Biology 12

June 1997 Provincial Examination

ANSWER KEY / SCORING GUIDE

Topics:

Core:	1.		Methods and Principles
	2.		Cells
	3.		Humans VII, VIII, IX
	4.		Humans X, XI, XII
Options: (Choose **two** of six)	5.	Option I:	Immunology
	6.	Option II:	Skeletal System and Muscles
	7.	Option III:	Reproduction and Embryology
	8.	Option IV:	Genetic Disorders and Engineering
	9.	Option V:	Cancer
	10.	Option VI:	Sensory Receptors

Part A: Multiple Choice

Q	C	T	K	S	CGR	Q	C	T	K	S	CGR

1.	U	2	D	1	III-B-1	27.	K	3	A	1	VIII-A-8
2.	K	2	A	1	III-C-2	28.	K	3	B	1	VIII-A-7
3.	H	2	A	1	III-C-3, 4; V-B-1	29.	K	3	C	1	IX-A-1
4.	K	2	D	1	III-C-7	30.	U	3	D	1	IX-A-2
5.	U	2	D	1	III-C-1, 8	31.	U	3	D	1	IX-B-2
6.	H	2	C	1	III-E-4	32.	U	3	C	1	IX-F-5
7.	U	2	B	1	III-E-1	33.	U	3	C	1	IX-F-9
8.	K	2	B	1	IV-A-1	34.	H	4	D	1	X-A-1
9.	K	2	D	1	IV-B-1	35.	U	4	D	1	X-A-11, C-1
10.	U	2	A	1	IV-A-3	36.	U	4	D	1	X-B-1
11.	H	2	B	1	V-A-1	37.	H	4	C	1	X-D-3
12.	U	2	C	1	V-A-2	38.	U	4	D	1	X-E-1
13.	H	2	D	1	V-B-5	39.	K	4	A	1	X-E-2
14.	U	2	B	1	V-C-2	40.	U	4	D	1	XI-A-1
15.	K	2	B	1	V-D-3	41.	K	4	B	1	XI-B-1
16.	U	2	B	1	V-D-3	42.	K	4	C	1	XI-C-2
17.	U	2	C	1	VI-D-1, IV-B-1	43.	K	4	A	1	XI-D-1
18.	U	2	B	1	VI-C-2	44.	U	4	B	1	XI-G-1
19.	U	2	D	1	VI-C-1	45.	U	4	B	1	XI-G-2, H-1
20.	K	2	B	1	VI-D-1	46.	K	4	C	1	XI-I-2; XII-C-1
21.	U	3	D	1	VII-1	47.	U	4	B	1	XII-C-1
22.	K	3	B	1	VIII-A-2, 3, 5	48.	U	4	B	1	XII-C-1
23.	K	3	C	1	VIII-A-5	49.	H	4	B	1	XII-C-1
24.	U	3	A	1	VIII-A-6	50.	U	4	A	1	XII-C-1
25.	H	3	C	1	III-C-9; VIII-A-7; XII-C-1	51.	U	4	A	1	XII-C-1
26.	U	3	C	1	VIII-A-2, 3, 5	52.	K	4	D	1	XII-C-1

Part B: Written Response

Q	B	C	T	S	CGR
1.	1	K	2	4	IV-B-1
2.	2	U	2	7	III-D-3, 4, 5, 6
3.	3	U	3	4	VIII-A-8
4.	4	H	3	6	IX-D-1, 2
5.	5	U	4	3	XI-H-1, I-2
6.	6	U	4	4	VIII-A-10, X-D-3, XII-C-1, E-1

Core written-response total = 28 marks

Part C: Option Section – Score only 2 out of 6 boxes (options) from box 7 to box 12.

	Q	B	C	T	S	CGR
Option I	1–3	7	U	5	10	Option I
Option II	1–3	8	U	6	10	Option II
Option III	1–3	9	U	7	10	Option III
Option IV	1–3	10	U	8	10	Option IV
Option V	1–3	11	U	9	10	Option V
Option VI	1–3	12	U	10	10	Option VI

Option Section written-response total = 20 (2 x 10)

Multiple Choice = 52 (52 questions)
Written Response = 48 (6 questions and 2 options)
Total = 100 marks

LEGEND:

Q = Question Number **C** = Cognitive Level **T** = Topic
K = Keyed Response **S** = Score **CGR** = Curriculum Guide Reference
B = Score Box Number

PART B: WRITTEN RESPONSE

Value: 28 marks **Suggested Time: 50 minutes**

INSTRUCTIONS:
1. Use a **pen** for this part of the examination.
2. Write your answers in the space below the questions.
3. Organization and planning space has been incorporated into the space allowed for answering each question.
4. You may not need all of the space provided to answer each question.

