

BIOLOGY
PERFECT
SCORE
MODULE

FORM 5
ANSWER SCHEME

NAME: _____


FORM: _____

CHAPTER 1

a) Objective

1.	D	2.	B	3.	D	4.	D	5.	B
6.	A	7.	B	8.	D	9.	B	10.	B
11.	C	12.	A	13.	C	14.	A	15.	D
16.	B	17.	D	18.	B	19.	B	20.	A
21.	C								

b) Structure

1(a)			1
		Both arrow correct	
(b)	A-Pulmonary artery B – Pulmonary vein	1 1	2
(c)	F: Contraction of ventricle /heart E1: generates a (high) pressure E2 : to propel /force/pump the blood flow from the heart /ventricle to vessel A	1 1 1 Any 2	2
(d)(i)	Coronary artery	1	1
(ii)	P1:Cut the supply of O2/nutrients to the heart muscle P2: causing chest pain/angina/heart attack/myocardial infarction Reject 'Heart problem'	1 1	2
(e)(i)	P1:platelets break down & release chemicals P2: to cause platelets to stick to each other P3:platelets clump together to form a plug to prevent blood loss P4: released thrombokinase & other clotting factors	1 1 1 1 Any 2P	2
(ii)	P1: Fibrinogen is soluble, fibrin is insoluble / not soluble P2 : Fibrin able to form fibres / meshwork / thread to trap blood cells, fibrinogen is not able to do so	1 1	2

2(a)(i)	Bendalir X : (Bendalir) limfa	1	1
(ii)	P1: Bahan toksik dalam bendalir X dineutralkan P2: patogen dalam bendalir X dimusnahkan / ditapis	1 1	2
b(i)	P1: Tekanan hidrostatik yang tinggi dalam kapilari	1	3

	P2: memaksa plasma darah terturas keluar ke ruang antara sel (kecuali SDM, platlet dan protein) P3: membentuk cecair interstis / bendalir tisu P4: sebahagian / 10% bendalir tisu meresap masuk ke dalam salur limfa (membentuk bendalir limfa)	1 1 Any 3	
(ii)	Bendalir X tidak mengandungi eritrosit/platlet/plasma protein (albumin, globulin dan fibrinogen manakala darah mengandungi eritrosit/ platlet/plasma protein)	1	1
(iii)	P1: mengumpul cecair interstis & mengembalikan ke sistem peredaran darah P2: mengangkut asid lemak dan gliserol / Vitamin A, D, E dan K ke sistem peredaran darah P3: mengembalikan bahan berguna seperti air, mineral, hormone (dan koenzim) yang tidak meresap ke dalam kapilari darah ke sistem peredaran darah P4: menyingkir bahan kumuh seperti asid urik dan urea ke sistem peredaran darah	1 1 1 1 Any 2	2
c(i)	Elephantiasis / Untut Nota : reject oedema	1	1
(ii)	P1: Salur limfa tersumbat P2: disebabkan oleh cacing filariasis P3: bendalir tisu yang berlebihan tidak dapat dikembalikan ke sistem darah P4: bendalir tisu berkumpul di ruang antara sel P5: tisu badan membengkak	1 1 1 1 Any 2	2

3(a)(i)	P – leucocyte/white blood cells/ phagocytes/monocyte/neutrophyll Q - Lymphocytes	1 1	2
(ii)	-white blood cell/phagocytes engulf the pathogen -by phagocytosis -hydrolytic enzyme/lysozyme digest/breakdown the pathogen (product are absorbed)	1 1 1 Any 2	2
(b)(i)	Antibody	1	1
(ii)	Specific	1	1
(c)(i)	Ind X : Artificial /(Acquired) active immunity Ind Y: Artificial /(Acquired) passive immunity	1 1	2
(ii)	X : Vaccine Y : anti serum	1	1

