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## FORM 4 ENTRANCE EXAMS 2024

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Name .....ADM.NO.....

Candidate's Sign .....

Date .....

**231/2**

**Biology Paper 2(Theory)**

**Time: 2 Hours**

### **Kenya Certificate of Secondary Education**

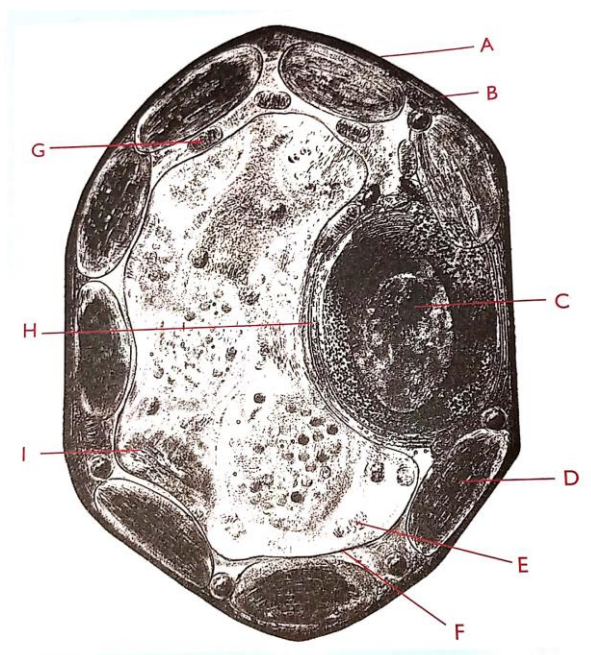
- Write your name, Index Number in the spaces provided above
- Write the date of examination in the space provided above
- Answer ALL the questions in section A in the spaces provided below each question in the question paper
- In section B, answer question 6(Compulsory) and either question 7 or 8

#### **FOR EXAMINER'S USE ONLY**

<b>Section</b>	<b>Question</b>	<b>Maximum Score</b>	<b>Candidate's Score</b>
<b>A</b>	<b>1</b>	<b>08</b>	
	<b>2</b>	<b>08</b>	
	<b>3</b>	<b>08</b>	
	<b>4</b>	<b>08</b>	

	<b>5</b>	<b>08</b>	
<b>B</b>	<b>6</b>	<b>20</b>	
	<b>7 or 8</b>	<b>20</b>	
	<b>TOTAL</b>	<b>80</b>	

1. The diagram shown below is a plant cell as seen when observed under an electron microscope at high power. Study it carefully and use it to answer the questions that follow.



(a) Name the parts labeled A, C and H. (3 marks)

A.....

C.....

H.....

(b) State the function of the parts labeled D and G. (2 marks)

D.....

.....

G.....

.....

(c) Give two differences between the structures labeled D and G. (2 marks)

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.....  
.....

(d) Based on observable features, suggest the main function the cell shown. (1 mark)

.....

2. Study the table below and then answer the questions that follow.

Name of disease	Causative agent	Age when vaccine is administered	Method of vaccination
Tuberculosis	Bacterium	At birth	Injection
Poliomyelitis	Virus	At birth, after 6 weeks, after 10 weeks, after 14 weeks	Oral inoculation
Whooping cough	Bacterium	6 <sup>th</sup> and 14 <sup>th</sup> week	Injection
measles	Virus	9 <sup>th</sup> month	Injection

(a)What part of the human body is affected by the virus that causes poliomyelitis? 1mk

.....

(b)Give a reason why some doses of vaccine are given more than once. 1mk

.....

(c) Suggest a reason for delay in vaccinating against measles until the 9<sup>th</sup> month(1 mark)

.....

(d) Describe immune response. (2 marks)

.....  
.....

(e) What is a vaccine? (1 mark)

.....

(f) What is the role of vaccination in providing immunity? (1 mark)

.....

(g) What triggers an allergic reaction? (1 mark)

.....

3.(a)State **three** limitations of using a quadrat to estimate the population of organisms.(3mks)

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.....  
.....  
b) In an attempt to estimate the number of grasshoppers in the field, a student captured 435 marked and released. Three days later, 620 were captured 75 of which were marked.

