The Institute of Animal Technology

FELLOWSHIP EXAMINATION 2000

Section B – BACKGROUND SUBJECTS

Afternoon Tuesday 6th June

(TOTAL TIME: THREE HOURS)

Part I

Short Answer Questions

Part II

Long Answer Questions

Write your candidate number in the top right hand corner

Read the instructions for each part carefully

Part I

Short Answer Questions

Attempt ALL Questions

Write your answers in the spaces provided

Numbers in brackets indicate the marks available for each question

You are advised to spend one and a half hours on this part

Hand in this book, together with your answers to Part II, at the end of the examination

Attempt ALL Questions

1. Name **five** classes of vertebrates.

   …………………………………….   …………………………………….

   …………………………………….   …………………………………….

   …………………………………….

   (5 x ½)

2. If cattle are bovidae, what are:

   sheep………………………………………………………………………………..

   deer…………………………………………………………………………………

   pigs?…………………………………………………………………………………
   (3 x ½)

3. List **six** ways in which an endoparasite such as *Taenia sp.* is adapted to its mode of life.

   ………………………………………………………………………………………

   ………………………………………………………………………………………

   ………………………………………………………………………………………

   ………………………………………………………………………………………

   ………………………………………………………………………………………

   ………………………………………………………………………………………
   (3 x ½)

4. Name **four** taxonomic groups of endoparasite.

   ………………………………..   ………………………………..

   ………………………………..   ………………………………..
   (4)

5. Why is it not possible to use a homozygous dominant organism (such as TT) in a test cross experiment to determine the genotype of an organism showing the dominant phenotype? Illustrate your answer fully using appropriate genetic symbols.

……………………………………………………………………………………………….

(3)

6. Body colour in cats is controlled by a sex-linked gene on the X chromosome. The following data was obtained from a breeding experiment where the homogametic sex was homozygous for body colour in the parental generation. Black colour is dominant to yellow.

black male x yellow female
↓
1 yellow male: 1 black female

Which is the heterogametic sex? Explain your answer with appropriate genetic diagrams.

……………………………………………………………………………………………..

(3)

7. In rabbits black hair (B) is dominant to white hair (b) and short hair (S) dominant to long hair (s). The cross BbSs x bbss results in the offspring phenotypic ratio:

1 black short: 1 black long: 1 white short: 1 white long

Which of the following crosses would also produce this result? (Indicate your answer by drawing a circle around it).

BBss x bbss   Bbss x bbSs

Bbss x bbSS   BbSs x BbSs

(1)

8. Albinism in mice is due to a recessive gene. If an albino was crossed with a pure breeding coloured mouse, what is the probability that the first offspring produced of the F2 generation is a heterozygous coloured mouse. Explain your answer.

…………………………………………………………………………………..

(3)

9. The genetic code is said to be a 'triplet code'. What does this mean?

…………………………………………………………………………………..

(1)

What is the significance of this?

…………………………………………………………………………………..

(1)

10. Explain the meaning of the following terms:

allele…………………………………………………………………………..

…………………………………………………………………………………...
(1)

autosome…………………………………………………………………...…

………………………………………………………………………………….
(1)

lethal in the homozygous condition………………………………………….

………………………………………………………………………………….
(1)

11. Draw a fully labelled diagram to show the structure of compact bone as seen in transverse section under the microscope.

(3)

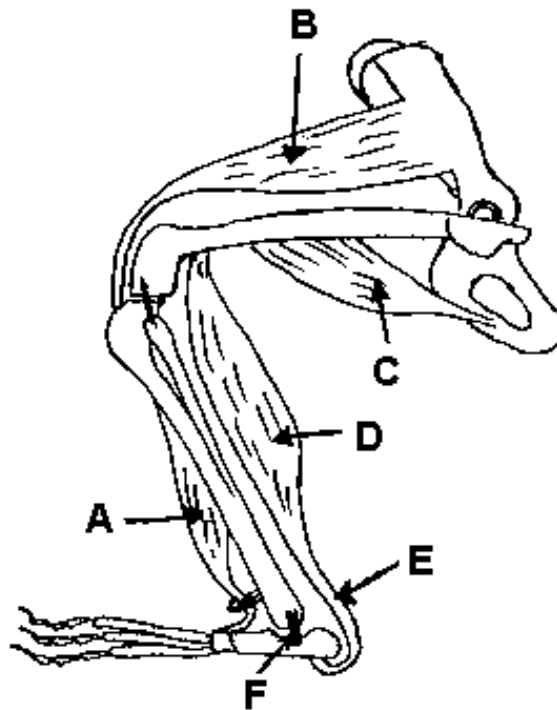**12.** What are the main functions of a skeletal system?