(iii)	- In x, after 2 nd injection, the concentration of antibody increase slowly & become higher than immunity level and is maintain for a long time - in Y, after the 2 nd injection, the concentration of antibody reduces slowly to below the immunity level	1 1	3
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4(a)	X: Artificial active immunity Y: Artificial passive immunity	1 1	2										
(b)	To increase the concentration of antibodies exceed immunity level	1	1										
(c)	<table border="1"> <thead> <tr> <th>P</th> <th>Q</th> </tr> </thead> <tbody> <tr> <td>P1: Produced its own antibody</td> <td>Receive ready-made antibodies from other sources</td> </tr> <tr> <td>P2: permanent/long lasting</td> <td>Temporary/short lasting</td> </tr> <tr> <td>P3: injection of vaccine</td> <td>Injection of anti-serum</td> </tr> <tr> <td>P4: slow response</td> <td>Fast/immediate response</td> </tr> </tbody> </table>	P	Q	P1: Produced its own antibody	Receive ready-made antibodies from other sources	P2: permanent/long lasting	Temporary/short lasting	P3: injection of vaccine	Injection of anti-serum	P4: slow response	Fast/immediate response	1 1 1 1 Any 2	2
P	Q												
P1: Produced its own antibody	Receive ready-made antibodies from other sources												
P2: permanent/long lasting	Temporary/short lasting												
P3: injection of vaccine	Injection of anti-serum												
P4: slow response	Fast/immediate response												
(d)	Cell A: Lymphocyte Material X: Antibody	1 1	2										
(e)	P1: Lymphocytes/ cell A identify/recognize the antigen P2: and produce (specific) antibodies P3: antibodies bind with antigen to form antigen-antibodies complex P4: antibodies destroy the antigen/pathogen	1 1 1 1 Any 3	3										
(f)	P1: to stimulate the lymphocytes to produce antibodies P2: to increase the concentration of antibodies produced exceed the immunity level P3: enable the lymphocytes to have memories for the same type of pathogen P4: enable body to provide immediate response towards the pathogen Notes: If students answer "No" P1: inaccurate preparation of vaccine P2: cause death/diseases P3: preparation of vaccine need high cost P4: risks for children/babies with low/weak immunity	1 1 1 1 1 1 1 Any 3	3										

5(a)			2
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	Characteristics	Importance		
	Small in size//have a large total surface area to volume(TSA/V)// Increases the surface area	For water (and mineral) absorption	1	
	Have thin cell wall/have no cuticle	For water (and mineral)ions absorption	1	
	The cell sap in R is usually hypertonic to surrounding soil water	For water absorption	1	
b(i)	-the cell sap of R is hypertonic to the soil water -the water diffuses into R by osmosis -the entry of water dilutes cell sap of R//cell sap of R becomes hypotonic compared to the cell sap of S/the next cells -therefore, water diffuses into S/to these adjacent cells which become more diluted themselves, so osmosis continues across the S -the continuous flow of water in S creates a force known as root pressure to push water into xylem		1 1 1 1 1 Any 4	4
(ii)	Adhesion and cohesion (force)		1	1
(iii)	-Adhesion: attraction force between water molecules and the xylem wall enable water to move up along the narrow xylem vessels -Cohesion: attraction force between water molecules form a continuous water column in the xylem vessels		1 1	2
(d)	-water is loss from the plant in the form of water vapour(into surrounding air) by transpiration -mainly through the stomata in the leaves -the amount of water lost depends on the size of the stomatal pore -(the size of the stomatal pore)is controlled by the guard cell//through the opening and closing of stomata		1 1 1 1 Any 3	

6(a)(i)	P: Floem Q : Xilem	1 1	2
(ii)	-Terdiri daripada tiub tapis berbentuk silinder/yang memanjang/bersambung pada hujung sel dengan tiub tapis yang lain -dinding antara dua sel tiub membentuk plat tapis -membenarkan sitoplasma dari satu sel tiub dapat bergerak melalui plat tapis ke	1 1	2

	Ways to prevent: P7: avoid water logged//clean the area	1	
	P8: use mosquitoes net	1	
	P9: use salt//ABATE to kill mosquito larvae	1	
	P10: campaign//public awareness to prevent filariasis	1	

