

Nama : Nombor Kad Pengenalan:

964/1



OTI 2 STPM
2010

JABATAN PELAJARAN NEGERI TERENGGANU

BIOLOGY
PAPER 1
MULTIPLE-CHOICE
One hour and Forty five minutes

Instructions to candidates :

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

There are **fifty** questions in this paper. For each question, four suggested answers are given. Choose **one** correct answer and indicate it on the multiple-choice answer sheet provided.

Read the instructions on the multiple-choice answer sheet very carefully.

Answer **all** questions.

TERENGGANU ANJUNG ILMU

Disediakan oleh:
AKRAM NEGERI TERENGGANU

Dibiayai oleh:
KERAJAAN NEGERI TERENGGANU

Dicetak oleh:
Percetakan Yayasan Islam Terengganu Sdn. Bhd.
Tel: 609-666 8611/6652/8601. Faks: 609-666 0611/0063

This question paper consists of 16 printed pages and 1 blank page.

1 Which term describes the organism that obtains its nourishment from another living host?

- A Parasite
- B Saprotroph
- C Photoautotroph
- D Chemoautotroph

2. Table below shows four groups of organisms and their modes of nutrition. Which of the following is **not** a correct match?

	Organisms	Mode of nutrition
A	Barnacle attaches to the body of the whale	Commensalism
B	The tick bird and rhinoceros	Mutualisme
C	Ferns growing on trees	Parasitism
D	Mycelium of Rhizopus growing on bread	Saprotrophism

3 Which is an example of a negative feedback in the human body?

- A Blood clotting
- B Osmoregulation
- C Depolarisation of neurone
- D Production of oxytocin during labour

4 What is the main function of ornithine cycle?

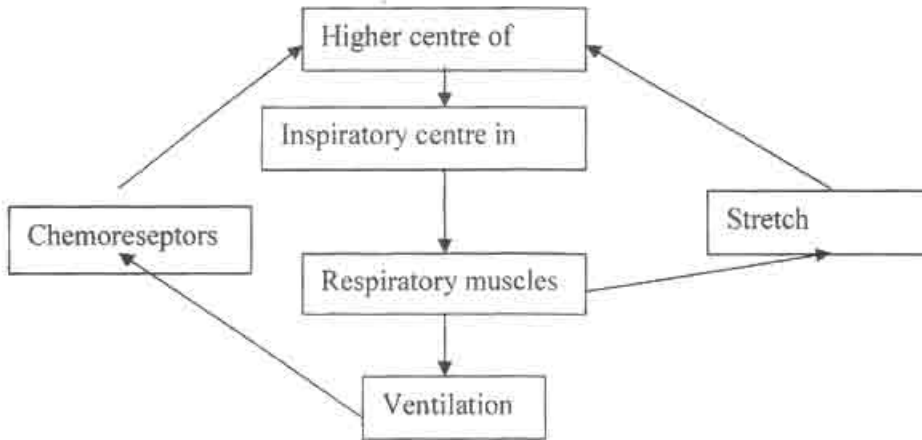
- A Deamination
- B Produce bile
- C Produce urea
- D Regulate lipids

5 Which of these factors do **not** affect the speed of impulse transmission along axon?

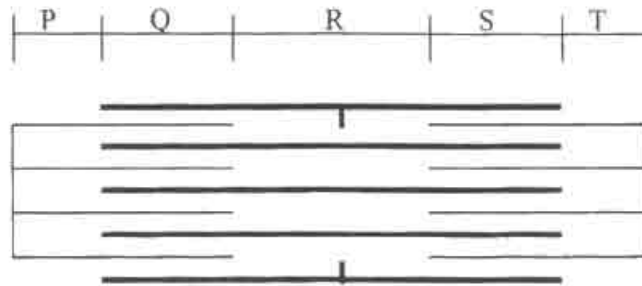
- I Diameter of axon
- II Presence of myelin sheaths
- III High number of dendrites
- IV Presence of nodes of Ranvier

- A II only
- B III only
- C I, III and IV
- D I, II, III and IV

- 6 Diagram below represents the control of breathing.
Which of the following terms best describes the control mechanism?

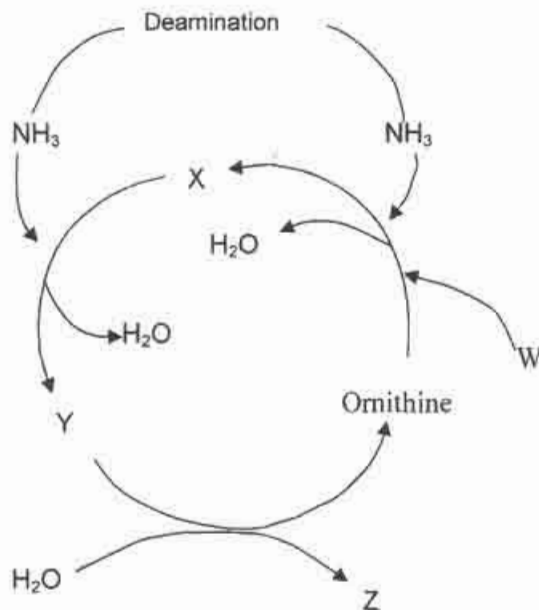


- A Reflex arc
 B Positive feedback
 C Negative feedback
 D Involuntary control
- 7 The diagram below shows the structure of a sarcomere.