1. A cell lining the digestive system produces and secretes an enzyme into the digestive tract. State the role of the following in these processes. **(4 marks: 1 mark each)**

   Ribosome:

- **Site of enzyme synthesis.**
- **Site of polypeptide synthesis.**
- **Site of protein synthesis.**
- **Site of translation.**

any one for 1 mark

Endoplasmic reticulum:

- **Temporarily stores enzymes.**
- **Transport enzymes to the Golgi bodies.**
- **Forms vesicles.**

any one for 1 mark

Golgi body:

- **Receives enzyme from endoplasmic reticulum.**
- **Modifies enzyme (for exocytosis).**
- **"Repackages" proteins.**
- **Produces exocytotic vesicles/golgi vesicles containing the enzyme.**

any one for 1 mark

Vesicle:

- **Transports enzyme to Golgi bodies.**
- **Transports enzyme to cell membrane for secretion/exocytosis.**
- **Stores enzyme until needed.**

any one for 1 mark

2. a) Describe DNA replication. **(3 marks)**

- **Breaking of the hydrogen bonds between base pairs (unzipping).**
- **Complementary base pairing occurs.**
- **Sugar of one nucleotide joins with the phosphate of another nucleotide to form the sugar-phosphate backbone.**
- **Two identical molecules are produced.**

any three for 1 mark each

b) Why is it important that a copy of the original DNA molecule be produced? **(1 mark)**

- **To ensure genetic continuity.**
- **To ensure that each daughter cell gets an exact copy of the genetic information of the parent cell.**
- **To ensure/maintain growth and/or repair.**

any one for 1 mark

c) What is it called when one of the bases in a DNA molecule is changed? **(1 mark)**

- **Mutation.**
- **Gene mutation.**
- **Point mutation.**
- **Substitution.**
- **Addition.**
- **Deletion.**

any one for 1 mark

d) What effect might the change in c) above have on a cell? **(1 mark)**

- **Only one amino acid may be changed.**
- **There may be no change because the code is redundant.**
- **Cell may be altered structurally.**
- **Cell may be altered functionally.**

any one for 1 mark

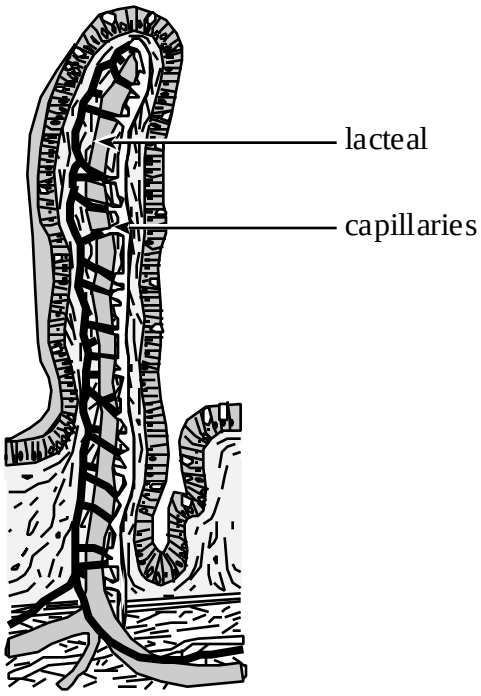
e) What could cause the change described in c) above? **(1 mark)**

- **Exposure to radiation.**
- **Exposure to chemicals.**
- **Virus.**
- **An error in replication.**
- **Heavy metals.**
- **Mutagen.**
- **Carcinogen.**

any one for 1 mark

(A wide variety of answers were accepted.)