3.	P1 : HIV Test is a screen test done on the blood	1	
	P2: to detect the presence of the HIV virus	1	
	P3: as a safety measure for couple to have children	1	
	P4: so that the virus is not transmitted // free from HIV	1	
	P5 : Healthy future generation // any suitable explanation on healthy community	1	
		Any 5	

4 a	P1: due to blockage/narrowing of the coronary artery/arteriosclerosis/atherosclerosis	1	5
	P2: heart's muscles receive less/no supply of oxygen and nutrients	1	
	P3: can cause angina/myocardial infarction/heart attack	1	
	P4: heart muscle cannot pump blood to the whole body	1	
	P5: bypass returns back supply of oxygen and nutrients to the muscles of heart	1	
	P6: so that heart can pump blood to the whole body	Any 5	
(b)	P1: eat a balanced diet	1	5
	P2: eat more vegetables and fruits	1	
	P3: reduce intake of food high in fats/cholesterol	1	
	P4: reduce intake of food high in salt/sodium	1	
	P5: exercise regularly	1	
	P6: to reduce obesity	1	
	P7: to maintain the normal body weight	1	
	P8: stop/no smoking	1	
	P9: to reduce the narrowing of coronary artery	1	
	P10: reduce stress	1	
	P11: take enough rest/sleep	1	
	P12: do recreational activities	1	
	P13: drink plenty of water	1	
	P14: no drinking alcohol	1	
	P15: alcohol can cause hardening of artery	1	
		Any 5	

5(a)	-the loss of water (molecules) from a plant into the atmosphere - in the form of water vapour//evaporation of water -occurs when the water content in the atmosphere is lower than (in the sub-stomatal air spaces) in leaves (Accept the difference in any suitable physical condition between these two regions)	1 1 1 Any 2	2
(b)	-During the day//in the presence of sunlight -Guard cells carry out photosynthesis // Glucose is produced -Active transport of potassium ions into the guard cells -osmotic pressure in the guard cells increases -water enters the guard cells by osmosis -hydrostatic pressure in the guard cells increases -the guard cells become turgid	1 1 1 1 1 1 1 1 1 Any 4	4
(c)	-Leaves/(young) stems are covered with thick cuticles/waxy -have sunken stomata//stomata are in grooves -more stomata on the lower epidermis(compared to the upper epidermis) -the stomata are closed during the day// absorption of carbon dioxide for photosynthesis occurs during the night -the young leaves roll/to reduce the surface area -these are to reduce the rate of transpiration /loss of water from the plant	1 1 1 1 1 1 Any 4	4
(d)	Xylem: S1: S are xylem (vessels) P2: xylem/S are well adapted for water transport which are long/narrow/continuous tubes P3: which transports water in plants P4: by capillary action P5: due to the forces between water molecules / cohesion force, and the forces between water molecules and wall of xylem /S/adhesion force OR P4: By root pressure P5: water enters xylem by osmosis	1 1 1 1 1 1 1 1 1 1 1	5

	OR P4:By transpiration pull P5:Water is pulled out of xylem(during transpiration) Any 3 Correct answer	1	
	Phloem -R are phloem/sieve tubes and companion cells -which transport organic compounds /glucose/products of photosynthesis -by translocation Any 2 correct answer	1 1 1	
(e)	-it is a necessity / need / important (for water transport in plant to survive) -water is a medium to transport minerals -as the medium of biochemical reaction (in cells) -transpiration creates a transpirational pull/pull water from roots -evaporation of water (during transpiration) keeps the plants cool -water provided turgor pressure for support -water/are needed in guard cells in the opening of stomata Any 5 correct answer	1 1 1 1 1 1 1	5

	P3: (pulling) force (from biceps/X) is transmitted to tendon /R P4: tendon / R cannot transmit the force to radius		
(ii)	P1: intake of food that contain high calcium / any suitable example of food P2: regular weight bearing exercise / any suitable example	1 1	2
(d)	P1: provides muscle attachments that act antagonistically to produce movement P2: produce blood cells (in bone marrow) P3: ligaments connect muscle to bones to allow movements	1 1 1	2