- Which of the following statement is not true?
- A I band consist of P and T
 B A band consist of Q, R and S
 C Total length of Q, R and S shortens during muscle contraction
 D Total length of P and T decreases during muscle contraction

8 Diagram below shows the ornithine cycle.

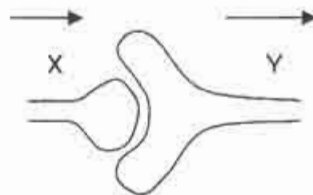


What substances do W, X, Y and Z represent?

	W	X	Y	Z
A	Urea	CO ₂	Citrulline	Arginine
B	Urea	Citrulline	Arginine	CO ₂
C	CO ₂	Arginine	Citrulline	Urea
D	CO ₂	Citrulline	Arginine	Urea

9

Diagram below represents the synapse between two mammalian myelinated neurons, X and Y. The arrows show the directions of impulses.



How the transmission of the impulses across the synapse occur?

- A By secretion of a chemical from X
- B By the release of sodium ions from X.
- C By passage of an electric current between
- D By break-down of the terminal membrane of X

10 Below are the functions of a plant hormone

- i Prevents lateral branching
- ii Ignites parthenocarpic
- iii Stimulates secondary growth
- iv Stimulates ripening of fruit

Which hormone carries out all the functions?

- A Auxin
- B Ethene
- C Cythokinin
- D Gibberellin

11 Table below shows the hormones and their roles during pregnancy

	Hormones		Roles
(a)	Human chorionic gonadotrophin (HCG)	(I)	Prevents the degeneration of corpus luteum
(b)	Oxytocin	(II)	Relaxes the elastin fibres that join the bones of the pelvic girdle
(c)	Prolactin	(III)	Stimulates rhythmic contraction of uterus during birth
(d)	Relaxin	(IV)	Stimulates milk production and secretion

Which of the following is the correct match ?

	(a)	(b)	(c)	(d)
A	I	II	IV	III
B	I	III	IV	II
C	IV	I	III	II
D	III	IV	I	II

12 Which of the following statements about phytochromes are **true**?

- I P_R is converted to P_{FR} by absorbing red light
 - II P_{FR} is converted to P_R slowly at night.
 - III Phytochromes are conjugated proteins
 - IV P_R activates or inhibits the stimulation of florigen in plants
- A II, III and IV
B I, III and IV
C I, II, III, and IV
D I, II, and III

13 Which of the following is/are the function/s of the follicular stimulating hormone?

- I Stimulates the development of uterus wall.
 - II Stimulates the development and maturation of follicle.
 - III Stimulates the ovary to excrete oestrogen.
 - IV Stimulates ovulation
- A I only
B II and III
C II and IV
D III and IV

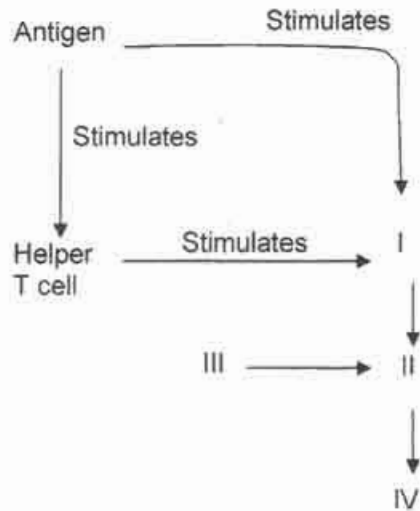
14 The following events occur during the infection of HIV.

- I DNA virus combines with DNA of T4 cell
- II RNA virus and reverse transcriptase are released
- III Virus protein attaches to the protein on T4 cell surface
- IV Virus replication occurs in T4 cell
- V RNA virus forms DNA

Which of the following events is the **correct** sequence?

- A III, II, V, I, IV
B II, I, V, IV, I
C III, I, II, V, IV
D IV, III, II, I, V

- 15 Diagram below shows the humoral reaction scheme in the formation of immunity.



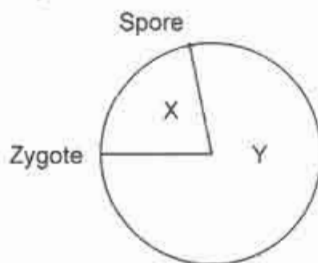
What are the components represented by I, II, III and IV in the scheme above?

	I	II	III	IV
A	Plasma cell	B cell	Memory cell	Antibody
B	B cell	Memory cell	Plasma cell	Antibody
C	B cell	Plasma cell	Memory cell	Antibody
D	Plasma cell	B cell	Antibody	Memory cell

- 16 What will happen if a T-cell recognizes an antigen?
- A T-cell divide rapidly
 - B T-cell release interferon
 - C T-cell release antibodies
 - D T-cell break down the cellular contents
- 17 Which of the following pairs does not correctly match the cell type with its function?
- A Macrophage – ingest bacteria
 - B Plasma cell – produce antibodies
 - C Helper cell – causes the lysis of infected cells
 - D Memory cell – divides to produce instantaneous response in secondary infections

- 18 Which of the following statements about reproduction in *Paramecium sp.* is true?
- A Both sexual and asexual reproduction occur when environmental conditions are unfavourable
 - B Sexual reproduction occurs when environmental conditions are unfavourable, while asexual reproduction occurs when environmental conditions are favourable.
 - C Both sexual and asexual reproduction occurs when environmental conditions are favourable.
 - D Sexual reproduction occurs when environmental conditions are favourable, while asexual reproduction occurs when environmental conditions are unfavourable.

