b) Describe TWO structural features evident in Figure 9 which account for the fact that the gorilla is not able to walk bipedally for extended periods of time.

2 marks

(c) Describe TWO structural features evident in Figure 9 which enable humans to carry out efficient bipedalism.

2 marks

SEE PAGE 28

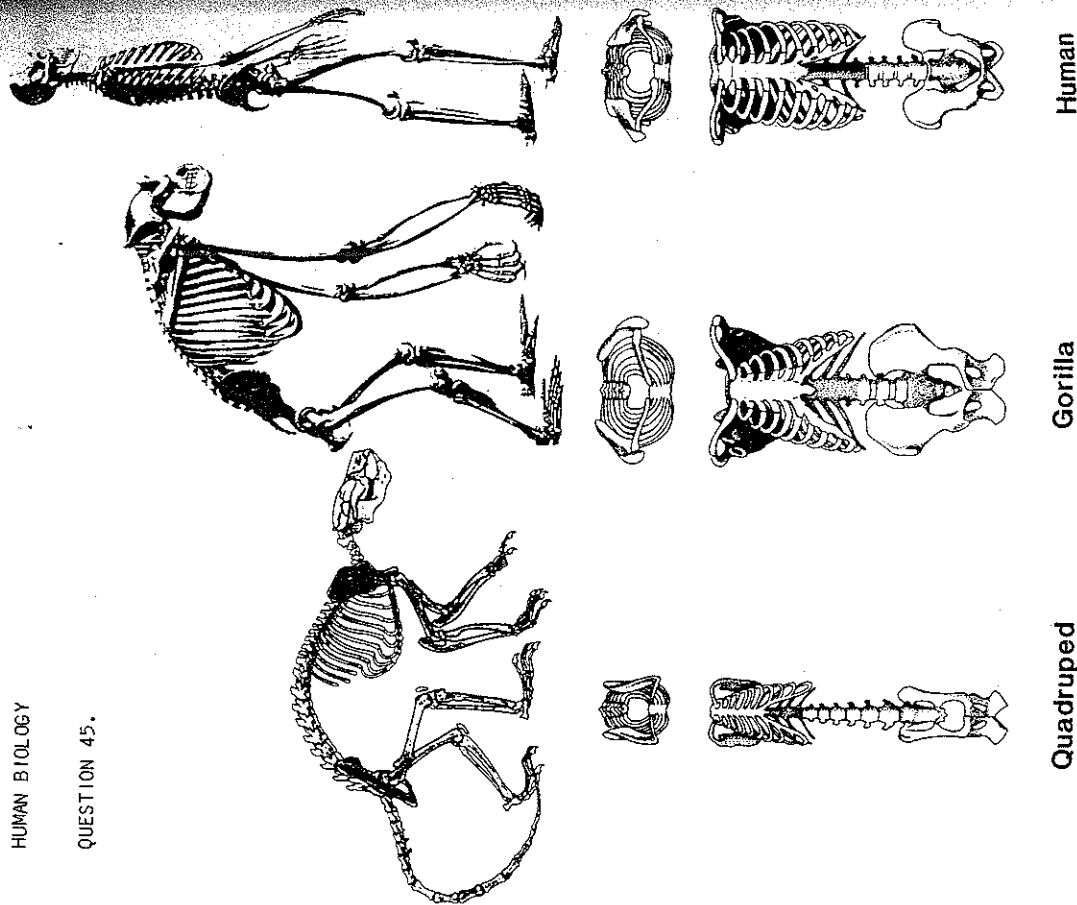


Figure 9. Skeletons and skeletal features of a quadrupedal primate, gorilla and human.

SEE PAGE 27

45. (continued)

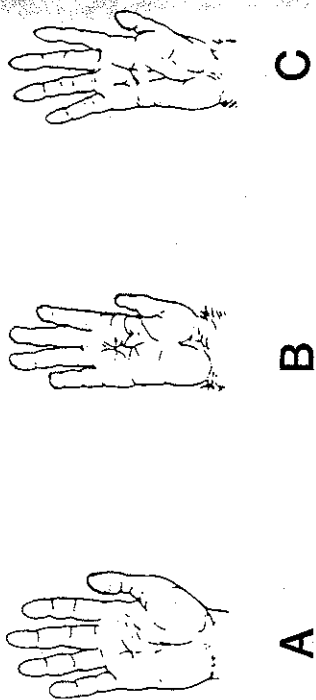


Figure 10. Primate hands

(d) Which of the hands illustrated in Figure 10 is best suited for brachiation? Explain why.