2	K: (otot) biseps M : Tendon	1 1	2
a(i)	Kuat/tidak kenyal	1	1
(ii)	Kuat/tidak kenyal	1	1
(iii)	P1:K dan L otot berantagonis P2: K mengecut, L mengendur P3: M memindahkan daya tarikan ke radius P4: radius ditarik ke atas	1 1 1 1 Any3	3
(b)	P1:membekalkan oksigen dan glukosa yang mencukupi kepada K dan L P2:membolehkan respirasi sel berlaku P3:menghasilkan tenaga mencukupi P4:untuk pengecutan otot K/L	1 1 1 1 2	2
c(i)	Distrofi otot	1	1
(ii)	P1:penyakit terangkai seks P2: disebabkan gen mutan P3: yang terdapat pada kromosom X	1 1 1	3

CHAPTER 2

a)Objective

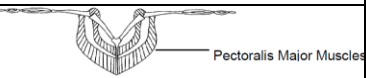
1.	A	2.	D	3.	C	4.	B	5.	A
6.	C	7.	C	8.	A	9.	B	10.	D
11.	C	12.	B	13.	C	14.	C	15.	A
16.	C	17.	A	18.	C	19.	B	20.	C
21.	C								

b) Structure

1(a)	R: Tendon S : Ball and socket joint	1 1	2
(b)	P1: Muscle Y/triceps contract while muscle X /biceps relax P2: Muscle X and Y acts in pairs and opposite ways//antagonist P3: Transferring force to the tendon / tissue R P4: Tendon pulls ulna and arm straightened	1 1 1 1	3
(c)(i)	P1: radius cannot pull the arm upward P2: biceps / X muscle contract	1 1	3

3(a)	R : centrum	1	1
(b)	P : muscle attachment Q : the placing of spinal cord	1 1	1
(c)	Lumbar vertebra	1	1
(d)(i)	Calcium/phosphorus	1	1
(ii)	Osteoporosis//porous/brittle bone	1	1
(iii)	Taking a diet rich in calcium/phosphorus and vitamin D//Drink milk, regular exercise (any 1)	1	1
e(i)	P:air sac	1	1
(ii)	To reduce the density of aquatic plant//to keep aquatic plant light	1	1
(ii)	To reduce the density of aquatic plant//to keep plant light	1	1
(iii)	-able to float -get enough sunlight	1 1	2

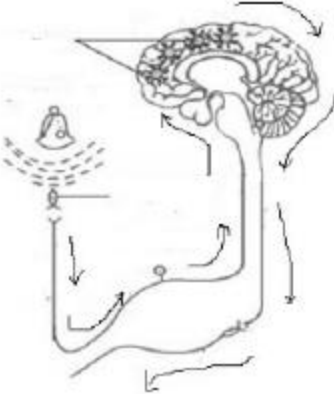
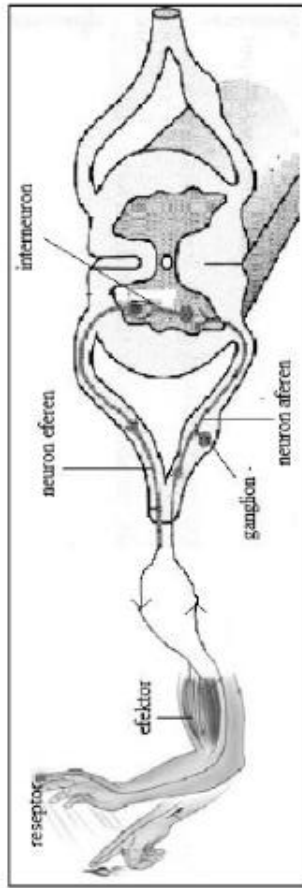
	-carry out photosynthesis	1 Any 2	
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4(a)	1.Circular muscles 2.longitudinal muscles	1 1	2
(b)	P1: Circular muscles and longitudinal muscles / both muscles act antagonistically //A pair of antagonistic muscles P2:the contraction of circular muscles //relaxation of longitudinal muscles P3:cause the segments (of the earthworm) to extend / be longer P4: the contraction of longitudinal muscles//the relaxation of circular muscles P5:cause the segments (of the earthworm) to shorten/shorter	1 1 1 1 1 Any 3	3
c(i)		1	1
(ii)	Mitochondrion	1	1
(iii)	P1:To produce (a lot of) energy (in a form of ATP)/ATP P2:for the contraction (and relaxation) of the muscle	1 1	2
(d)	F1: (Bird's) bones mass decreases E1: as the bones are more porous/lighter E2: since it had lay many eggs E3:much calcium/phosphorus/phosphates used in forming the shells of the eggs E4:leaving less/little calcium/phosphorus/phosphates used to form (strong)bones//more bones minerals to be lost than deposited//re-absorption of calcium/phosphorus/phosphates into the blood stream is more than the withdrawing of calcium (during the formation of bones)	1 1 1 1 1 Any 3	3