(i) What is the name of the sampling method describe above? (1 mark)

.....

(ii) Calculate the approximate population size of the grasshoppers in the field(2 marks).

(iii) What are the disadvantages of this method? (2 marks)

.....  
.....

4. Study the photograph below and answer the questions that follow



(a) Name the parts labelled A and B and state its functions. (2 marks)

.....  
.....

(b) Identify the mode of feeding of the organism. (1 mark)

.....

(c) (i) Name the tooth labelled S. (1 mark)

.....

(ii) State how the tooth named in (c) (i) above is adapted to its function.(2 marks)

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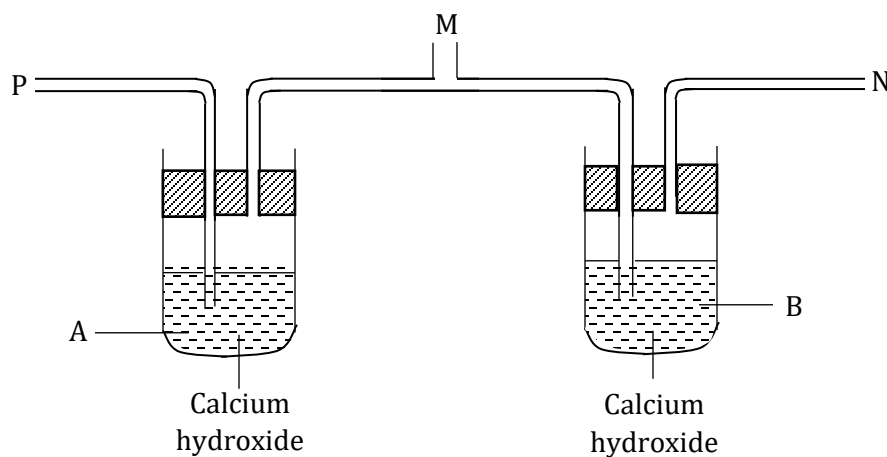
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(d)Distinguish between competitive and non-competitive enzyme inhibitors.(2 marks)

.....

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5.A student set up an experiment to investigate some aspect of gaseous exchange using the apparatus represented below.



The student placed the mouth at the M and breathed in out several times through the tube.

(a) Using arrows show the direction of air movement along tube P and N on the diagram during the experiment. (1 mark)

(b) Suggest a possible aim of this experiment. (2 marks)

.....

(c)What results were expected after breathing in and out through tube M several times?3mks

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(d) What characteristics do mammalian lungs and the gills of bony fish have in common that enables them to exchange gases efficiently? (2mks)