……………………………………………………………………………………

……………………………………………………………………………………

………………………………………………………………………………………
(3 x ½)

13. Name the **three** main types of skeletal system found in animals.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………
(3 x ½)

14. The diagram below shows some of the structures in the hind limb of a rabbit.

Which of the muscles labelled **A, B, C** or **D** are responsible for the following:

straightening the knee?………………………………..

lifting the heel?……………………………………….
(2 x ½)

For each of structures **E** and **F** state one function and the property of the structure which enables this function to occur.

	FUNCTION	PROPERTY
STRUCTURE **E**		
STRUCTURE **F**		

(4 x ½)

15. State **two** ways in which friction is reduced at joints.

……………………………………………………………………………………

……………………………………………………………………………………
(2 x ½)

16. Describe the difference between dentine and enamel.

……………………………………………………………………………………

……………………………………………………………………………………
(2)

17. What is secreted by the mammalian pancreas?

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………
(3)

Describe the functions of these pancreatic secretions.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………
(3)

18. Explain how the release of pancreatic secretions is controlled.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

(4)

19. Explain how the sensory receptor mechanisms of the eye or ear, as appropriate, enable discrimination between:

green and red colours.………………………………………………………….

……………………………………………………………………………………

……………………………………………………………………………………

small objects……………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

sounds of different pitch (frequency)………………………………………….

……………………………………………………………………………………

……………………………………………………………………………………

rotational movements of the head……………………………………………….

……………………………………………………………………………………

……………………………………………………………………………………

varying positions of the head with respect to gravity…………………………

……………………………………………………………………………………

……………………………………………………………………………………

(5 x 1)

20. Explain how each of the following is involved in the transmission of information across a synapse in the nervous system of a mammal:

synaptic vesicles……………………………………………………………………

……………………………………………………………………………………………..

……………………………………………………………………………………………..

calcium ions………………………………………………………………………….

……………………………………………………………………………………………

……………………………………………………………………………………………

receptor sites on the post-synaptic membrane…………………………………..

……………………………………………………………………………………………

……………………………………………………………………………………………

hydrolytic enzymes at the synapse………………………………………………..

……………………………………………………………………………………………

……………………………………………………………………………………………

(4)

21. Complete the following table which compares some features of nervous and hormonal co-ordination.

	Nervous	**Hormonal**
Pathway of transmission		
Form of transmission		
Speed of transmission		
Duration of effect		

(8 x ½)

22. Study the figure below which indicates the variations in pressure in different parts of a mammalian circulatory system.
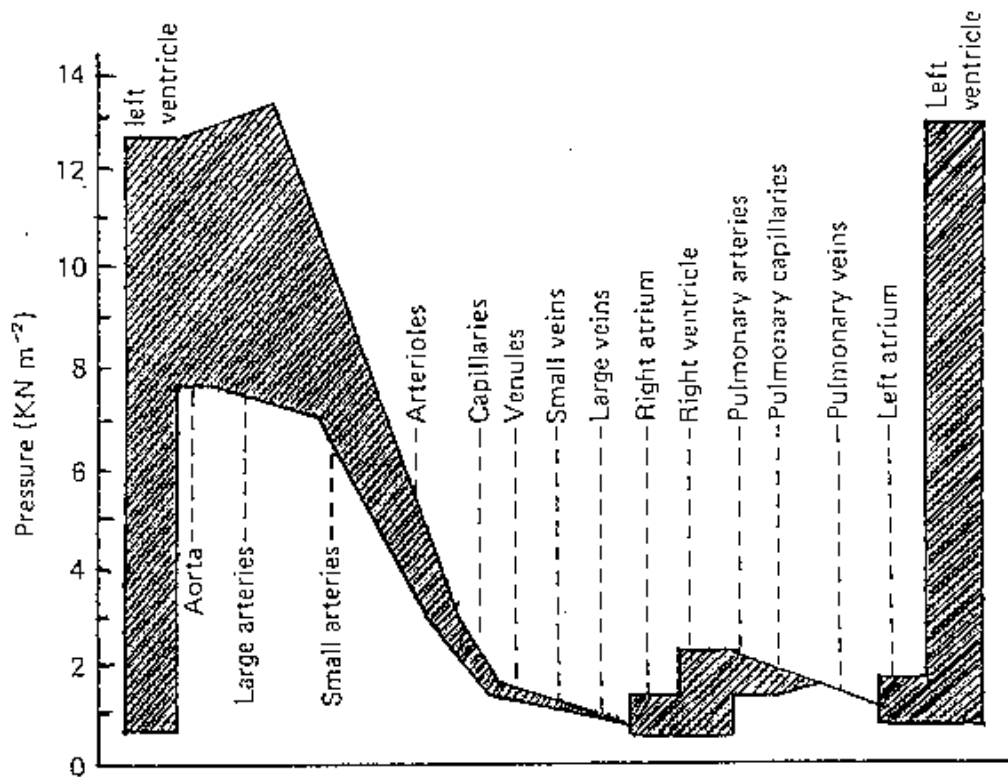
Answer the following questions.