c) Essay

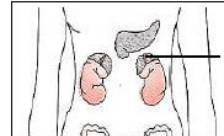
1(a)	P1 :has flexible endoskeleton P2: has W shaped muscle block i.e. myotomes P3: contract and relax antagonistically //one side contract, another side relaxes P4: make the tail/caudal fin to move side by side alternatively P5: to push the fish forward //control the fish direction	1 1 1 1 1	6
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	P6:has sleek and streamlined body shape P7: overlapping scale facing backward P8: to reduce water resistance P9: yawing is prevented by having dorsal & ventral fin P10:pitching is prevented by having pelvic and pectoral fin P11: Rolling is prevented by having dorsal and ventral fin	1 1 1 1 1 Any 6	
b(i)	F1: Fish have streamlined shapes (where the anterior of the fish is smooth and rounded, and the body is long & tapers towards the end) E1: this will help the fish to reduce water resistance F2:The skin is covered with scales that have a slimy coating E2: This will help the fish to reduce friction F3:Fish have fins E3: the fins help the fish to stabilize the fish the fish and help to move efficient in water	1 1 1 1 1 1	4 Any 2f & 2E
(ii)	-The muscles of the fish is called myotomes -Myotomes are arranged on both sides of the body/anchored to both side of the vertebral column -The muscles act antagonistically -When one side of myotomes contract, the other side of myotomes relax -This causes the body to bend in the direction of contraction	1 1 1 1 1	4 Any 4
c)	F1:Hydrostatic skeleton E1: Fluid in the body cavity helps the earthworm to move F2: muscle at the body wall are longitudinal & circular muscle / antagonistic muscle E2: contraction of circular muscles cause segment to extend while the longitudinal muscles relax E3: contraction of longitudinal muscles cause segment to shorten while the circular muscles relax F3: chaetae E3: secure the shorted segments in the posterior to the ground while the anterior segments extended owing to	1 1 1 1 1 1 1	6

									
(ii)		1 1	2						
c)	<p>Similarity</p> <ul style="list-style-type: none"> -both actions occur due to stimulus' -involve three neurones <p>Differences</p> <table border="1"> <tr> <th>Diagram (a)</th> <th>Diagram (b)</th> </tr> <tr> <td>The centre is in the cerebrum</td> <td>The centre is in the spinal cord</td> </tr> <tr> <td>Response under conscious</td> <td>Automatic response</td> </tr> </table>	Diagram (a)	Diagram (b)	The centre is in the cerebrum	The centre is in the spinal cord	Response under conscious	Automatic response	1 1 1	2
Diagram (a)	Diagram (b)								
The centre is in the cerebrum	The centre is in the spinal cord								
Response under conscious	Automatic response								
d)	Diagram a): Able to control response by will / conscious Diagram b) to avoid injuries	1 1	2						

e)	P1: Weak muscles and shivering limbs (legs and arms) P2: Unable to control body balanced and coordination P3: weak brain and unable to function efficiently	1 1 1	3
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2(a)	P : Thyroxin hormone R : Growth hormone	1 1	2
(b)	i) Follicle stimulating hormone (FSH) ii) Estrogen hormone	1 1	2
c)	E1 : More ADH will increase the permeability of distal convoluted tubule and collecting duct E2: more water is reabsorbed into the blood capillary E3: urine become less and more concentrated	1 1 1	3
d)	E1: Hormone R stimulate growth E2: lack of hormone R cause stunted growth in Y E3: Over secretion of hormone R causes gigantism in X	1 1 1	3
e)	F-its secreted hormones which control the activities of other endocrine glands to secrete their hormones E-FSH control the secretion of estrogen in ovary (or any other examples)	1 1	2