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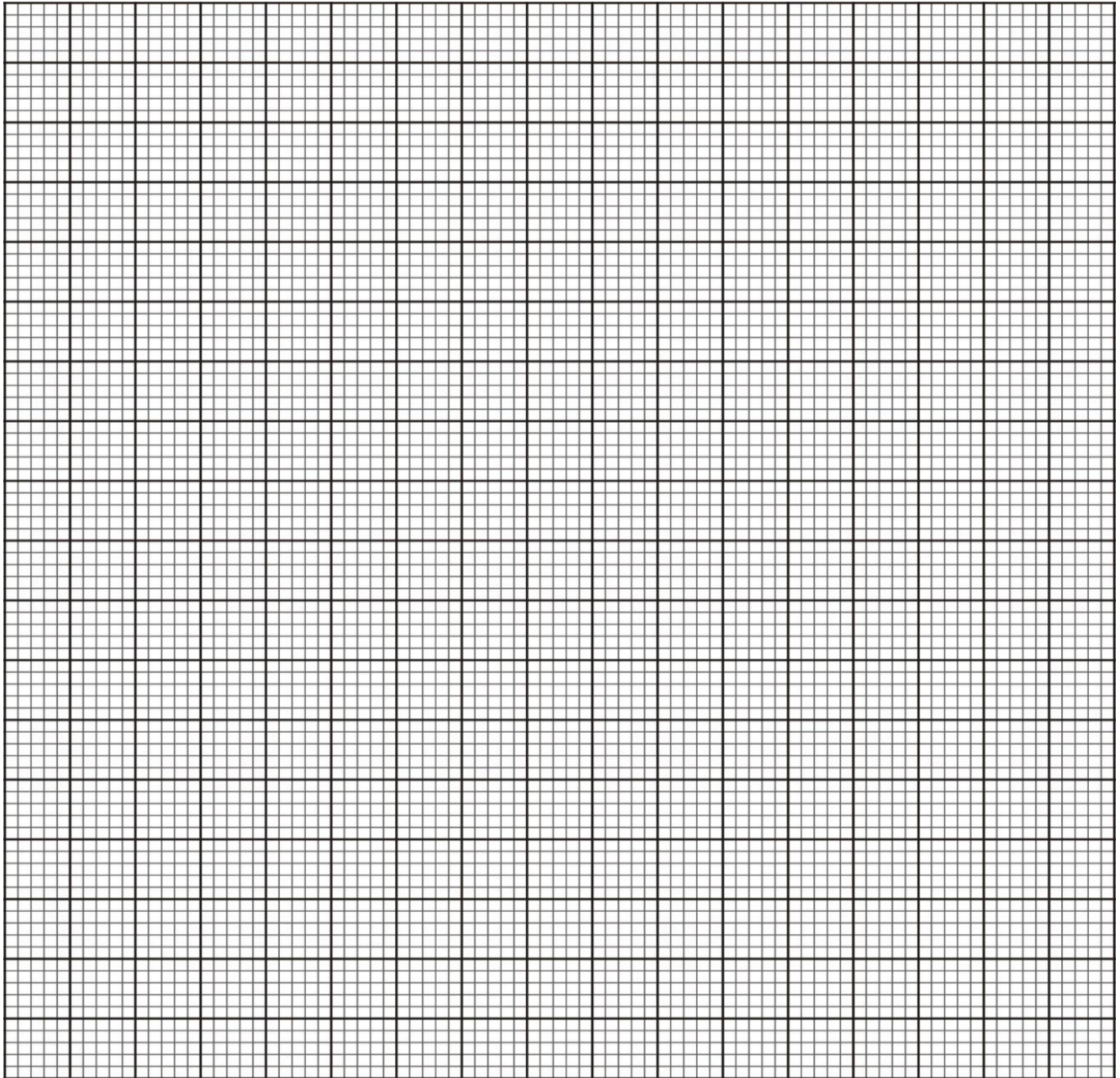
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**Answer questions 6 (compulsory) in the spaces provided and either question 7 or 8 in the spaces provided after question 8.**

6.The table below shows the concentration of lactic acid in  $\text{mg}/100\text{cm}^3$  in the human blood during and after exercise

Time (seconds)	0	5	10	15	20	25	30	35	40	45	50	55
Lactic acid concentration ( $\text{mg}/100\text{cm}^3$ )	22	25	45	90	86	85	84	60	44	25	22	22

(a)Using the readings in the table ,plot a graph of lactic acid concentration against time [6marks]



b) From the graph determine the duration of vigorous exercise [1 mark]

.....

c) Write an equation leading to the production of lactic acid in humans [1 mark]

.....

d) i) Suggest the normal concentration of lactic acid in the blood when the person was resting [1 mark]

.....

ii) What is the effect of lactic acid on the body tissues when its concentration rises above 90mg/100cm<sup>3</sup> [1mark]

.....

iii) Give three ways in which the body adjusts to the high concentration of lactic acid [3marks]

.....

.....

.....

e)From the graph determine the time when oxygen debt

i)        Occurred [1mark]

.....

ii)       Began to be paid in the person's body [1mark]

.....

f)List three differences between aerobic and anaerobic respiration in animals [3marks]

.....

.....

.....

.....

g)Name the product of anaerobic respiration that is essential in: [2marks]

I ) The brewing industry .....

II) The bread making industry .....

7(a)Describe the process of fertilisation in Angiosperms. (15 mks)

(b) State the changes that take place in a flower after fertilization.