3. a) In the space below, draw a villus. On your diagram, clearly label the capillaries and lacteal. **(3 marks)**



- **1 mark for a suitable villus shape with some structure.**
- **Labelling a lacteal with correct location ($\frac{1}{2}$ mark) and suitable shape ($\frac{1}{2}$ mark).**
- **Labelling capillaries with correct location ($\frac{1}{2}$ mark) and suitable shape ($\frac{1}{2}$ mark).**

b) Give **one** function of the villus. **(1 mark)**

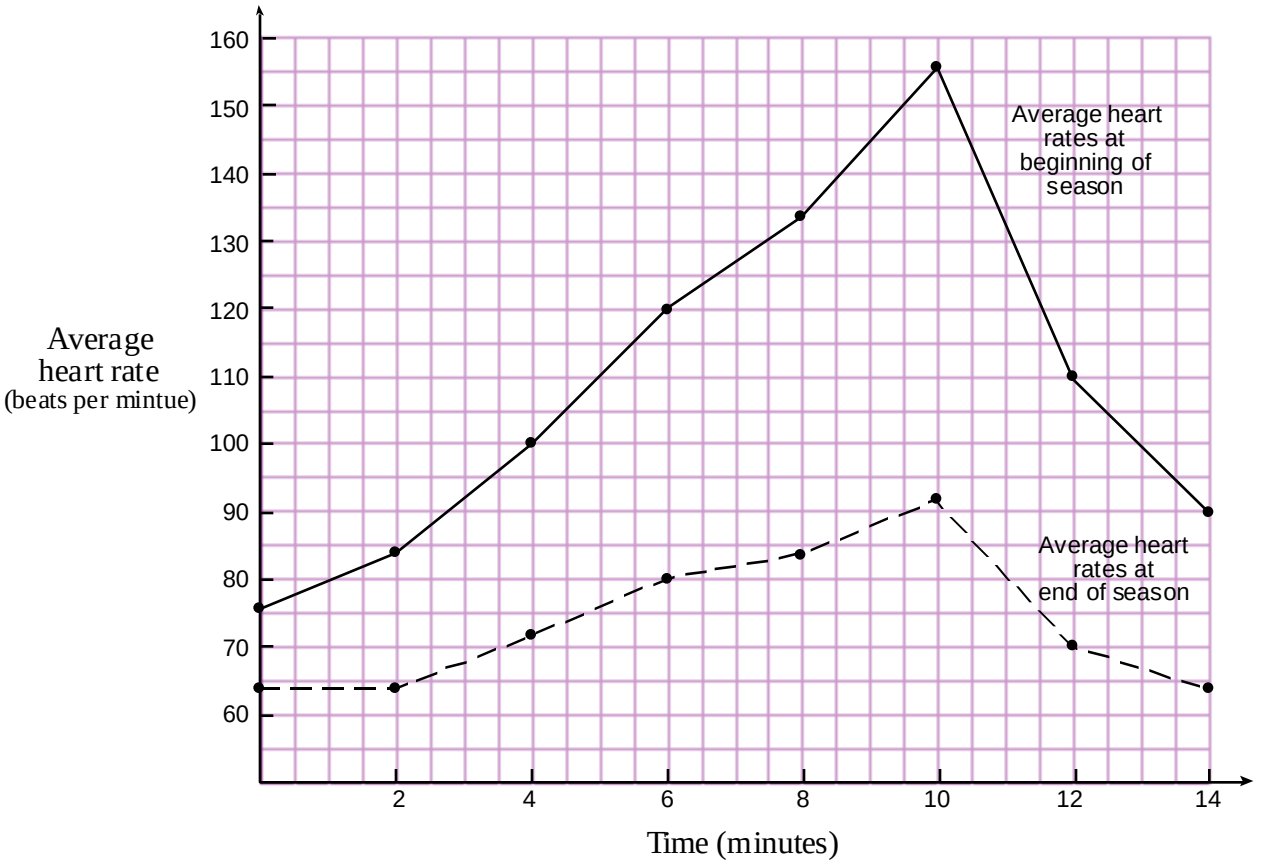
- **Increases absorptive surface area of the small intestine.**
- **Absorbs the products of digestion: glucose, fatty acids, amino acids.**
- **Produces enzymes and mucus.**
- **Site of active transport of nutrients.**

any one for 1 mark

4. The average heart rate (beats per minute) of a group of figure skaters was calculated every two minutes over a 14 minute period which included a ten minute skating exercise. Heart rates were recorded at both the beginning and end of the skating season. The results appear in the data table below.