In which part of the circulation are the greatest fluctuations in pressure?

…………………………………………………………………………………….
(1)

In which parts are there no fluctuations?

…………………………………………………………………………………….
(1)

Which part of the circulation always maintains a pressure above

7.3 KN m $^{-2}$?………………………………………………………………….
(1)

Suggest the sector of the circulation which offers the greatest resistance to the flow of blood. How is this indicated on the diagram?

……………………………………………………………………………………

……………………………………………………………………………………

(2)

Blood flow in the main veins is under relatively low pressure. Describe how the return of blood to the heart is maintained.

……………………………………………………………………………………

……………………………………………………………………………………

(1)

Account for the different ranges of pressures in the pulmonary and systemic circulations. What are the advantages to the mammal of having a double circulatory system?

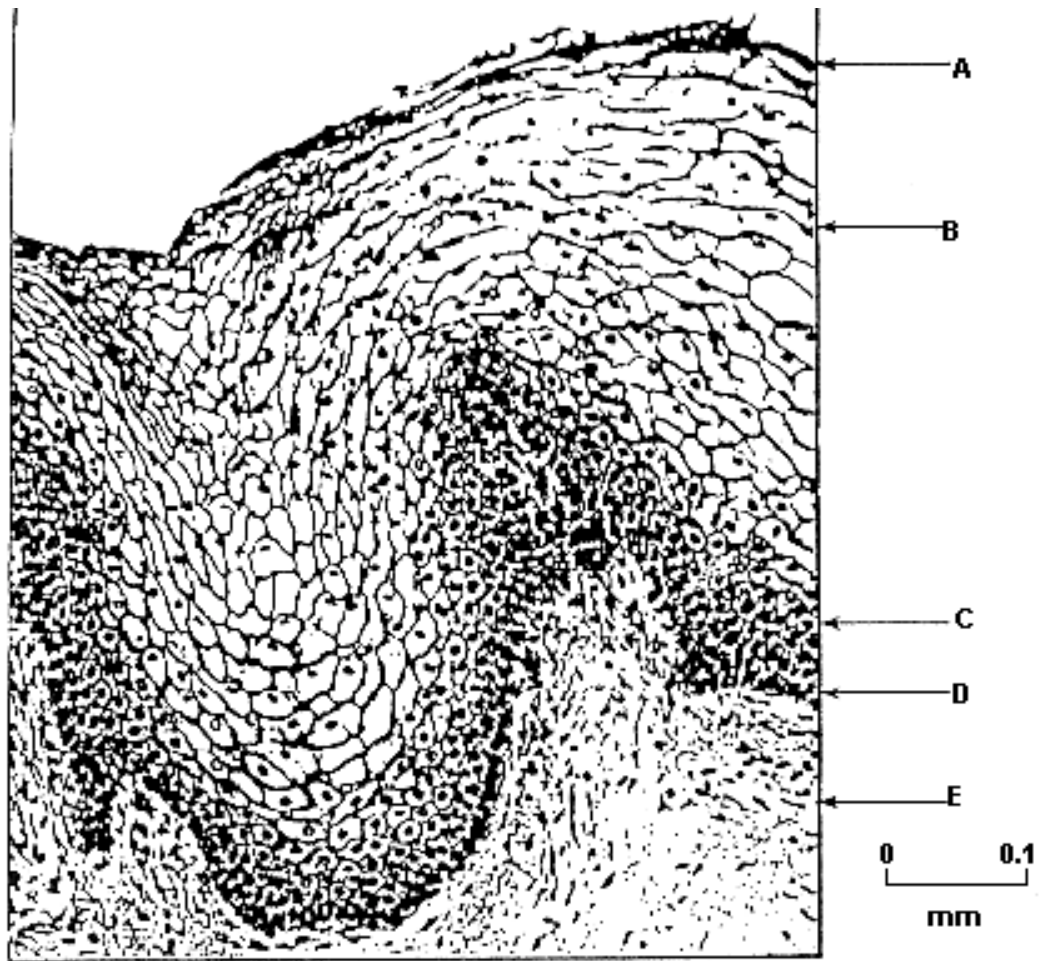……………………………………………………………………………………

……………………………………………………………………………………

(2)

23. Complete the table below by giving the names of the appropriate mammalian blood vessels.

Description of blood	Major blood vessel
Highest oxygen concentration	
Highest pressure	
Highest glucose concentration	
Highest CO_2 concentration	
Highest urea concentration	
Higher than average temperature	

(6 x ½)

24.