8.Describe how the mammalian skin is adapted to its functions. (20 mks)

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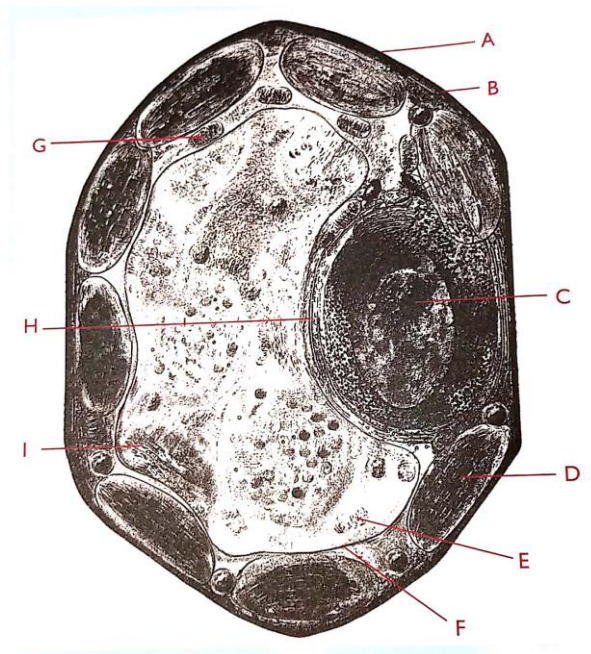
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## FORM 4 ENTRANCE EXAMS 2024

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1. The diagram shown below is a plant cell as seen when observed under an electron microscope at high power. Study it carefully and use it to answer the questions that follow.



(a) Name the parts labeled A, C and H. (3 marks)

A-Cell wall

C-Nucleus

H-Rough endoplasmic reticulum

(b) State the function of the parts labeled D and G. (2 marks)

D...site for photosynthesis

G...site for respiration

(c) Give two differences between the structures labeled D and G. (2 marks)

D	G
Has stroma	Has matrix

Greatly folded into granum	Greatly folded into cristae
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(d) Based on observable features, suggest the main function the cell shown. (1 mark)

Photosynthesis.

2. Study the table below and then answer the questions that follow.

Name of disease	Causative agent	Age when vaccine is administered	Method of vaccination
Tuberculosis	Bacterium	At birth	Injection
Poliomyelitis	Virus	At birth, after 6 weeks, after 10 weeks, after 14 weeks	Oral inoculation
Whooping cough	Bacterium	6 <sup>th</sup> and 14 <sup>th</sup> week	Injection
measles	Virus	9 <sup>th</sup> month	Injection

(a) What part of the human body is affected by the virus that causes poliomyelitis? 1mk

Joint/muscles

(b) Give a reason why some doses of vaccine are given more than once. 1mk

To boost previous vaccinations.

(c) Suggest a reason for delay in vaccinating against measles until the 9<sup>th</sup> month (1 mark)

Some immunity is naturally passed from mother through colostrum/placenta.

(d) Describe immune response. (2 marks)

Reaction of the body as a result of antigens/pathogen; it involves production of antibodies/leucocytes which combine with antigens.

(e) What is a vaccine? (1 mark)

A substance rich in weakened antigens.

(f) What is the role of vaccination in providing immunity? (1 mark)

Stimulates the body system to produce antibodies in response to pathogens.

(g) What triggers an allergic reaction? (1 mark)

Allergens. e.g. named examples e.g. pollen grains/dust/fur

3.(a)State **three** limitations of using a quadrat to estimate the population of organisms.(3mks)

Cannot be used for most animals and plants;Assumes that organisms are evenly distributed;Usually inaccurate due to underestimation or overestimation.

(b)In an attempt to estimate the number of grasshoppers in the field, a student captured 435 marked and released. Three days later, 620 were captured 75 of which were marked.

(i) What is the name of the sampling method describe above? (1 mark)

Capture-Recapture method.

(ii) Calculate the approximate population size of the grasshoppers in the field(2 marks).

First marked X second capture

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Marked recaptured

620 X435

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75

3596 Grasshoppers.

(iii) What are the disadvantages of this method? (2 marks)

Some grasshoppers may die during capture;The mark may fade off;mark may expose grasshoppers to predation;migration

4.Study the photograph below and answer the questions that follow.

(a) Name the parts labelled A and B and state its functions. (2 marks)

A-Diastema;provides space for manipulation of food by the tongue so as to separate the newly cut vegetation from that which is being chewed.

B-Horny pad;This is where grass is pressed against and cut by the lower incisors.