1 mark

(e) What important anatomical feature accounts for the manipulative ability of the human hand?

1 mark

SEE PAGE 29

45. (continued)

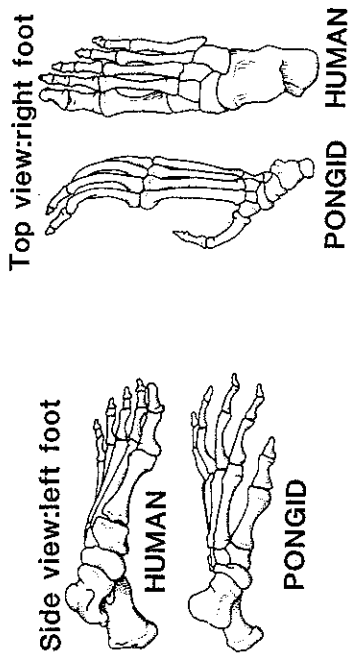


Figure 11. Skeleton of human and pongid foot

(f) Describe two specialized features in the bone structure of the human foot evident in Figure 11, which are adaptations for bipedalism.

i.

ii.

2 marks

(g) Describe one feature of the human skull that can be related to the evolution of bipedal locomotion.

1 mark

SEE PAGE 30

QUESTION 46

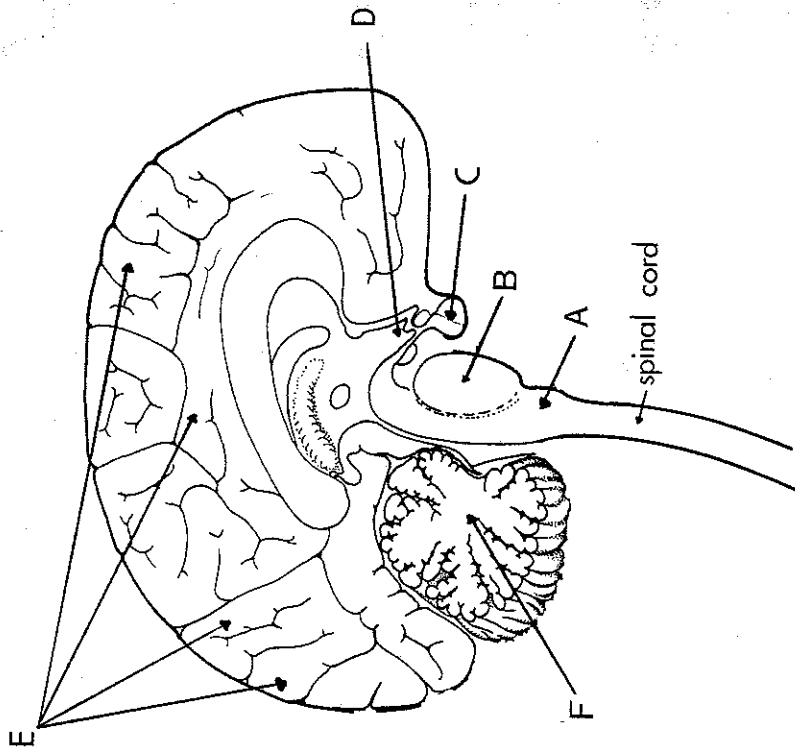


Figure 12. Mid-sagittal section of the human brain.

SEE PAGE 31

46. (continued)

(a) Name the parts of the brain labelled A, B, C, D, E and F in Figure 12.

- A _____
- B _____
- C _____
- D _____
- E _____
- F _____

6 marks

(b) Structure E is organised into two distinct layers.
What are they called?

What is the major function of each?

4 marks

(c) What is the name of the fluid in the spaces within the brain?

What is the function of this fluid?

2 marks

SEE PAGE 32

QUESTION 47.