Identify the tissue shown on the diagram above.

……………………………………………………………………………………………

(1)

Label the regions of tissue indicated by **A** to **E** on the diagram.

A………………………………….

B………………………………….

C…………………………………

D………………………………….

E……………………………………

(5 x ½)

Name one area of the body where you would expect to find this tissue.

……………………………………………………………………………………………..
(1)

Which letter indicates the region of the tissue where you would expect to find the process of mitosis occurring?

……………………………………………………………………………………………..
(1)

What happens to the cells in the region **A** of the tissue?

……………………………………………………………………………………………..
(1)

24. The diagrams below show two cells, **X** and **Y**, from the same organism. The nucleus of one cell is dividing by mitosis, the other by meiosis.

CELL **X**   CELL **Y**
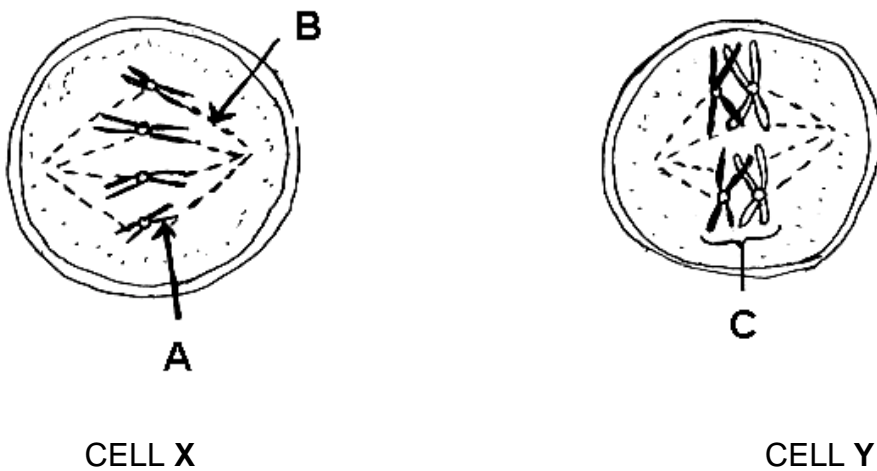
Name the structures labelled **A, B** and **C**

A……………………………………….   B……………………………………………

C……………………………………

(3)

Which cell is dividing by meiosis? Give **two** reasons for your answer

……………………………………………………………………………………………

……………………………………………………………………………………………
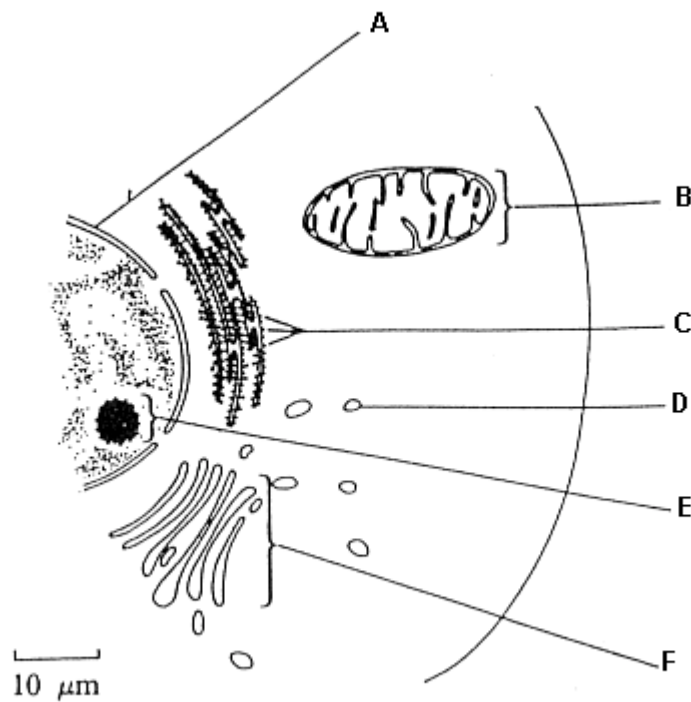*(3)*

25. Indicate by ticks which of the following statements are true of mitosis, first division of meiosis and second division of meiosis.

Statement	Mitosis	1st division meiosis	2nd division meiosis
Divides haploid nuclei			
Divides diploid nuclei			
Involves pairing of chromosomes			
Involves splitting of chromosomes			

(4)

26.

On the diagram above, name features **A, D** and **E**.

A……………………………….

D…………………………………

E……………………………….