3(a)(i)	P: Thyroxine Q : ADH // FSH // LH	1 1	2
(ii)	Goiter	1	1
(iii)	Taking enough iodine in our diet	1	1
(b)		1	1
c)	P1: From 0 to 60 minutes, the blood glucose level increases more than the normal level P2: islet cells in gland R is stimulated to secrete insulin P3: insulin stimulates the conversion of excess glucose to glycogen (in the liver) P4: this cause the glucose level to return to the normal level at the 90 th minute	1 1 1 1	Max 3
d(i)	The blood osmotic pressure increases	1	1

(ii)	P1: The osmoreceptor detects the increase in the osmotic blood pressure P2: Gland P is stimulated to release more ADH P3: ADH is transported by blood to the kidneys P4: ADH increases the permeability of the wall of the distal convoluted tubule and collecting ducts	1 1 1 Max 3	3
		12	

4(a)(i)	Dialysis machine	1	1
(ii)	P1: During haemodialysis, patient's blood is pumped out from the artery in the arm and flow into dialysis machine P2: the blood flow through semipermeable tube in the machine P3: blood has higher concentration of urea and salts P4: urea and salts diffuse out through the semipermeable tube into dialysis fluid P5: dialysis fluid contain lower concentration of urea and salts compare to the blood P6: the blood is returned back in the body through vein in the same arm P7: concentration of urea and salts in the blood // blood osmotic pressure back to normal range	1 1 1 1 1 1	Max 3
b(i)	Volume of urine is less and concentrated	1	1
(ii)	P1: salted "sup tulang" caused the blood osmotic pressure increase P2: more ADH secreted by pituitary gland P3: wall of nephron in kidneys become more permeable to water P4: more water reabsorb into the blood capillary by osmosis	1 1 1 1	Max 3
C(i)	Notes : 3 labels correct 2 labels correct 1 label correct	2 1 0	2
(ii)	P1: all glucose and amino acids are reabsorbed into blood capillary P2: at proximal convoluted tubules	1 1	2

			12
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5(a)(i)	Auxin	1	1										
(ii)	<table border="1"> <tr> <td>Tip of shoot</td> <td>Negative geotropism</td> </tr> <tr> <td>Tip of root</td> <td>Positive geotropism</td> </tr> </table>	Tip of shoot	Negative geotropism	Tip of root	Positive geotropism	1 1	2						
Tip of shoot	Negative geotropism												
Tip of root	Positive geotropism												
(b)	P1: hormone X accumulate at lower side P2: because of gravity forces P3: a high concentration of auxins inhibits the elongation of cell in the root P4: the upper side of the roots grows faster than the lower side P5: the young root curves and grows downward	1 1 1 1 Any 2	2										
c(i)	Parthenocarpy	1	1										
(ii)	<table border="1"> <tr> <td>Diagram (a)</td> <td>Diagram (b)</td> </tr> <tr> <td>F1: Do not use hormone</td> <td>Using hormones</td> </tr> <tr> <td>P2: pollination occur</td> <td>Sprayed with auxins on stigma and ovary to form fruit</td> </tr> <tr> <td>F2: Double fertilization</td> <td>Without fertilisation</td> </tr> <tr> <td>P3: involved pollen grain and egg cells</td> <td>Do not involved pollen grains</td> </tr> </table>	Diagram (a)	Diagram (b)	F1: Do not use hormone	Using hormones	P2: pollination occur	Sprayed with auxins on stigma and ovary to form fruit	F2: Double fertilization	Without fertilisation	P3: involved pollen grain and egg cells	Do not involved pollen grains	1 1 1 1 Any 3	3
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F1: Do not use hormone	Using hormones												
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P3: involved pollen grain and egg cells	Do not involved pollen grains												
(iii)	P1: reduce biodiversity P2: less variation P3: no natural selection // not involve male gamete and female gamete by randomly P4: become extinct	1 1 1 1	Any 3										