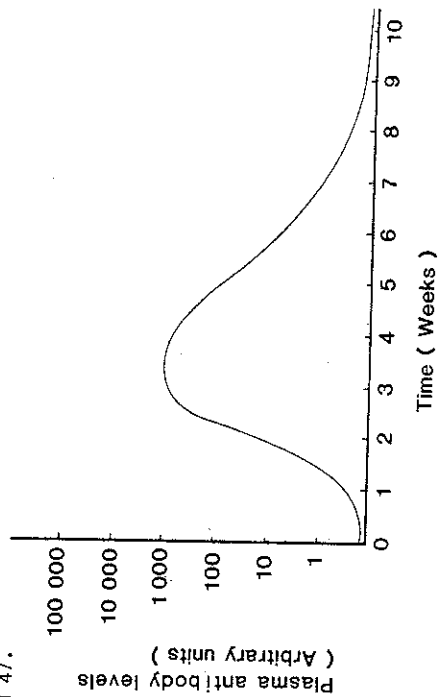


Figure 13. Immune response of a person injected with a single dose of antigen.

- (a) In Figure 13 a logarithmic scale has been used on the vertical axis. Suggest ONE advantage of using such a scale.

1 mark

- (b) What is:

(i) plasma ?

(ii) an antigen ?

2 marks

SEE PAGE 33

47. (continued)

- (c) Plasma antibody levels did not begin to rise until the sixth day after the injection of antigen. What events have to take place before antibody levels start to rise?

3 marks

- (d) After ten weeks plasma antibody levels have fallen to the same as they were prior to the injection of antigen. Why has this happened?

2 marks

- (e) The immune response only occurs if a foreign substance or organism penetrates other parts of our protective system. Describe FOUR other ways in which our bodies are protected against foreign invaders.

8 marks

SEE PAGE 34

PART 111

ANSWER ANY TWO QUESTIONS FROM THIS SECTION.

ILLUSTRATE YOUR ANSWER WITH LABELLED 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.)

WRITE YOUR ANSWER IN INK BUT DRAW ALL DIAGRAMS IN PENCIL.

QUESTION 48.

World population is expanding at a rate which is causing it to double every 25 of 30 years. Accompanying this "population explosion" is a trend towards urbanisation - more and more people living in large cities.

(a) Explain separately why:

- (i) population growth
- (ii) urbanisation

have contributed to air and water pollution. Use specific examples to illustrate your answer.

12 marks

(b) Explain, with examples, how recycling can help to reduce pollution and conserve resources.

4 marks

(c) Describe the effect on humans of:

- (i) two common pollutants of air.
- (ii) two common pollutants of water.

4 marks

QUESTION 49.

During an excavation anthropologists uncovered fossil material at various depths under the earth's surface.

(a) Discuss the principles underlying FOUR methods anthropologists might use to date this material and explain ONE limitation or problem associated with each method.

12 marks

(b) Among the fossils found was a hominid mandible. Describe how FOUR separate characteristics of this individual or his/her way of life could be obtained from examining this mandible.

4 marks

(c) Explain FOUR further pieces of evidence the anthropologists might look for in the same stratum that would help them to infer the lifestyle of this hominid.

4 marks

SEE PAGE 35

QUESTION 50.

It could be said that in the human species today, cultural evolution has largely taken over from evolution by natural selection.

(a) Name a transmissible disease and explain how, in the past, natural selection would have operated with respect to that disease.

6 marks

One result of cultural evolution is preventive medicine - the stopping of disease before people become ill.

(b) Explain the role of preventive medicine with regard to:

- (i) a sexually transmitted disease.
- (ii) a non-transmissible disease.
- (iii) mental illness.

For each of (i), (ii) and (iii), name a disease, discuss ONE cause, and one preventive measure being taken in the Australian community. Explain how this measure helps to prevent the disease.

12 marks

(c) Explain how cultural evolution could eliminate a disease from a human population.

2 marks

QUESTION 51.

During a 1/3 kilometre fun-run a student noticed that:

(a) Her breathing rate did not increase until she had run about 50 metres and that it did not return to its normal resting level until nearly three minutes after she had stopped running. Use what you know about the mechanisms of breathing homeostasis to account for these observations.

7 marks

(b) Towards the end of the run her performance fell away badly despite the fact that her muscles were not sore and that she was not overheating. Use what you know about the mechanisms of blood sugar homeostasis to account for this observation.

7 marks

(c) Several runners, who had not drunk water before or during the run, collapsed and had to be treated for "heat exhaustion". Use what you know about the mechanisms of heat homeostasis to account for this observation.

6 marks

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