(3 x ½)

Describe **one** function of each of the following features:

B…………………………………………………………………………………………

C ……………………………………………………………………………………..

F…………………………………………………………………………………………
(3)

What is the functional relationship between:

B and **C**……………………………………………………………………………

C and **E**?……………………………………………………………………………
(2 x 1)

27. What is cellular respiration?

……………………………………………………………………………………….
(1)

Where in the cell does it occur?

……………………………………………………………………………………………

……………………………………………………………………………………………
(2 x ½)

28. List the main ways in which substances may be transported across the cell membrane.

……………………………………….   ……………………………………..

……………………………………….   ……………………………………..

……………………………………..
(5 x ½)

29. The following diagrams show mouse embryos at various stages of development.

Name structures **A**, **B** and **C**.

A……………………………….   **B**…………………………………..

C…………………………………
(3)
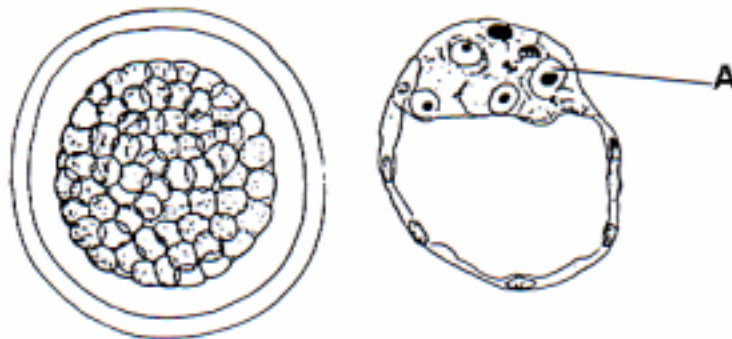
Indicate the age of the zygote in the above diagram:

5 minutes   24 hours   5 days
(1)

Name the stage shown in the diagram above.

……….
(1)

Name structure **A**………………………………………………………………………………
(1)

What is the name given to the process of division of the zygote into 2, 4, 8, etc. cells?

………..
(1)

What is the name of the process by which the embryo separates into ecto- and endoderm?

………..
(1)

The diagram shows a 9-day old embryo. Name structures **A**, **B** and **C**.
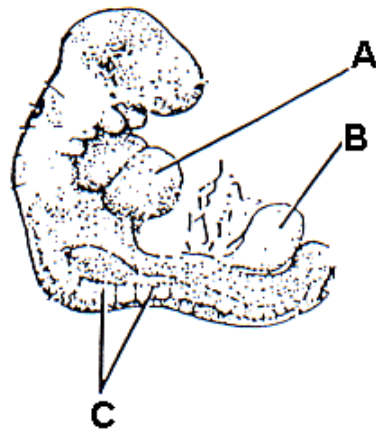
A...................................   B.....................................

C...............................

(3)

What name is given to the process by which the embryo forms an
association with the uterus?

....

(1)

30. Briefly describe the changes to the blood circulation of the neonate at
    birth.

....

....

....

....

(4)

31. Define the following terms:

   triploblastic...

   ....

acoelomate……………………………………………………………………………………

……………………………………………………………………………………………………

cephalisation………………………………………………………………………………

……………………………………………………………………………………………………

bilateral symmetry…………………………………………………………………………

……………………………………………………………………………………………………

(4 x 1)

32. Name **two** of the major classes into which antibodies are divided.

……………………………….. ………………………………..

(2)

33. What is an auto-immune disease?

……………………………………………………………………………………………

……………………………………………………………………………………………

(2)

34. What is the difference between active and passive immunity?

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

(3)

35. What is meant by a secondary immune response?

…………………………………………………………………………………

…………………………………………………………………………………

(2)

36. Name **four** culture media that may be used to aid in the identification of bacteria.

…………………………………………………………………………………

…………………………………………………………………………………

(4)

37. What term is used to describe bacteria that can only grow in the absence of oxygen?

…………………………………………………………………………………

(1)

38. What are the anatomical characteristics of:

cocci……………………………………………………………………………

bacilli……………………………………………………………………………

spirilli……………………………………………………………………………

(3)

39. Name **two** diagnostic tests that may be used to detect antibodies in a blood sample.

…………………………………………………………………………………

…………………………………………………………………………………

(2)

40. Give **two** ways in which fats and oils differ?

……………………………………………………………………………………………

……………………………………………………………………………………………

(2)

41. Which chemical elements are found in lipids?

……………………………………………………………………………………………

(1)

42. Name **two** cell structures in which lipids occur.

……………………………………………………………………………………………

……………………………………………………………………………………………

(2)

43. What is meant by an 'unsaturated fatty acid'?

……………………………………………………………………………………………

……………………………………………………………………………………………

(1)

44. Explain the following terms which relate to enzymes:

active site………………………………………………………………………………...

