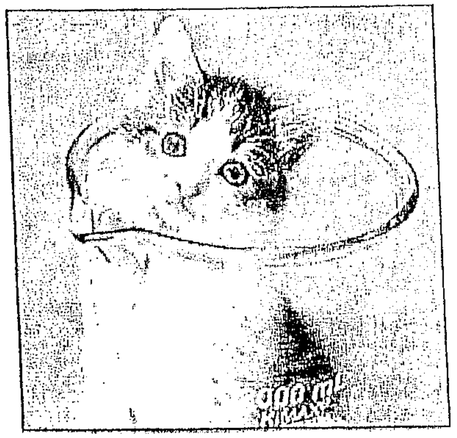
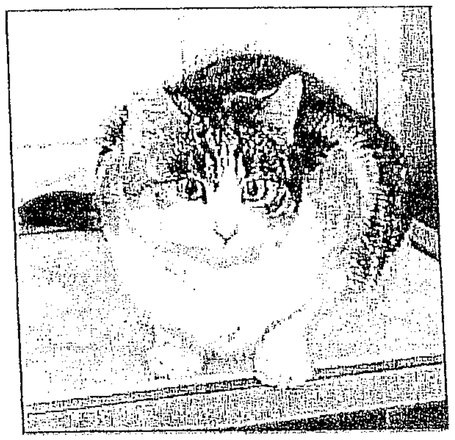
1. In 2002, the first cloned cat (Kopy Cat) was produced using a somatic cell from a calico cat (Rainbow).



Kopy Cat



Rainbow

Kopy Cat is not identical to Rainbow. Rainbow's coloured fur patches are not of the same size and shape as her clone.

The most probable explanation for this phenomenon is

A. the influence of environment on phenotype
B. crossing over during meiosis
C. independent assortment of chromosomes in meiosis
D. expression of recessive genes from previous generations

2. Many organisms have structural characteristics which help them achieve homeostasis within sometimes extreme environments. Some mammals possess large ears richly supplied with blood vessels.

To which of the following environments would such ear adaptations be best suited?

A. strong winds
B. cold temperatures
C. high temperatures
D. humid conditions

3. There are four main types of disease: infectious, nutritional, inherited and lifestyle diseases.

Which of the following criteria is true of ALL infectious diseases and NOT true of the other disease categories?

A. Caused by a pathogenic organism
B. Inherited from our parents
C. Passed from person to person by an infective agent
D. Caused by a lack of exercise

4. Which of the following statements does NOT apply to the gene?

A. It is involved in producing a poly peptide chain
B. It is attached to a ribosome
C. It has a specific sequence of nucleotide bases
D. It is a segment of DNA

5. The picture of a prickly pear below includes fruits, "leaves" or pads developed from modified stem, and reduced leaves which have become thorns.

Which of the following is NOT an adaptation of the prickly pear for a dry environment?

A. Water storage in succulent pads
B. Vascular tissue of pads located deep in modified stem structure
C. Leaves reduced to thorns to minimise transpiration
D. Fruits attract grazers for dispersal of seed.

6. Non-cellular barriers against infection include which of the following body components?

A. phagocytes in the blood
B. mucous lining the walls of the gut and respiratory organs
C. B and T lymphocytes
D. red blood cells

The next TWO questions refer to the diagram below.

7. In rabbits, short hair (H) is dominant over long hair (h). The offspring produced from a cross between a short haired female and a long haired male were one long haired and seven short haired individuals.

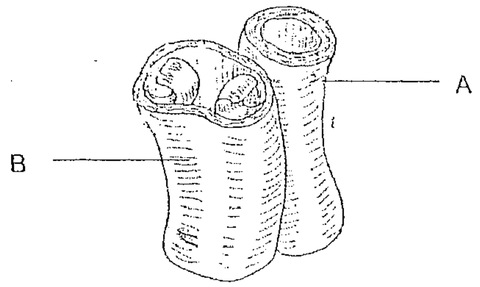
Which of the following combinations represents the genotypes of the parents?