19. Diagram below shows a life cycle of an organism.



Key :

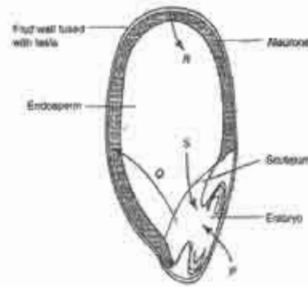
X : Sporophyte

Y : Gametophyte

Which of the following plant phyla possesses the above alternation?

- A Bryophyta
 - B Filicinophyta
 - C Coniferophyta
 - D Angiospermophyta
- 20 In the evolution of plants, a transition is seen from an aquatic environment to a terrestrial one. Which of the following is considered an adaptation to reproduction on land ?
- A Pollen grains
 - B Thalloid vegetative body
 - C Alternation of generations
 - D Antheridia and archegonia

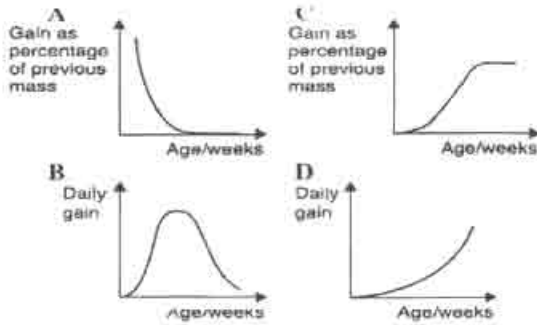
- 21 Diagram below shows the longitudinal section of a seed. During germination, the movement of P, Q, R and S are shown by the arrows below.



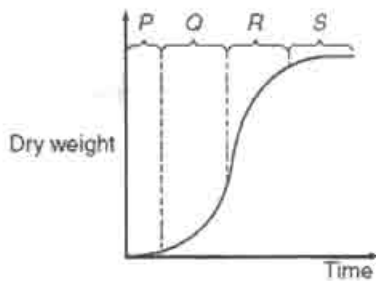
What are P, Q, R and S?

- | | P | Q | R | S |
|---|---------|---------|---------|--------|
| A | Hormone | Water | Sugar | Enzyme |
| B | Hormone | Sugar | Water | Enzyme |
| C | Water | Enzyme | Hormone | Sugar |
| D | Water | Hormone | Enzyme | Sugar |
- 22 Which membranes formed placenta in mammals?
- A Amnion and chorion
 B Amnion and allantois
 C Chorion and allantois
 D Allantois and yolk sac
- 23 What is the main source of progesterone in the early stages of pregnancy in mammals?
- A Placenta
 B Interstitial cells
 C Corpus luteum
 D Graafian follicles
- 24 Which of the following statements correctly describes the mobilization of nutrients during the germination of a barley seed?
- A The aleurone releases gibberellic acid which stimulates the embryo synthesise amylase
 B The aleurone releases amylase which stimulates the embryo to synthesise gibberellic acid
 C Gibberellic acid inhibits amylase synthesise and this ensures a constant supply of starch to the embryo
 D The embryo produces gibberellic acid which causes the aleurone to secrete amylase

- 25 What is the product of the first mitotic division of the zygote in a fertilized ovule?
- A The root-shoot axis
 - B The plumule and radicle
 - C The suspensor and embryo
 - D A basal cell and a terminal cell
- 26 Which of the following represent the absolute growth curve of a maize plant?



- 27 A typical sigmoid growth curve is shown below.



Which of the following are represented by P, Q, R and S?

- | | P | Q | R | S |
|---|---------------|--------------|--------------|---------------|
| A | Lag phase | Log phase | Linear phase | Plateau phase |
| B | Lag phase | Linear phase | Log phase | Plateau phase |
| C | Plateau phase | Log phase | Linear phase | Lag phase |
| D | Plateau phase | Linear phase | Log phase | Lag phase |

- 28 Which of the following organisms shows limited growth?
- I Human
II Locusts
III Annual plants
IV Fungi
- A I, II and III
B I, III and IV
C II, III and IV
D I, II, III and IV
- 29 Where is Juvenile hormone secreted?
- A Corpus allatum
B Corpus cardiacum
C Prothoracic gland
D Neurosecretory cells
- 30 Flower colour in garden pea plants exist in two forms, dominant purple colour and recessive white colour. Which of the following crosses can be used to determine the genotype of a pea plant with purple coloured flowers?
- A Test cross
B Back cross
C Selfing cross
D Reciprocal cross
- 31 Self crossing of a dihybrid heterozygous plant produced 1,000 plants. How many of the 1,000 plants is has both the dominant traits?
- A 63
B 188
C 250
D 563
- 32 White eye in *Drosophila* is determined by a recessive sex-linked gene and its dominant allele produces a red eye. Which of the following is **correct** progeny of a cross between a heterozygous red eye female with a white eye male?

	Female		Male	
	Red	White	Red	White
A	1	1	1	1
B	3	1	3	1
C	1	3	1	3
D	1	-	-	1

- 33 Table below shows the value of chromosome crossing over between linked genes.

Linked genes pair	Value of chromosome crossing over(%)
MN	30
MO	5
MP	10
NO	35
NP	20
OP	15

What is the genes sequence on the chromosome?