b) Essay

1(a)	P1: Nerve impulses arrive at the axon terminal of (presynaptic) neurone P2: causes the synaptic vesicles to move towards the (presynaptic) membrane and fuse with the membrane P3: neurotransmitter /acetylcholine (examples) molecules are released from synaptic vesicles P4: (The neurotransmitter molecules) diffuse across the	1 1 1 1	6
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	synaptic cleft into the postsynaptic knob/dendrite /cell body of neighbouring neurone P5: the neurotransmitter molecules bind to specific receptor sites in the postsynaptic knob P6: the binding triggers/generates new nerve impulses P7: the impulses then move along the postsynaptic neurone P8: the release of neurotransmitter is in one direction, from the synaptic knob to the postsynaptic neurone P9:mitochondria in the synaptic knob generate ATP / energy to synthesis neurotransmitter molecules	1 1 1 1 1 Any 6	
(b)(i)	P1:tindakan balas yang cepat/serta merta/automatic P2: hanya melibatkan saraf tunjang //tidak melibatkan otak	1 1	2
(ii)	P1: Sakit adalah rangsangan P2: Reseptor mengesan rangsangan / sakit P3: dan mencetuskan impuls (saraf) P4 : Aferen neuron menghantar impuls ke interneuron / saraf tunjang P5: impuls dipindahkan merentasi sinaps (dalam jirim kelabu)//neuron aferen bersinaps bersinaps dengan interneuron dan kemudian bersinaps dengan neuron eferen P6: neuron eferen menghantar impuls ke efektor / otot/ biceps P7: bisep akan mengecut P8: lalu menarik lengan daripada objek tajam	1 1 1 1 1 1 1 1 1 1	8
(iii)	F1: P is afferent neurone which transmits nerve impulse from the receptors to the interneurone E1: If P damaged, impulse from receptor cannot be transferred to the intereurone E2: (As a result), individual A cannot feel any pain F2: R is efferent neurone which transmits nerve impulse from interneurone to the effector E1: If R damaged, impulse from interneurone cannot be transferred to the effector E2: (As a result), individual A cannot withdraw the finger // pull the hand away from the pointed needle	1 1 1 1 1 1 1	6

2(a)				1 0									
		Diagram (a)	Diagram (b)										
F1	Knee jerk reflex	Withdraw finger from a sharp needle reflex		1									
E1	Leg swings forward // knee jerk while the hand is withdrawn from the sharp needle			1									
F2	Involved afferent and efferent neurone / two types	Involved afferent, interneurone and efferent neurone / three types of neurone		1									
E1	Receptor detect the stimulus and triggers a nerve impulse			1									
E2	Afferent neurone carries impulse from receptor to the spinal cord			1									
E3	Synapses with the efferent neurone (in grey matter) / synapse with the efferent neurone (in grey matter)			1									
E4	Efferent neurone carries impulse from spinal cord to effector			1									
E5	Stimulates the quadriceps / biceps muscle to contract			1									
F3	Produce response faster	Produce response fast		1									
E1	Involved one synapse id diagram (a) while two synapse is diagram (b)			1									
(b)(i)	Tindakan terkawal	Tindakan luar kawal		2									
	Makan	Muntah		1									
	Berlari	Peristalsis		1									
(ii)	<p>Persamaan: P1: Kedua-dua tindakan terkawal dan tindakan luar kawal melibatkan koordinasi sistem saraf P2:Kedua-dua tindakan terkawal dan tindakan luar kawal merupakan gerakbalas terhadap rangsangan yang diterima</p> <p>Perbezaan</p> <table border="1"> <tr> <td>Tindakan terkawal</td> <td>Perbezaan</td> <td>Tindakan luar kawal</td> </tr> <tr> <td>Mengikut kemahuan seseorang</td> <td>Cara berlaku</td> <td>Tidak mengikut kemahuan seseorang</td> </tr> <tr> <td>Berlaku di bawah kesedaran seseorang</td> <td>Kesedaran</td> <td>Berlaku secara tidak disedari</td> </tr> </table>		Tindakan terkawal	Perbezaan	Tindakan luar kawal	Mengikut kemahuan seseorang	Cara berlaku	Tidak mengikut kemahuan seseorang	Berlaku di bawah kesedaran seseorang	Kesedaran	Berlaku secara tidak disedari		8
Tindakan terkawal	Perbezaan	Tindakan luar kawal											
Mengikut kemahuan seseorang	Cara berlaku	Tidak mengikut kemahuan seseorang											
Berlaku di bawah kesedaran seseorang	Kesedaran	Berlaku secara tidak disedari											
				1									
				1									
				1									
				1									
				1									