A. Hh and Hh
B. HH and hh
C. HH and Hh
D. Hh and hh

8. All of the following factors can result in greater genetic variation in a population except

A. choosing a small number of breeding organisms
B. independent assortment of chromosomes during meiosis
C. crossing over in meiosis
D. mutations.

9. Examine the diagram of two blood vessels below.



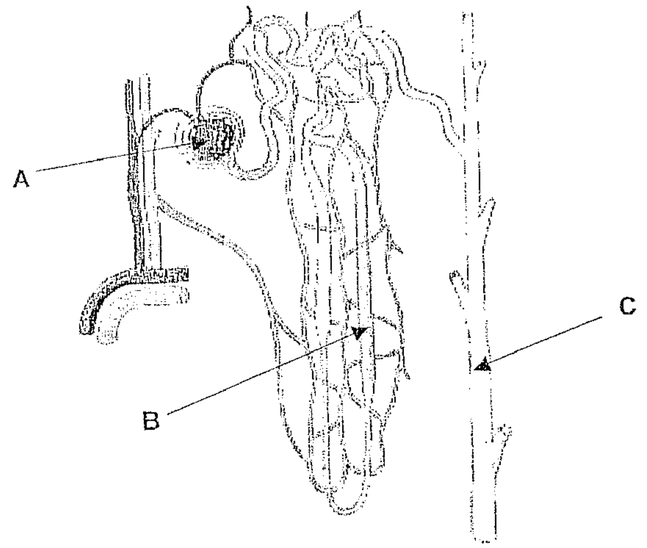
Which of the following statements below links the structure of the blood vessel A to its function?

A. valves prevent back flow to capillary beds
B. thin walls facilitate gas exchange with body cells
C. blind vessels enable one way net movement of fluid
D. thick walls recoil with energy and push blood

10. One reason burns victims are in such danger of infectious disease is because

A. they experience shock and trauma
B. pathogens are transmitted in the flames
C. their skin is damaged
D. high temperatures destroy antibodies.

The next TWO questions refer to the diagram below.



The diagram above shows the structure of a nephron within a human kidney. The table below shows an analysis of samples taken from various points (A to C) along the nephron.

Analysis of Samples of Fluids at A, B and C

Substance	A(%)	B(%)	C(%)
Water	91.50	99.00	96.00
Proteins	8.00	0.00	0.00
Urea	0.04	0.04	2.80
Glucose	0.15	0.15	0.00

11. Which of the following is the BEST explanation for the difference in glucose concentration between B and C?

A. osmosis
B. solubility of glucose molecule in water
C. blood pressure at A pushing blood contents into tubule
D. active transport