- A M, N, O, P
 B N, O, P, M
 C N, P, M, O
 D N, M, P, O
- 34 During oogenesis, non-disjunction of sex chromosome occurred. The ovum produced was then fertilised by a normal Y chromosome bearing sperm. Which of the following sex chromosomes is a complement of the resulting zygote?
- A XO
 B XY
 C XXY
 D XXXY
- 35 Hybridisation of plant M ($2n = 16$) with plant N ($2n = 20$) produces a sterile plant P. Total non-disjunction in plant P produces plant Q. What is the number of chromosomes in plant P and Q?
- A P= 18 and Q= 36
 B P= 36 and Q= 36
 C P= 36 and Q= 72
 D P= 72 and Q= 72
- 36 Which one is the condition of *euploidy*?
- A $3n$
 B $2n + 1$
 C *Monosomy*
 D *Turner syndrome*

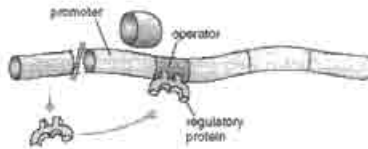
- 37 A type of gene mutation is as follows:

mRNA	-AAA	UGG	GUG	UCU-
Amino acid	lys	trp	val	ser
			↓ Mutation	
mRNA	-AAA	UGG	GAG	UCU-
Amino acid	lys	trp	glu	ser

What is the result of this mutation?

- A Haemophilia
 B Cystic fibrosis
 C Sickle cell anemia
 D Thalassaemia major
- 38 In a population of 10000 individuals, 1600 are found to have straight hair. Straight hair is controlled by a recessive allele. What is the frequency of the dominant allele?
- A 0.16
 B 0.36
 C 0.40
 D 0.60
- 39 In a population of 1250 individuals, 1200 individuals have normal vision. Normal vision is controlled by the dominant allele S while short-sightedness is controlled by the recessive allele s. How many individuals are heterozygous?
- A 50
 B 250
 C 400
 D 1000
- 40 In a population of 100 000 people, 10 of them are albinos. What is the frequency of the albinism carriers?
- A 0.01
 B 0.02
 C 0.20
 D 0.99

- 41 What is a *gene pool*?
- A The total number of the genes of all the individuals in a population.
 - B The sharing of genes between two populations through interbreeding.
 - C The random changes in the allelic frequency in a small breeding population.
 - D A population in which the allelic and genotype frequencies do not change from one generation to the next.
- 42 A condition of lac operon is shown in the diagram below.



- Which statement is true of the lac operon?
- A Glucose is present.
 - B The operon is 'switched on'.
 - C β -galactosidase is produced.
 - D Transcription of the structural genes occurs.
- 43 Which of the following statements is not true of the Jacob- Monod theory of the gene regulation?
- A The regulator gene codes the β -galactosidase enzyme.
 - B The promoter region is the binding site for RNA polymerase.
 - C The structural gene is transcribed when the repressor protein binds with lactose.
 - D The structural gene is inactive due to the repressor protein produced by the regulator gene.
- 44 If the promoter of the lactose operon system in *E. coli* has mutated and is non-functional.
- Which of the following statements is true?
- A β -galactosidase is not synthesised in the presence of lactose.
 - B β -galactosidase enzyme is synthesised in the presence of lactose.
 - C β -galactosidase enzyme is synthesised with or without the presence of lactose.
 - D β -galactosidase enzyme is not synthesised with or without the presence of lactose.

- 45 How many mRNA is produced if 3 structural genes in the lactose operon of *E. coli* go through transcription?
- A 1
 - B 2
 - C 3
 - D 4
- 46 Why a bacteria carrying a plasmid with an antibiotic resistance gene is important in cloning?
- A They help in screening.
 - B They can kill other bacteria.
 - C They can produce antibiotics for commercial.
 - D They protect themselves after being released into the environment.
- 47 An unidentified human skeleton is discovered. Which of the following steps could be done to identify the victim?
- I Isolating RNA sample from the victim.
 - II Collecting tissue sample from the victim.
 - III Collecting fingerprints from probable family members.
 - IV Collecting blood samples from probable family members.
- A I and II
 - B I and IV
 - C II and III
 - D II and IV
- 48 What is the restriction site recognised by *EcoRI*?
- A GGCATT
 - B GCCAAT
 - C GAATTC
 - D GGATCC

- 49 Which DNA sequences are palindromic?
- A 5' AAGGTT 3'
3' TTCCAA 5'
 - B 5' GAGGCCTC 3'
3' CTCCGGAG 3'
 - C 5' GGGGGTTTTT 3'
3' CCCCCAAAAA 5'
 - D 5' CATCATCATCAT 3'
3' GTAGTAGTAGTA 5'
- 50 Which of the following is not transgenic organism?
- A The cloned sheep (Dolly)
 - B The herbicide-resistant maize
 - C The bacteria producing human insulin
 - D The sheep producing human protein in milk

Nama : Nombor Kad Pengenalan:

964/2

**OTI 2 STPM
2010**



JABATAN PELAJARAN NEGERI TERENGGANU

**BIOLOGY
PAPER 2**

Two and a half hours

Instructions to candidates :

Answer all the questions in Section A in the spaces provided.

Answer any four questions from section B. For this section, write your answers on the answer sheets provided. Begin each answer on a fresh sheet of paper. Answers should be illustrated by large, clearly labeled diagrams wherever suitable.

Answers may be written in either Malay or English.

Arrange your answer in numerical order and tie the answer sheets to this booklet.