ACTIVITY	TIME (minutes)	AVERAGE HEART RATE (beats per minute)	
		BEGINNING OF SEASON	END OF SEASON
At rest (before skating)	0	76	64
Skating	2	84	64
	4	100	72
	6	120	80
	8	134	84
	10	156	92
At rest (after skating)	12	110	70
	14	90	64

a) Construct a graph of the data given above. Use a solid line for heart rates at the beginning of the season and a broken line for heart rates at the end of the season. **(2 marks)**



b) State **two** reasons for the change in heart rate during the skating exercise.
(2 marks: 1 mark each)

- **Body muscles are working harder, therefore more oxygen is required by the muscle tissue.**
- **Increase in CO_2 stimulates medulla and heart rate.**
- **Increase in sympathetic nervous system activity.**
- **Increased rate of removal of metabolic waste.**
- **Increased H^+ ion levels in blood.**
- **Increase in rate of cellular respiration.**

any two for 1 mark each

c) Explain the difference in the time required for heart rates to return to resting levels at the beginning and at the end of the skating season. **(2 marks)**

- **The average resting heart rate at the end of the season is lower because of improved cardiovascular fitness. The heart may be hypertrophic, the blood vessels and lungs more elastic. Therefore, the circulatory system is more efficient in delivering O_2 and glucose and in removing CO_2 and lactic acid (metabolic wastes). Therefore, after exercise the heart rate returns to the resting rate more quickly. At the beginning of the season, the heart rate takes more time to return to the resting rate because the athletes have a lower level of cardiovascular fitness.**

2 marks

5. a) List **two** substances that are selectively reabsorbed at the proximal convoluted tubule of a nephron. **(1 mark: $\frac{1}{2}$ mark each)**

- **Amino acids.**
- **Glucose.**
- **Ions, e.g. sodium.**
- **Vitamins.**
- **Minerals.**
- **H_2O**

} **any two for $\frac{1}{2}$ mark each**

b) List **two** substances that are excreted at the distal convoluted tubule of a nephron. **(1 mark: $\frac{1}{2}$ mark each)**

- **Hydrogen ions.**
- **Histamine.**
- **Ammonia.**
- **Penicillin.**
- **Urea.**
- **Uric acid.**
- **Creatinine.**

} **any two for $\frac{1}{2}$ mark each**

c) What effect does increased antidiuretic hormone (ADH) have on urine production? **(1 mark)**

- **ADH decreases the amount of urine produced.**
- **Increased urine concentration.**

} **either one for 1 mark**

6. Give **one** physiological response of the body to the following situations and explain why this response occurs. **(4 marks: 2 marks each)**

Lower than normal body temperature:

- **Shivering – muscular contractions increase heat production.**
- **Goose bumps – hairs stand up and trap air close to the body which slows heat loss.**
- **Decreased blood flow to the skin – reduces heat loss from the blood to the air.**
- **Thyroxin release – increases metobolic rate.**
- **Thyroxin release – increases cell respiration.**

any one for 2 marks

Large amounts of protein in the stomach:

- **The lower portion of the stomach wall secretes gastrin – this increases the secretion of gastric juice.**
- **Increased secretions of gastric juice – this provides pepsinogen and HCl for the digestion of protein.**

any one for 2 marks

PART C: OPTION SECTION

Value: 20 marks **Suggested Time: 30 minutes**

INSTRUCTIONS:

1. Select **two** options from the six options listed below.
2. Answer **all** of the questions in each option that you select.
3. If you answer questions in more than two options, only the **first two** will be marked.
4. You may not need all of the space provided to answer each question.