12. Which of the following is the BEST reason for the increase in urea concentration from B to C?

A. secretion of urea at C
B. water re-absorbtion at B
C. increased solubility of urea at C
D. active transport

13. The following diagram summarises base sequences on **m-RNA** and the amino acids they code for.

Second letter

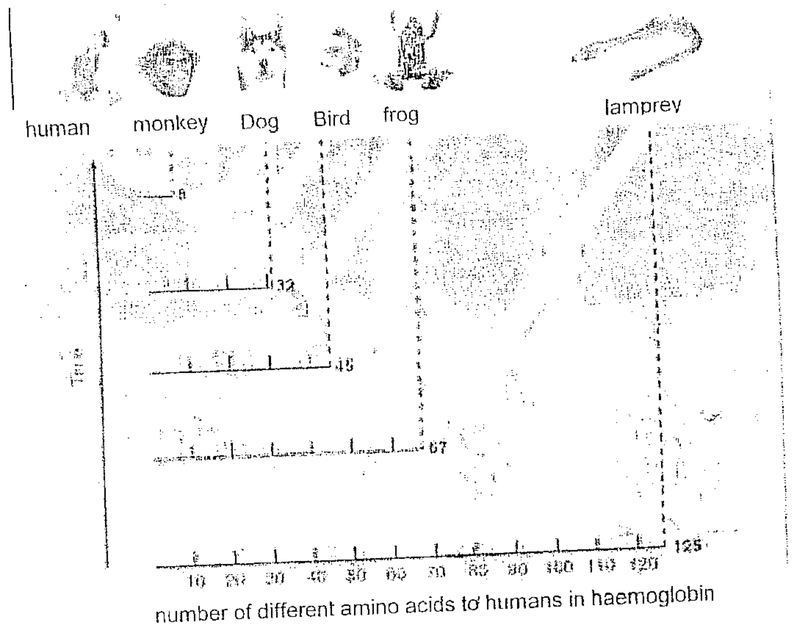
First letter		U		C		A		G	
U	UUU, UUC	Phenyl-alanine	UCU, UCC, UCA, UCG	Serine	UAU, UAC	Tyrosine	UGU, UGC	Cysteine	U
	UUA, UUG	Leucine			UAA	Stop codon	UGA	Stop codon	C
					UAG	Stop codon	UGG	Tryptophan	A
									G
C	CUU, CUC, CUA, CUG	Leucine	CCU, CCC, CCA, CCG	Proline	CAU, CAC	Histidine	CGU, CGC, CGA, CGG	Arginine	U
					CAA, CAG	Glutamine			C
									A
									G
A	AUU, AUC, AUA	Isoleucine	ACU, ACC, ACA, ACG	Threonine	AAU, AAC	Asparagine	AGU, AGC	Serine	U
	AUG	Methionine initiation codon			AAA, AAG	Lysine	AGA, AGG	Arginine	C
									A
									G
G	GUU, GUC, GUA, GUG	Valine	GCU, GCC, GCA, GCG	Alanine	GAU, GAC	Aspartic acid	GGU, GGC, GGA, GGG	Glycine	U
					GAA, GAG	Glutamic acid			C
									A
									G

Which of the following **DNA** sequences would code for the amino acid Valine?

A. GUA
B. CAU
C. CAT
D. GUT

The next two questions refer to the graph below.

The graph below reports the number of amino acid differences between human haemoglobin and that of a variety of animals. The graph also illustrates time estimates for the divergence of each animal group from a direct line of ancestors to humans.



number of different amino acids to humans in haemoglobin

14. Which organism is genetically closer to humans?

A. bird
B. frog
C. lamprey
D. monkey

15. In estimating times of divergence of groups in the graph, what is the most significant assumption which has been made?

A. Frogs were the first land vertebrates
B. Vertebrate life originated in the oceans
C. Mutation rates are constant over long time periods
D. Mammals were the last class of vertebrates to evolve.

18 Below is a graphic used in the USA in a public health campaign directed

Part B

Total marks (60)
Attempt questions 16 – 28
Allow about 1 hour and 45 minutes for this part

Show all relevant working in questions involving calculations.

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16. Distinguish between the terms

(a) homozygous and heterozygous 2

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(b) translation and transcription of DNA 2

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17. Outline ONE advantage of a named blood substitute over human blood for the purposes of transfusions. 2

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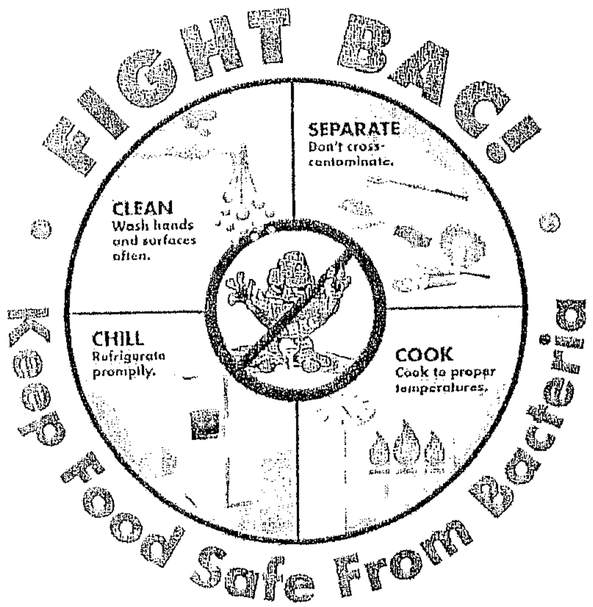
18. Below is a graphic used in the USA in a public health campaign directed at household practices for avoidance of bacterial disease.