……………………………………………………………………………………………

(1)

competitive inhibition…………………………………………………………………...

……………………………………………………………………………………………

(1)

45. The graph below shows the relation between temperature and the rate of an enzyme-controlled reaction.
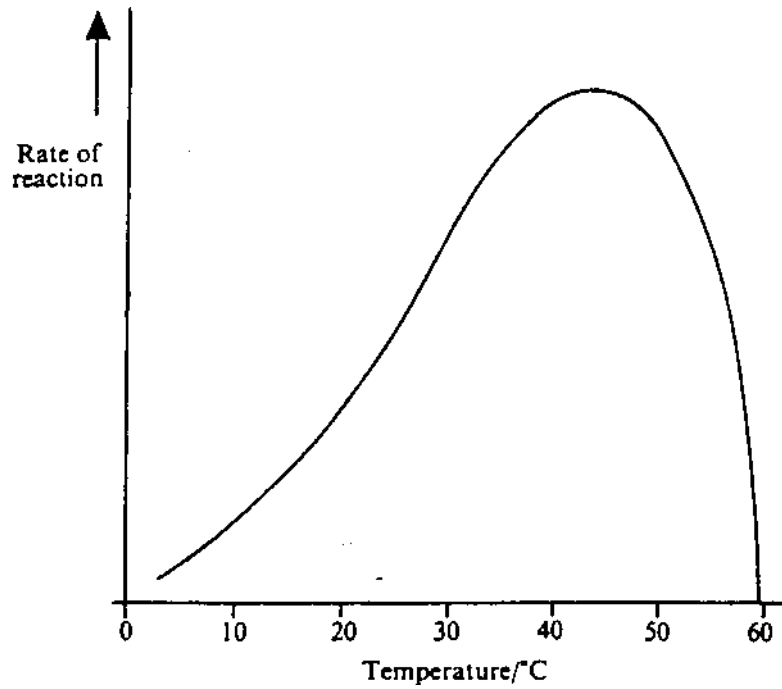
Account for the shape of the curve:

between 15°C and 30°C……………………………………………………..

(1)

from 45°C to 60°C…………………………………………………………...

(1)

46. Define the following with respect to the microscope:

magnification………………………………………………………………

………………………………………………………………………………

resolution…………………………………………………………………

………………………………………………………………………………

tube length………………………………………………………………

………………………………………………………………………………

(3 x 1)

47. Biochemical analysis of a sample of DNA showed that 33% of the nitrogenous bases was guanine. Calculate the percentage of the bases in the sample which would be adenine. (Show your workings).

…………………………………………………………………………………..

(1)

48. 650 cm³ of blood pass through the capillaries of the lungs of a dog every minute. If 100 cm³ of venous blood contains 14 cm³ of oxygen and 100 cm³ of arterial blood contains 19 cm³ of oxygen, calculate how much oxygen is transferred to the tissues every minute. (Show your workings).

………………………………………………………………………………….

(3)

49. Measurements performed on a dog produced the following data:

blood flow through the renal arteries = 150 cm³/min;
filtrate produced   = 18 cm³/min;
urine formed   = 0.15 cm³/min.

Calculate the following: (show your workings):

blood flow through the renal veins;

....

volume reabsorbed in the kidneys;

....

urine production over a 24 hour period.

....
(3 x ½)

50. What do you understand by the term 'bias'?...

....
(2)

51. Lysozyme is a protein made of 129 amino acids. How many nucleotides are needed to encode for this chain of amino acids?
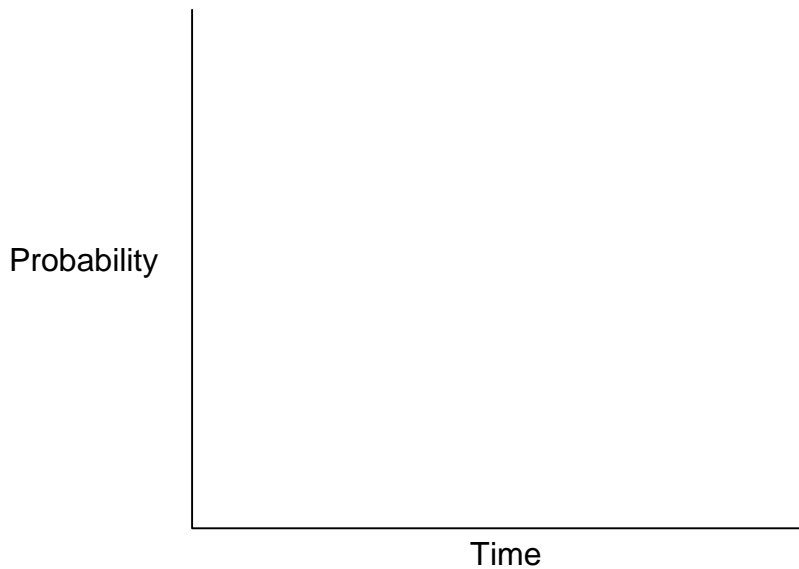
………………………………………………………………………………..
(1)

A complete turn of the DNA molecule double helix contains ten base pairs and is 3.4 nm long. What length of DNA molecule is occupied by the gene for lysozyme?