(b) Identify the mode of feeding of the organism. (1 mark)

Herbivorous

(c) (i) Name the tooth labelled S. (1 mark)

Molar

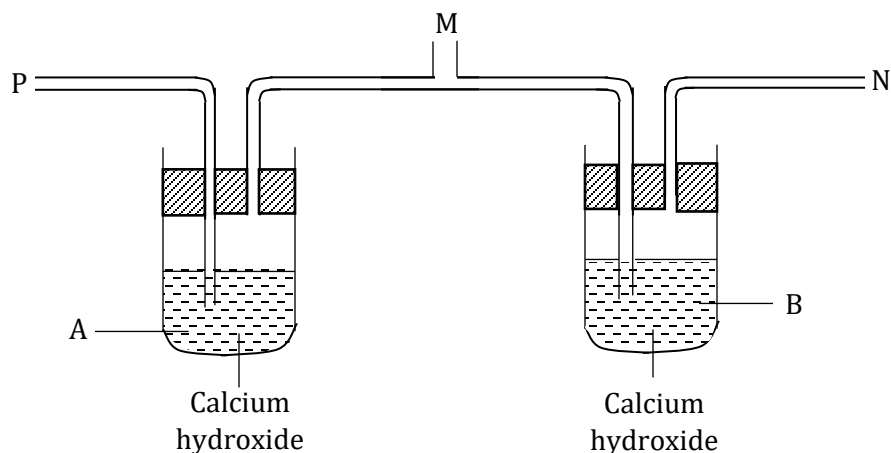
(ii) State how the tooth named in (c) (i) above is adapted to its function.(2 marks)

Has wider crown for crushing and grinding of food;has cusps for grinding food;root branched to hold tooth firmly on jaw.

(d)Distinguish between competitive and non-competitive enzyme inhibitors.(2 marks)

Competitive	Non-competitive
Combines temporarily to the active site of the enzyme	Combines permanently on the active site of the enzyme
Resembles the substrate	Do not resemble the substrate

5.A student set up an experiment to investigate some aspect of gaseous exchange using the apparatus represented below.



The student placed the mouth at the M and breathed in out several times through the tube.

- (a) Using arrows show the direction of air movement along tube P and N on the diagram during the experiment. (1 mark)
- (b) Suggest a possible aim of this experiment. (2 marks)

To compare the carbon(IV)oxide concentration in inhaled and exhaled air.

(c)What results were expected after breathing in and out through tube M several times?3mks

The calcium hydroxide in B had more white precipitate than the calcium hydroxide in A.This was because exhaled air with more carbon(IV)oxide in it was bubbled through B;Atmospheric air with less carbon(IV)oxide was bubbled through A hence less precipitate.

- (d) What characteristics do mammalian lungs and the gills of bony fish have in common that enables them to exchange gases efficiently? (2 marks)

Both are richly supplied with blood capillaries for steep diffusion gradient; comprises of alveoli and lamellae in gills having a thin epithelial lining for faster diffusion of gases.

6. The table below shows the concentration of lactic acid in  $\text{mg}/100\text{cm}^3$  in the human blood during and after exercise

Time (seconds)	0	5	10	15	20	25	30	35	40	45	50	55
Lactic acid concentration ( $\text{mg}/100\text{cm}^3$ )	22	25	45	90	86	85	84	60	44	25	22	22

- a) Using the readings in the table, plot a graph of lactic acid concentration against time [6marks]

***Axes : 1x2= 2marks***

***Scale : 1x2 =2marks***

***Plotting : 1mark***

***Smooth curve : 1mark***

- b) From the graph determine the duration of vigorous exercise [1mark]

***10-15 seconds***

- c) Write an equation leading to the production of lactic acid in humans [1mark]

***Glucose***  $\longrightarrow$  ***lactic acid + energy (150kj/mole)***

- d) i) Suggest the normal concentration of lactic acid in the blood when the person was resting [1mark]

***22mg/100cm<sup>3</sup> of blood***

- ii) What is the effect of lactic acid on the body tissues when its concentration rises above  $90\text{mg}/100\text{cm}^3$  [1mark]

***Blood will rise resulting into fatigue,muscle pain;cramps***

iii) Give three ways in which the body adjusts to the high concentration of lactic acid  
[3marks]