(a) Identify a bacterial disease. 1

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(b) Justify ONE of the pieces of advice depicted in the graphic on the basis of known facts about transmission of the named bacterial disease above. 2

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(c) Assess the effectiveness of a named public health program in Australia. 2

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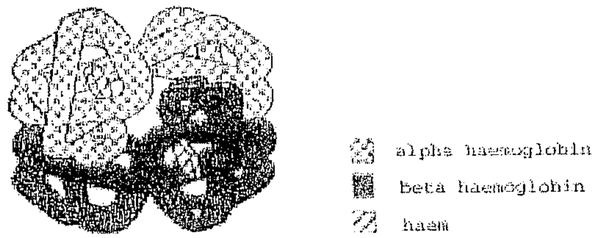
19. The diagram below depicts a haemoglobin molecule.



Explain how the nature of the haemoglobin molecule facilitates oxygen uptake into the bloodstream in the lungs and oxygen down load from the bloodstream in the tissues. 4

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20. The following is a transcript of an interview of a 50 year old male patient, Doug, suffering form a disease called Syndrome X, fatal to sufferers by middle age.

"Neither of my two older sisters have the disease, fortunately. My mother died from the disease at age 45, nursed by my elderly father who remains healthy to this day. No-one in Dad's family (his sister and brother and parents) display any evidence of the disease. Mum was an only child, both of her parents living to their early nineties."

(a) Draw a pedigree or inheritance tree to represent this data. 3
(Use a pencil.)

(b) Discuss the evidence for the nature of the gene for syndrome X, i.e dominant, recessive, sex linked etc. Justify your conclusions. 2

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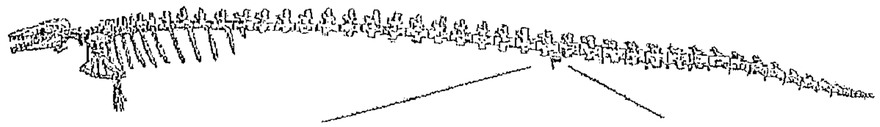
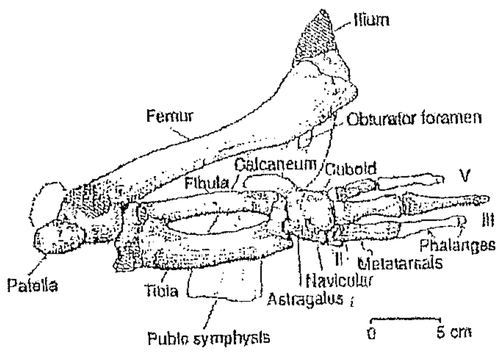
...ir...latory system facilitates

21. Palaeontologists digging in Egypt and Pakistan have recently identified extinct whales that had hind limbs.

The diagram below shows the body and hind leg bones of *Basilosaurus*, one of these ancient whales. These bones are thought to have been enclosed in a flipper appendage.

Body of
Basilosaurus





Hindlimb of a Basilosauras

These whales were fully aquatic animals that no longer used their legs to support their weight and walk.

(a) Identify two features of this fossilised leg bone that demonstrate *Basilosaurus* has common ancestors with terrestrial vertebrates. 2

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(b) Explain why common ancestry is considered evidence for evolution. 2

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22. Circular/circuitous flow in a mammalian circulatory system facilitates the operation of the third line of defence of the immune system.

Plant transport systems are not circuitous. This results in a more localised immune response.