………………………………………………………………………………..
(1)

How many turns of the DNA double helix does this represent?

………………………………………………………………………………..
(1)

52. On the graph axes below sketch a normal distribution curve.

Probability

Time

(2)

53. In repeated crosses between mice heterozygous for coat colour the following offspring were obtained:

104 agouti, 40 albino

What is the expected ratio?…………………………………….……

(1)

$$\chi^2 = \frac{(observed - expected\ frequencies)^2}{expected\ frequencies}$$

What is the approximate value of chi-squared for the results?

………………………………………………………………………..

(4)

How many degrees of freedom are there in this situation?

……………………………………………………………………………………

(1)

54. Name a statistical test other than chi-squared that may be used to interpret a set of data in a biological experiment.

……………………………………………………………………….

(1)

55. Name the units used to measure:

energy of emitted radiation……………………………………………………

exposure dose (amount of ionisation produced)……………………………….

exposure dose (amount of energy absorbed)………………………………….

(3)

56. What is a Becquerel?……………………………………………………..…

…………………………………………………………………………………….
(1)

57. Sketch a graph of the number of radioactive particles in a sample of an isotope against time.

Number of
radioactive
particles

0	Time
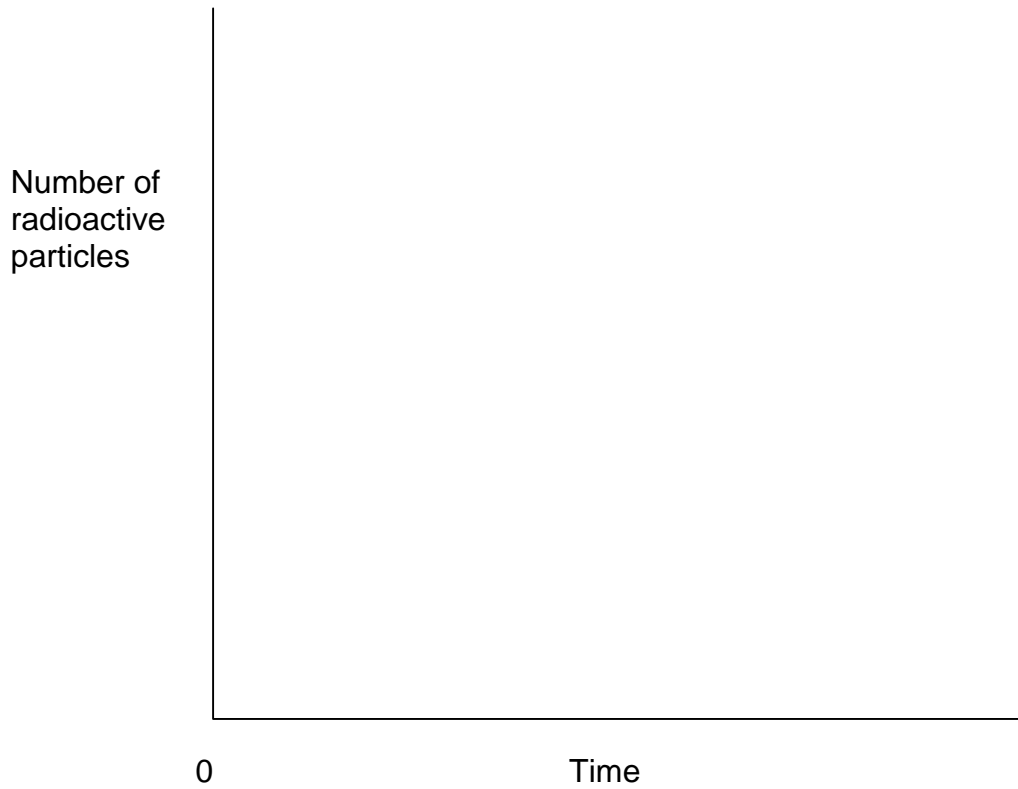
(1)

Indicate on your graph the "half life" of the isotope.
(1)

What fraction of isotope remains after 5 half lives?