OPTION I: IMMUNOLOGY

OPTION II: SKELETAL SYSTEM AND MUSCLES

OPTION III: REPRODUCTION AND EMBRYOLOGY

OPTION IV: GENETIC DISORDERS AND ENGINEERING

OPTION V: CANCER

OPTION VI: SENSORY RECEPTORS

OPTION I: IMMUNOLOGY

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6 marks)**

COLUMN A	COLUMN B	
interferon		
passive immunity	a) produces monoclonal antibodies	**hybridoma**
active immunity	b) produced by infected cells	**interferon**
hybridoma	c) causes airways to constrict	**histamine**
helper T cell	d) stimulates other cells of the immune system	**helper T cell**
histamine	e) lyses infected cells	**cytotoxic (killer T) cell**
cytotoxic (killer T) cell	f) results from circulating memory cells	**active immunity**
neutrophil		

2. Define *auto immune disease*, and give **one** example of such a disease. **(2 marks: 1 mark each)**

Definition:

- **Production of antibodies that attack an individual's own cells/tissue. (1 mark)**

Examples:

- **Multiple sclerosis.**
- **Rheumatoid arthritis.**
- **Diabetes.**
- **Lupus.**

} **any one for 1 mark**

3. Identify **two** ways that the rejection of transplanted tissue may be prevented. **(2 marks: 1 mark each)**

- **Transplanted organ and recipient should have the same type of MHC.**
- **Use of immuno-suppressive drugs such as cyclosporine.**

} **1 mark each**

OPTION II: SKELETAL SYSTEM AND MUSCLES

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6 marks)**

COLUMN A	COLUMN B	
sarcolemma		
tendon	a) found in ears and between vertebrae	**cartilage**
myofibril	b) connects bones to bones	**ligament**
ligament	c) portion of a muscle fibre with multiple sarcomeres	**myofibril**
sarcoplasmic reticulum	d) capable of breaking down ATP	**myosin**
myosin	e) cell membrane of muscle cells	**sarcolemma**
creatine phosphate	f) source of energy for contraction	**creatine phosphate**
cartilage		

2. Name **two** types of joints and give **one** example of each. **(2 marks)**

Name: **Immovable joint.**
Example: **Bones of the skull.**

Name: **Slightly movable joint.**
Example: **Between vertebrae.**

Name: **Movable synovial joint or hinge joint.**
Example: **Knee, elbow.**

Name: **Fibrous joint.**
Example: **Skull.**

Name: **Cartilaginous joint.**
Example: **Vertebrae.**

Name: **Ball and socket joint.**
Example: **Shoulder, hip.**

any two pairs for 1 mark each
($\frac{1}{2}$ mark for name; $\frac{1}{2}$ mark for example)

3. State **two** differences between smooth muscle and skeletal muscle. **(2 marks)**

	Smooth Muscle	Skeletal Muscle
i)	**non-striated**	**striated**
ii)	**involuntary**	**voluntary**

OPTION III: REPRODUCTION AND EMBRYOLOGY

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6 marks)**

COLUMN A	COLUMN B	
acrosome		
corpus luteum	a) a hollow ball of cells	**blastula**
follicle	b) site of embryonic development	**uterus**
blastula	c) initial stage of cellular differentiation in embryo	**neurula**
neurula	d) produces progesterone	**corpus luteum**
uterus	e) contains enzymes that dissolve the membrane of the egg	**acrosome**
epididymis	f) site where sperm mature	**epididymis**
seminiferous tubules		

2. Give **two** functions of seminal fluid. **(2 marks: 1 mark each)**

- **Supplies fructose (or glucose or sugar) for sperm.**
- **The fluid is basic and helps to neutralize acidity of the vagina.**
- **Provide a medium for locomotion.**
- **Provides energy for sperm.**
- **Provides lubrication.**

} **any two for 1 mark each**

3. a) What gland is the source of luteinizing hormone (LH)? **(1 mark)**

- **The anterior pituitary gland. (1 mark)**

b) What is the function of luteinizing hormone (LH) during the last half of the ovarian cycle (days 15 to 28)? **(1 mark)**

- **Promotes the development of the corpus luteum.**
- **Maintains the corpus luteum.**
- **Triggers ovulation.**
- **Stimulates release of progesterone.**
- **Stimulates release of estrogen.**

any one for 1 mark

OPTION IV: GENETIC DISORDERS AND ENGINEERING

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6 marks)**

COLUMN A	COLUMN B	
DNA probe		
protoplast	a) used to "cut up" DNA molecules	**restriction enzyme**
plasmid	b) enzyme that joins pieces of DNA	**ligase**
recombinant DNA	c) a circular segment of DNA	**plasmid**
ligase	d) used to obtain fetal cells	**amniocentesis**
restriction enzyme	e) a plant cell with wall removed	**protoplast**
amniocentesis	f) results from a change in the genetic makeup of the cell	**recombinant DNA or transformation**
transformation		