(a) Identify TWO components of the third line of defence of the mammalian immune system. 1

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(b) Justify why a circuitous circulatory system is necessary for the functioning of this third line of defence. 2

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(c) Evaluate the description of a plant's transport system as non-circuitous. 3

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(d) Describe ONE example of a localised plant immune response you have studied. 2

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23. Modern biological science has enabled humans to alter the genetic make-up of living things. The following quote represents some of the opinion on this subject over the past two hundred years.

> *'Whoever could make two ears of corn, or two blades of grass grow upon a spot of ground where only one grew before would deserve better of mankind, and do more essential service to his country, than the whole race of politicians put together.'* **The King of Brobdingnag in Gulliver's Travels, Jonathan Swift, 1727**

(a) Describe a modern example in horticulture or agriculture which would fit Jonathon Swift's description. **1**

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(b) Compare the techniques of Jonathan Swift's time to those used today for the development of new species in horticulture or agriculture. **3**

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(d) Outline an ethical concern arising from the development of such new species. **2**

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24. Epidemiology is the study of how often diseases occur in different groups of people and why. Epidemiological information is used to plan and evaluate strategies to prevent illness and as a guide to the management of patients in whom disease has already developed.

(a) Describe TWO pieces of evidence that were used to determine the cause of a non-infectious disease you studied. **2**

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(b) Illustrate, using your non-infectious disease example, how the knowledge of the cause of a disease influences the choice of strategies for the prevention and treatment of the disease. **2**

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25. Describe three aspects of the experimental technique used by Gregor Mendel that led to his success. **3**

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26.

(a) Describe an experimental procedure you undertook to identify microbes in food or in water. **4**

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(b) Outline ONE safety precaution which was required in the procedure justifying its inclusion. **2**

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27. Rennin, an enzyme, is characteristically found in the gastric juices of the stomach of young mammals whose diet is exclusively mothers milk.

Rennin catalyses the conversion of the protein of milk, caseinogen, into paracasein, which is precipitated in the stomach as a solid (clotting).

Rennin is secreted in an inactive form, pro-rennin, which is activated by the hydrochloric acid of the gastric juice. This ensures the proteins of the stomach wall are not digested by the pro-rennin, and that protein digestion begins in the lumen of the stomach where the acidic gastric juices and milk food are located.

(a) Explain why pro-rennin has no effect on proteins like those in milk while rennin has major effects on the same substances. **2**

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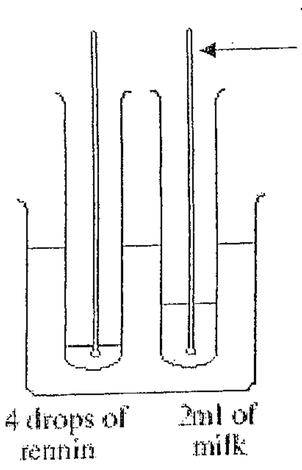
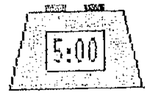
A student performs an experiments on rennin . An example of the set up of one run of her experiment is shown below.



Thermometers in both rennin and milk ensure the right temperature is achieved.

Once the desired temperature is achieved the contents of the test tubes are combined



Stopclock to measure time to a tenth of a second for greater accuracy.

Some of the students results are shown below.

Milk (mL)	Rennin (drops)	Water (drops)	Conc. Rennin %	Temp. (°C)	Time to Clot (sec)	Reaction Rate
2	4	0	100	37	40.4	0.025
2	3	1	75	37	53.4	0.019
2	2	2	50	37	290	0.003
2	1	3	25	37	3000 *	0.0003
2	0	4	0	37	infinity #	0.000

* clotting took over 50 minutes
\# no clotting was observed

(b) Deduce the aim of the experiment. 1

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(c) Identify the variables which are controlled in the experiment. 1

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Time to clot is the inverse of reaction rate i.e. the longer the time to clot the slower the reaction rate. To work out the reaction rate the student used a 1/T calculation.