…………………………………………………………………………………….
(2)

End of Part I

Part II

Long Answer Questions

Attempt THREE of the four questions

Write your answers on the paper provided

Start each new answer on a fresh sheet of paper
Write on one side of the paper only

*Write your candidate number in the top right hand corner and the
question number in the top left hand corner of every answer sheet*

You are advised to spend half an hour on each question

*The approximate percentage of marks available for each section of
the question is indicated*

Credit will be given for suitable illustration

You must hand in all answer sheets at the end of the examination

Attempt THREE questions

1. Identify structures **A - F** on the separate sheet.

    Outline the function of **A**, **D** and **F.**

    50%

    Outline the process of spermatogenesis.

    50%

2. Explain how mammalian skin functions in:

    a)   protection

    b)   temperature regulation

    100%

3. What is a protein?

    15%

    List ten proteins and give a function of each in the mammalian body.

    70%

    Explain how the structure of proteins permits a wide variety of functions.

    15%

4. What is the resting potential of a nerve fibre and how is it maintained?

    30%

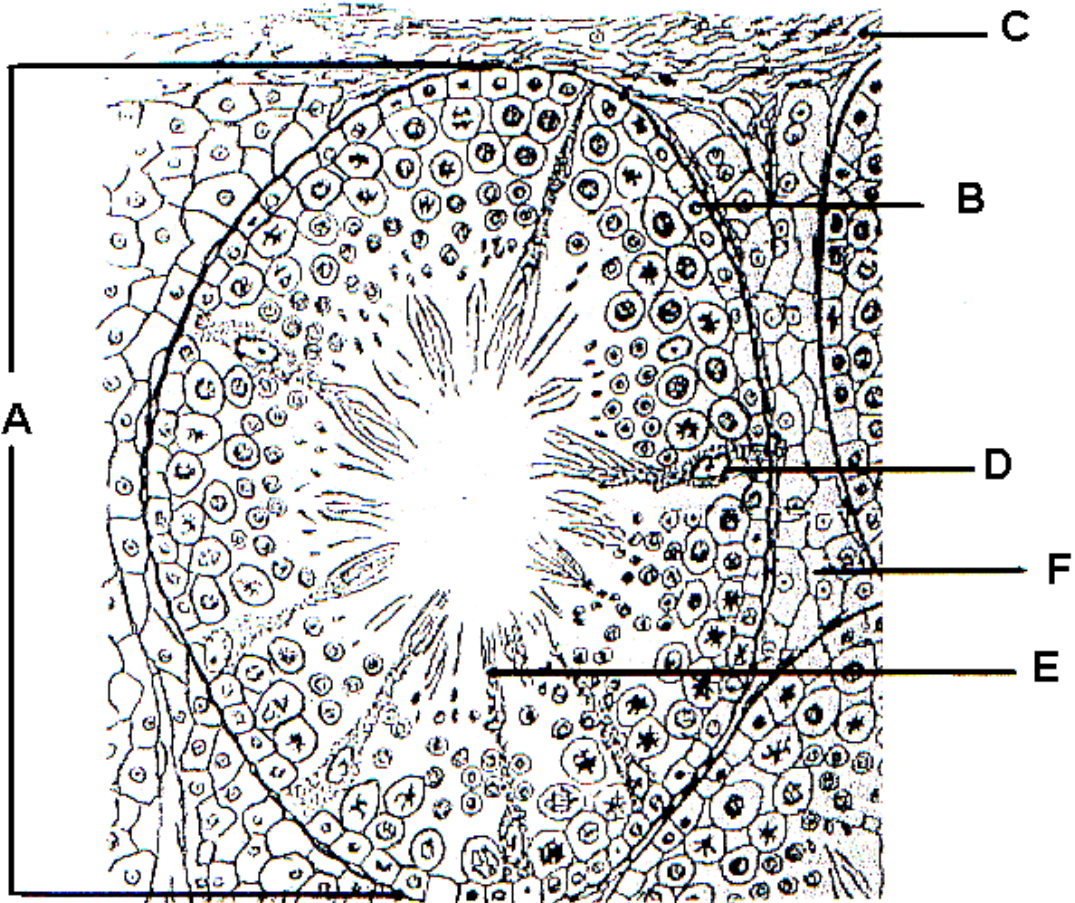   Describe an action potential and explain how it is propagated
    along a nerve fibre.

    70%

End of Part II

The Institute of Animal Technology

Fellowship Examination 2000   Section B   Part II   <u>Question 1</u>

A……………………………..   B……………………………………..

C……………………………..   D……………………………………..

E……………………………..   F……………………………………...

Write your candidate number in the top right hand corner

Remember to hand this sheet in with the rest of your answer

Continue your answer on the lined paper provided