***Ventilation rate increases***

***Breathing rate deepens***

***The heart pumps vigorously and blood circulation rate increases***

e) From the graph determine the time when oxygen debt

iii) Occurred [1mark]

***Between 0-15 Seconds***

iv) Began to be paid in the person's body [1mark]

***Between 15 – 50 seconds***

f) List three differences between aerobic and anaerobic respiration in animals [3marks]

<b><i>Aerobic</i></b>	<b><i>Anaerobic</i></b>
<b><i>Occurs in mitochondrial matrix</i></b>	<b><i>Occurs in the cell cytoplasm</i></b>
<b><i>Dependent on oxygen gas</i></b>	<b><i>Independent of oxygen gas</i></b>
<b><i>Substrate breakdown is complete</i></b>	<b><i>Substrate breakdown is incomplete</i></b>
<b><i>Products are harmless to the cells</i></b>	<b><i>Products are toxic to the cells</i></b>
<b><i>Products formed include carbon(IV)oxide, energy and water</i></b>	<b><i>Products formed are lactic acid and energy</i></b>

g) Name the product of anaerobic respiration that is essential in: [2marks]

I ) The brewing industry

***Ethanol***

II) The bread making industry

***Carbon (iv) oxide gas***

7. After pollination ,the pollen grains land onto the stigma and adhere to it as a result of the stigma cells secreting a sticky substance.It absorbs nutrients and germinates forming a pollen tube which grows down the style to the ovary, deriving nourishment from surrounding tissue. The pollen tube has tube nucleus at the tip and generative nucleus immediately behind it .As the tube grows downwards into the ovary the generative nucleus divides by mitosis/mitotically, to give rise to two male nuclei which represent the male gamete. The pollen tube penetrates the ovule/embryo sac/chalaza through micropyle. After the pollen tube enters the embryosac the tube nucleus breaks down /disintegrates/degenerates, leaving a clear passage for the entry of the male nuclei. The two male nuclei then enter into the embryo sac, where one fuses with the



egg cell nucleus to form a diploid zygote which develop into an embryo. The other male nuclei fuse with the two polar nuclei to form triploid nucleus/primary endosperm nucleus which becomes the endosperm.

b) i) Diploid zygote undergoes mitosis to form embryo, that later differentiates into radical, plumule and cotyledons.

ii) Triploid nuclei develop to become primary endosperm nucleus which then becomes the endosperm. Integuments develop to become the testa or seed coat.

iii) Micropyle persists as small hole in the testa through which water and oxygen imbibe during germination.

iv) Ovary becomes the fruit while ovary wall becomes the pericarp that later differentiates into epicarp, mesocarp and endocarp.

v) Ovules become the seeds, floral parts wither and die.

## 8. ADAPTATION OF SKIN TO ITS FUNCTION

The skin is made of epidermis and dermis. The epidermis is made up of three layers. The outermost layer is known as the cornified layer; made up of dead cells that protect against mechanical damage/ desiccation/ microbes; the granular layer; is made up of living cells that give rise to the cornified layer, the malpighian layer; contain actively dividing cells that rise to new epidermal cells, that contain melanin that protects the skin against ultra violet rays.

The dermis has several components; has sweat glands that produce sweat; sweat evaporates (carrying it with latent heat of vaporization) thus reducing the body temperature; under cold conditions little/ no sweat is produced thus heat is conserved; the sweat contains water/ sodium chloride/ uric acid/ urea; the skin is an excretory organ. Has hair, the hair stands erect to trap air when temperature is low to reduce heat loss/ lies flat to allow heat loss when the temperature is high. Has nerve endings, which are sensitive to stimuli/ such as heat/ cold/ pain/ pressure/ touch. Has subcutaneous fats/ adipose tissue, that insulate the body against heat loss. Has arteriole; that vasodilate when temperature is high to lose heat by radiation/ convection ( see converse); blood vessels/ capillaries for arterioles to supply food/ nutrients/ oxygen/ remove excretory products. Has sebaceous gland; which secrete sebum, an antiseptic/ water repellent/ that prevent drying/ cracking of skin/ skin suppleness (MAX 20MKS)