(d) Identify the units for reaction rate in this case. 1

(d) On the graph paper provided over page draw a graph of rennin concentration vs reaction rate. 3

(e) Explain the shape of the graph from your knowledge of enzyme function. 2

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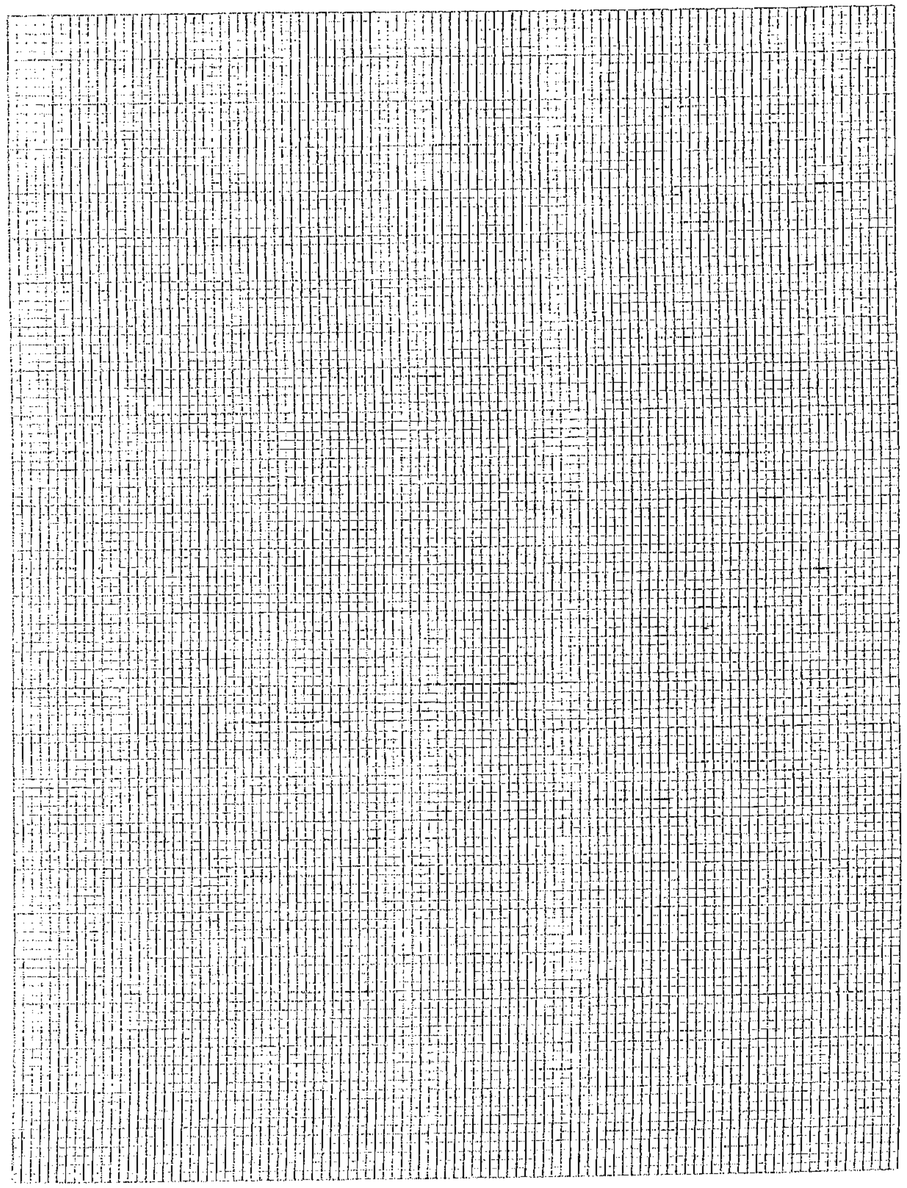
Student Number: _____



... the pituitary gland. Its role is to regulate the functioning of