2. List **two** characteristics of a person with Down's Syndrome. **(2 marks: 1 mark each)**

- **Trisomy (chromosome 21).**
- **Short and stocky.**
- **Mental retardation.**
- **Enlarged tongue.**
- **Fold of upper eyelid.**
- **Round head.**
- **Stubby fingers.**
- **Small mouth.**
- **Underdeveloped sex organs.**
- **Sterile.**
- **Low ears.**
- **Small eyes.**
- **Palm crease (simian line).**
- **Bull neck.**
- **Heart problems.**
- **Generally happy.**
- **Mental retardation.**
- **Low life expectancy.**
- **Wide gap between first and second toes.**

any two for 1 mark each

3. State **one** function of each of the following in mitosis. **(2 marks: 1 mark each)**

Spindle fibres:

- **Pull chromatids to poles.**
- **Keeps chromatids properly aligned.**

} **either one for 1 mark**

Centromeres:

- **Allow attachment of the spindle fibres to chromosomes.**
- **Hold the chromatids together.**

} **either one for 1 mark**

OPTION V: CANCER

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6 marks)**

COLUMN A	COLUMN B	
neoplasia		
vascularization	a) a tumor that does not spread	**benign**
contact inhibition	b) consumes cancerous cells	**macrophage**
benign	c) capable of making DNA from RNA	**retrovirus**
malignant	d) increased development of blood vessels	**vascularization**
oncogene	e) new growth of cancer cells	**neoplasia**
retrovirus	f) characteristic of non-cancerous cells	**contact inhibition**
macrophage		

2. What is the role of the following in the development of cancer?

Initiator: **(1 mark)**

- **Alters the DNA of a cell.**
- **Causes conversion of a proto-oncogene into an oncogene.**
- **Causes mutations.**

} **any one for 1 mark**

Promoter: **(1 mark)**

- **Speeds the effects of the initiator, causing cells to multiply, which in turn creates a tumor. (1 mark)**

3. Give **two** danger signals that may indicate the presence of cancer. **(2 marks: 1 mark each)**

- **Unusual bleeding.**
- **A lump.**
- **A sore that does not heal.**
- **Change in bowel or bladder habits.**
- **Persistent hoarseness or cough.**
- **Persistent indigestion.**
- **Change in size or colour of a wart or a mole.**

any two for 1 mark each

(A wide variety of answers were accepted.)

OPTION VI: SENSORY RECEPTORS

1. Select a term from column **A** that matches its description given in column **B**. Write the term in the blank beside each description. Each term may be used **only** once, and not all the terms will be used. **(6 marks)**

COLUMN A	COLUMN B	
chemoreceptor		
cone	a) generates impulses that give sense of hearing	**Organ of Corti**
Organ of Corti	b) senses the body's position	**proprioceptor**
rod	c) responsible for olfactory detection	**chemoreceptor**
fovea	d) light sensitive cell responsible for colour vision	**cone**
proprioceptor	e) area of most acute vision	**fovea**
oval window	f) absorbs sound waves from the stirrup	**oval window**
round window		

2. When viewing a close-up object, the ciliary muscles contract, ligaments relax and the lens becomes round. What is this process called? **(1 mark)**

- **Accommodation. (1 mark)**

3. a) Name **two** parts of the ear which are involved in maintaining balance. **(2 marks)**

- **Vestibule.**
- **Utricle.**
- **Saccule.**
- **Semi-circular canals.**
- **Otoliths.**

any two for 1 mark each

b) Choose **one** of the parts in 3a) above and describe briefly how it functions. **(1 mark)**

Vestibule:	**Contains utricle which contains otoliths which bend cilia which produce nerve impulses.** **or** **Contains saccule which contains otoliths which bend cilia which produce nerve impulses.**	**any one for 1 mark**
Utricle:	**Contains otoliths which bend cilia which produce nerve impulses.**	
Saccule:	**As above.**	
Semi-circular canals:	**Fluid in these canals moves about. As we move, this causes the cilia of the hair cells to bend. Nerve impulses are sent to the brain. The brain determines orientation of the body.**	
Otoliths:	**Ear stones which move as head shifts. Their movement (in a gel) is sensed by hair cells which bud accordingly.**	

END OF KEY