For examiner's use	
Section	Marks
A	1
	2
	3
	4
B	5
	6
	7
	8
	9
	10
TOTAL	

TERENGGANU ANJUNG ILMU

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Tel: 609-666 8611/6652:8601 Faks: 609-666 0611/0063

Section A (40 marks)

Answer all question in this section

- 1. (a) Autotrophs are organisms that can be divided into two groups which are chemoautotroph and photoautotroph. By giving **one** example of each group, differentiate the two groups of organisms. [4 marks]

.....

.....

.....

.....

- (b) Based on their modes of nutrition, heterotrophic organisms can be further divided into holozoic, saprophytic and parasitic organisms.

- (i) *Mucor sp* is an example of saprophytic organism. Explain how this organism obtains its nutrition. [3 marks]

.....

.....

.....

- (ii) There are two type of parasites, *endoparasite* and *ectoparasite* . Explain these two types of parasites and give one example each. [4 marks]

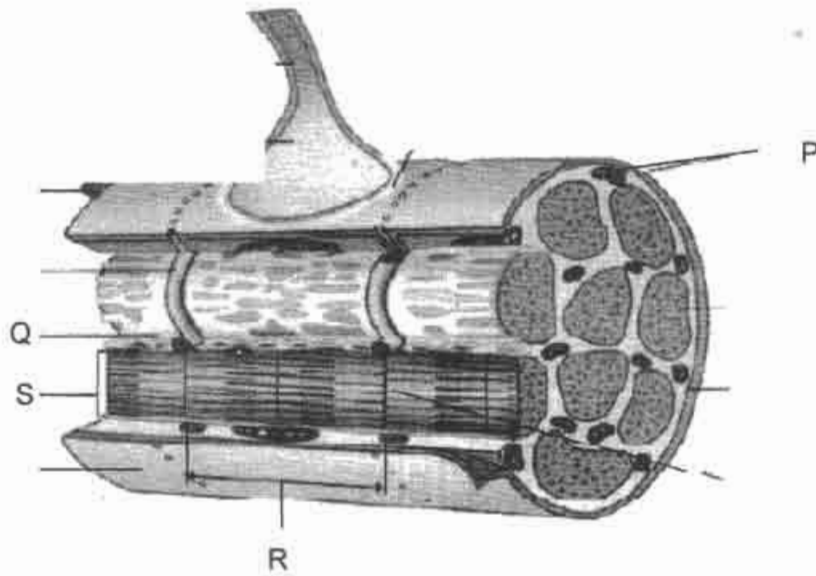
Endoparasite ;

Example

Ectoparasite

Example

2. The diagram below shows the neuromuscular junction



a. Name the structures labelled P to S [2 marks]

P :

Q :

R :

S :

b. Muscle fibres are composed of numerous myofibrils arranged parallel to one another. The myofibrils consists of two types of protein which are thin filament and thick filament. Name the proteins. [1 mark]

.....

c. (i) Draw a sarcomere and labeled A band, I band and H zone. [2 marks]

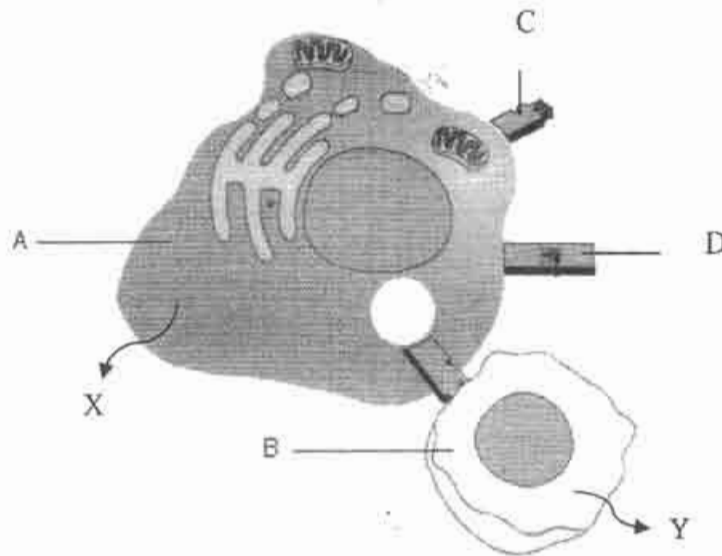
(ii) During muscle contraction, state the changes of each band. [2 marks]

.....
.....

d. Explain the role of calcium ions in skeletal muscle contraction. [3 marks]

.....
.....
.....
.....

3. Diagram below shows part of the cell-mediated mechanism of immunity system in human body



(a) Name the structures labelled A to D [2 marks]

A:.....
B:.....
C:.....
D:.....

(b) The immune system will reacts in certain way when a virus invades our body.

(i) Explain the response by structural A [2 marks]

.....
.....
.....

(ii) Explain what happen to the virus. [2 marks]

.....
.....
.....

(c) (i) State the name and function of substance X secreted by structure A. [2 marks]

.....
.....

(ii) State the name and function of substance Y secreted by structure B. [2 marks]

.....
.....

4 The colour and shape of radish is controlled by two pairs of allele that do not show dominance; each genotype producing different phenotypes. Radish can be red (RR), purple (Rr), or yellow (rr). Radish shape can be long (LL), oval (Ll) or round (ll).

(a) Draw a genetic diagram for the cross between the red and long radish with the yellow and round radish. [4 marks]

(b) Draw a Punnett square if the selfing of F_1 generation produced in (a) occurs.

[3 marks]

(c) By using a data in (b), complete the table below.

[3 marks]

Phenotype	Genotype	Genotype ratio	Phenotype ratio
Red, long			
Red, oval			
Red, round			
Purple, long			
Purple, oval			
Purple, round			
Yellow, long			
Yellow, oval			
Yellow, round			

Section B [60 marks]

Answer any four questions in this section.

- 5 (a) Outline the main features of the kidney nephron. Include in your account, structural details of the regions of ultrafiltration and selective reabsorption. [8 marks]
- (b) Describe how the kidney regulates the water content of the body fluids. [7 marks]
- 6 (a) With the aid of a diagram, describe the process of double fertilization in an angiosperm. [5 marks]
- (b) Describe the main structural features that favour cross-pollination in an angiosperm. [4 marks]
- (c) Describe the characteristics of the following types of asexual reproduction. [6 marks]
- (i) Polyembryony
 - (ii) Parthenogenesis
 - (iii) Vegetative reproduction
- 7 (a) Describe the processes involved in the mobilization of food reserve in an endosperm in seed germination. [8 marks]
- (b) Describe the processes involved during fertilization in humans. [7 marks]
- 8 In pea plants, the allele for smooth seed, W , is dominant over the allele for wrinkled seed, w , while allele for yellow seed, G , is dominant over the allele for green seed, g . In one of Mendel's dihybrid crosses, pea plants of genotypes $wwGG$ were crossed with $WWgg$. The F_1 obtained were selfed and yielded 630 F_2 plants with phenotypes of smooth and yellow, 216 smooth and green, 202 wrinkled and yellow, 64 wrinkled and green seeds. Using the χ^2 test at 5% level, determine whether
- (a) the result fits a 9 : 3 : 3 : 1 ratio, [7 marks]
 - (b) the number of phenotypes of smooth seeds to wrinkled seeds fits a 3 : 1 ratio, [4 marks]
 - (c) the number of phenotypes of yellow seeds to green seeds fits at 3 : 1 ratio. [4 marks]

Table of chi-square (χ^2) values at 5% level

Degree of freedom	5% level
1	3.841
2	5.991
3	7.815
4	9.488
5	11.070
6	12.592
7	14.067
8	15.507
9	16.919
10	18.307

- 9 (a) (i) Explain what is meant by mutation. [3 marks]
(ii) Name the different type of mutation.
- (b) Describe the mutation that occur in DNA and chromosomes. [12 marks]
- 10 (a) Recombinant DNA technology has been used to transform higher plants and animals and to modify them to produce better crops and more productive farm animals. What are the possible risks could genetically modified plants have ? [10 marks]
- (b) Explain the theoretical basis of genetic fingerprinting and suggest uses for the process. [5 marks]

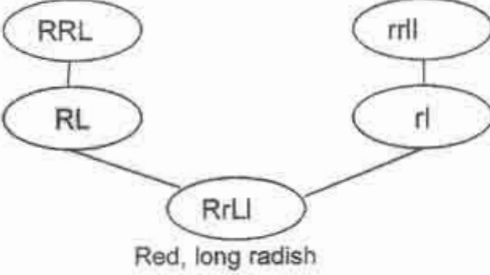
ANSWER SCHEME PAPER 1 OTI 2 2010

Q	ANSWER	Q	ANSWER
1	A	26	B
2	C	27	A
3	B	28	A
4	C	29	A
5	B	30	A
6	C	31	D
7	C	32	A
8	D	33	C
9	B	34	C
10	A	35	A
11	B	36	A
12	D	37	C
13	B	38	D
14	C	39	C
15	A	40	B
16	A	41	A
17	C	42	A
18	B	43	A
19	A	44	D
20	A	45	A
21	D	46	A
22	C	47	D
23	C	48	C
24	D	49	B
25	D	50	A

MARKING SCHEME PAPER 2
- 0ti 2 biology stpm 2010

Section A [40 marks]

No	Suggested answer	mark	
1 (a)	Photoautotroph absorb sunlight as energy source and use it to convert carbon dioxide into complex organic molecule Example : Plants	1 1	
	Chemoautotroph use inorganic molecules such as sulphur and use it to convert carbon dioxide into complex organic molecule Example : Sulphur bacteria	1 1	
	(b)(i) Mucor sp secretes enzymes onto dead organic matter. Digestion occurs to produce simple molecules such as glucose Glucose is then absorbed into the body through hyphae	1 1 1	
	Endoparasite is a parasite that live within/inside the host Example : Tapeworm	1 1	
	Ectoparasite is a parasite that live on the outer surface of a host Example : Leeches, fleas, mite, ticks	1 1	
	TOTAL	10m	
	2(a)	P : Mitochondrion Q : Sarcoplasmic reticulum R : Sarcomere S : Myofibril	4 = 2m 2-3 = 1m 1 = 0m
	(b)	Actin and myosin	1m
	(c)(i)	<p style="text-align: center;">H zone</p> <p style="text-align: center;">I band A band I band</p>	1m- Diagram 1m-Label -at least 2 correct label 2m
	(ii)	A bands do not change in length I band shorten	

(d)	<p>When an impulse reaches the terminal end of a motor neurone. Ca²⁺ ions diffuse into the synaptic knob and cause release of neurotransmitter molecules.</p> <p>These neurotransmitter molecules diffuse across the synaptic to depolarize the sarcolemma and action potential is generated</p> <p>The impulses are conducted along the transverse tubule and trigger the release of Ca²⁺ ions from sarcoplasmic reticulum</p> <p>Ca²⁺ ions act as trigger for muscle contraction</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>Any 3= 3m</p> <p>10M</p>
TOTAL		
3 (a)	<p>A: Macrophage / Antigen Presenting Cell (APC)</p> <p>B: Helper T cell</p> <p>C : MHC - II</p> <p>D : Cell T receptor</p>	<p>4 = 2m</p> <p>2-3 = 1m</p> <p>1=0m</p>
(b)i	<p>Macrophage/ Structure A encounter the pathogen, then engulf it by endocytosis</p> <p>Pathogen is then digested into small fragments</p>	<p>1</p> <p>1</p>
(b)ii	<p>The digested virus move to the surface of a macrophage and form a complex with MHC-II protein on the macrophage surface membrane</p> <p>The complex is known as antigen presenting cell</p>	<p>1</p> <p>1</p> <p>1</p> <p>Any 2= 2m</p>
(c (i)	<p>Substance X is interleukin 1 (cytokine).</p> <p>It stimulates the helper cell to secrete interleukin-2</p> <p>Substance Y is interleukin 2 (cytokine)</p> <p>It stimulates the T helper cell and T cytotoxic to divide through mitosis</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
TOTAL		
10M		
4(a)	<p>Parental phenotype Red, long radish yellow, round radish</p> <p>Parental genotype </p> <p>Parental gamete RL rl</p> <p>F₁ genotype RrLl</p> <p>F₁ phenotype Red, long radish</p>	<p>1m</p> <p>1m</p> <p>1m</p> <p>1m</p>

4 (b)	gamete					3m	
		RL	RI	rL	rl		
	Gamete	RL	RRLl	RRII	RrLl		RrIi
		RI	RRLi	RRII	RrLi		RrIi
		rL	RrLl	RrLi	rrLl		rrLi
rl		RrLi	RrIi	rrLi	rrIi		

4 (c)	Phenotype	Genotype	Genotype ratio	Phenotype ratio	All correct 3 marks
	Red, long	RRLl	1	1	
	Red, oval	RRII	2	2	
	Red, round	RRIi	1	1	
	Purple, long	RrLl	2	2	
	Purple, oval	RrLi	4	4	
	Purple, round	RrIi	2	2	
	Yellow, long	rrLl	1	1	
	Yellow, oval	rrLi	2	2	
	Yellow, round	rrIi	1	1	

Section B –OTI 2 2010

No.	Suggested scheme	Marks
5 (a)	<p>the main features of the kidney nephrons:-</p> <p><u>ultrafiltration</u></p> <ul style="list-style-type: none"> -the structure involved are the glomerulus, a mass of blood capillaries - supplied with blood from afferent arteriole of the renal artery -the Bowman's capsule consists of a basement membrane and podocytes -the force for ultrafiltration to occur is due to the larger diameter of the afferent arteriole/creating high blood pressure in the glomerulus -the forced from the blood pressure enables substances to pass through the filter formed by the basement membrane and podocytes <p><u>selective reabsorption</u></p> <ul style="list-style-type: none"> -proximal convoluted tubule (active removal of substances), have many microvilli forming a brush border along the closely packed layer of epithelial cells , increasing the surface area for diffusion -the proximal convoluted tubule has many mitochondria to provide ATP (for the active uptake) -the structure of the loop of Henle that has a narrow descending limb with readily water-permeable walls and a wider ascending limb with less water-permeable walls, created a counter-current multiplier system -the permeability of the walls of the distal convoluted tubule and the collecting ducts affected by hormones such as ADH 	<p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>Max 8m</p>
5(b)	-Anti-diuretic hormone (ADH) is involved in water content regulation in the kidney	-1M

)	<p>-a decreased in the water content of the body fluids by excessive sweating or reduced water intake increases the blood osmotic pressure</p> <p>-the increase is detected by osmoreceptors in the hypothalamus and impulses are transmitted to stimulate the posterior pituitary gland to releases ADH. The presence of anti-diuretic hormone (ADH) causes the walls of the distal convoluted tubule and collecting duct to be more permeable to water and urea.</p> <p>this allows uptake of water to occur osmotically from the glomerular filtrate into the medulla and vasae rectae</p> <p>-in addition, active uptake of sodium from the ascending loop of Henle coupled with movement of urea out from the collecting duct creates a hyperosmotic condition in the surrounding interstitial fluids</p> <p>-thus, urine that is hypertonic to the blood will be produces,</p> <p>-an increase in water content of the body fluids because of little sweating or excessive water intake reduces the blood osmotic pressure.</p> <p>-thus, ADH production is inhibited. The distal convoluted tubule and the collecting duct will remain impermeable to water and urea</p> <p>-less water will be drawn out from the tubule and the collecting duct, resulting in urine that is hypotonic to the blood</p>	<p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>-1M</p> <p>Max 7m</p>
6(a))	<p>Diagram – showing the growth of the pollen tube and penetration of the embryo sac through the micropyle</p> <p>- detailed view of events that occur in the embryo sac upon penetration by the pollen tube</p> <ul style="list-style-type: none"> • Double fertilization is a process in angiosperms (flowering plants) that occurs during sexual reproduction • After a pollen grain [A] has landed on a sticky stigma [B] (the female reproductive structure), it germinates to form a pollen tube [C] • Digestive enzymes released by the pollen tube enable it to grow through the style [D] and ovary wall [E] • During growth of the pollen tube, the haploid generative nucleus of the pollen grain divides by mitosis to form two haploid male nuclei (the male gametes)[F] • These male gametes move down the pollen tube during its growth. Eventually, growth of the pollen tube enables it to penetrate the embryo sac [G] through a tiny pore called the micropyle [H] • After the burst, leaving a clear passage for the two male gametes to enter the embryo sac. One of the male gametes then fuses with the egg cell (ovum or female gamete)[J] to form a diploid zygote (2n) • The second male gamete fuses with the two haploid polar nuclei (at the center of the embryo sac)[K] to form the triploid endosperm nucleus (3n). thus, during double fertilization, fertilization occurs twice as opposed to once 	<p>2 m (diagram)</p> <p>3 m (any 3 explanations based on diagram)</p> <p>Total = 5 marks</p>
6(b))	<p>Cross-pollination is encouraged by the following structural features in angiosperms:</p>	

- contains digestive enzymes
- Exocytosis of the acrosome release enzymes that digest a path in the zona pellucida. The acrosome action allows the sperm to drill through the zona pellucida
- The sperm then passes through the zona pellucida. Once the sperm penetrates the zona pellucida, it binds to and fuses with the plasma membrane of the oocyte. Upon binding of the sperm, the egg undergoes metabolic and physical changes
- Enzymes released from the cortical granules in the egg cytosol hardens the zona pellucida and prevents other sperms from further penetration. The sperm receptors in the zona pellucida are also destroyed
- The nuclear envelope of the sperm degenerates and the chromatin from both the sperm and egg are soon encapsulated in a nuclear membrane, forming a male pronucleus
- At the same time, the secondary oocyte completes meiosis II forming a second polar body and the female pronucleus
- Each pronucleus contains a haploid genome. The male and female pronuclei fuse to form the diploid zygote, which develops into an organism

Total =
7m

8(a)

o = observed number, e = expected number

9 smooth yellow : 3 smooth green : 3 wrinkled yellow : 1 wrinkled green

Expected ratio	o	e	o-e	(o-e) ²	(o-e) ² /e
9 smooth yellow	830	625.5	4.5	20.25	0.032
3 smooth green	216	208.5	7.5	56.25	0.268
3 wrinkled yellow	202	208.5	-6.5	46.25	0.203
1 wrinkled green	64	69.5	-5.5	30.25	0.435
	1112				χ^2 0.938

- degree of freedom, $df = 3$
- the χ^2 0.938 < 7.82 // insignificant at 95% confidence level
- therefore, the data fits / obeys/ follow the 9:3:3:1 ratio

(b) 3 smooth : 1 wrinkled

Expected ratio	o	e	o-e	(o-e) ²	(o-e) ² /e
3	846	834	12	36	0.043
1	266	278	-12	36	0.129
	1112				χ^2 0.172

- degree of freedom, $df = 1$
- the χ^2 0.172 < 3.84 // insignificant at 95% confidence level
- therefore, the data fits / obeys/ follow the :3:1 ratio

(c) 3 yellow : 1 green

	<ul style="list-style-type: none"> genes to wild relatives ❖ this might be undesirable if, for example, the genes made weeds tolerant of herbicides ❖ most crops are unable to cross-breed with wild plants, and many cannot themselves survive outside of agriculture ❖ some crops are modified to be tolerant of herbicides used for weed control. It has been argued that the cultivation of such crops might increase the use of chemical sprays ❖ there are, however, cases where the introduction of herbicide resistant crops could reduce the use of harmful herbicides - by reducing the number of applications necessary, or by allowing the use of herbicides that break down rapidly, instead of spraying with more persistent and damaging herbicides such as atrazine and 2,4-D. ❖ it is very unlikely that transgenic DNA will affect humans who eat genetically modified crops ❖ DNA is not toxic and is degraded when eaten ❖ transgenic DNA is not fundamentally different to the DNA in other foods ❖ some transgenic proteins could be toxic or cause allergies, just as other proteins could. This will be especially true for genetically modified crops that produce pharmaceuticals or enzymes for industry. 	Max 10m
10(b)	<ul style="list-style-type: none"> • By analogy to fingerprinting, where each person's thumb and finger prints are unique, so also is each person's DNA – hence the term DNA fingerprint • the only exception to this is in the case of siblings derived from the division of a single egg (identical twins and triplets) • variation is particularly marked in non-coding DNA and DNA not involved in gene regulation ; for example, much of the repetitive DNA • this is because mutations in genes and regulatory sequences are mostly selected against, while those in DNA with no function aren't deleterious and can persist <p>Uses of the Process:</p> <ul style="list-style-type: none"> • <i>the uniqueness of each person's genetic fingerprint means that biological samples taken from the scene of a crime can be used to identify, or to rule out, potential suspects</i> • the same technology can be used to determine the relationships between individuals; for example, in a paternity dispute • very small amounts of DNA can be analysed – from blood and semen stains, for example. • the most modern methods can even analyse the tiny amounts of DNA found on hair roots • these methods use a technique called the polymerase chain reaction (PCR), which amplifies DNA of the region of interest • in addition, fingerprinting can be performed on DNA samples that are quite old. (It has even been done on the ancient DNA of Egyptian mummies over 2400 years old) 	Max 5m