	Serebrum	Pusat integrasi	Medula oblongata	1
	Rangsangan luar	Rangsangan	Rangsangan dalam	
	Organ deria	Reseptor	Reseptor dalam yang khusus	
	Otot rangka	Efektor	Otot licin, otot kardiak dan kelenjar	

	P12: brain more alert to mobilise body into immediate action/ run away from the dog		
--	---	--	--

3(a)	<p>F1: Nervous system P1: Consists of brain, spinal cord and neurons P2: stimulates by external stimuli P3: Send information in the form of electrical impulses P4: Impulses is transmitted via neurones to effector</p> <p>F2: Endocrine system P5: Consists of endocrine glands // glands without ducts P6: Stimulates by internal stimuli P7: Send information in the form of chemical impulses / hormones P8: Hormones is transported by blood to target organ</p>	1 1 1 1 1 1 1 1 1	6
(b)	<p>P1: Stimuli is detected by hypothalamus P2: Hypothalamus send impulse through sympathetic nervous system to the effector / heart / respiratory muscle / blood vessel P3: Hypothalamus send nerve impulse to adrenal medulla P4: Adrenal medulla secretes adrenaline and noradrenaline P5: Both hormones are sent to target organ / heart / respiratory muscle / blood vessel through blood P6: these two system cooperate with each other P7: causes increase in blood glucose level P8: Causes blood vessels constriction to increase the blood pressure P9: causes respiratory muscles to contract and relax faster // increase breathing rate P10: causes heart to pump faster // increase heart rate P11: to transport more oxygen and glucose to the skeletal muscle and brain</p>	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	8

4(a)(i)	<p>-Mekanisme pembetulan untuk mengembalikan keadaan persekitaran dalam menjadi normal -Apabila aras glukosa dalam darah meningkat, mekanisme pembetulan akan menurunkan semula aras glukosa kepada normal// -Apabila aras glukosa dalam darah menurun, mekanisme pembetulan akan meningkatkan semula aras glukosa kepada normal</p>	1 1 1	2
(ii)	<p>-Hormon X ialah insulin - Hormon Y ialah glucagon -Apabila aras glukosa dalam darah meningkat daripada aras normal, (sel beta pada kelompok sel Langerhans) di pancreas merembeskan hormone X ke dalam darah -di hati, hormone X menukarkan glukosa berlebihan dalam darah kepada glikogen untuk disimpan di sel-sel hati dan sel-sel otot - aras glukosa dalam darah menurun semula dan kembali ke aras normal -Apabila aras glukosa dalam darah menurun daripada aras normal, (sel alfa pada kelompok sel Langerhans di) pancreas merembeskan hormone Y ke dalam darah -di hati, hormone Y, menukarkan glikogen kepada glukosa -aras glukosa dalam darah meningkat semula dan kembali ke aras normal</p>	1 1 1 1 1 1 1 1 1 1 1 1	8
(b)(i)	<p>P1: sweat glands are stimulated to produce sweat P2: Evaporation of sweats gives a cooling effect to the body / excess body heat is lost P3: Vasodilation occurs / blood capillaries dilate and increase their diameter P4: More blood flows near body surface, excess heat is lost through conduction and radiation to the environment P5: Hair erector muscles relax, hair lie flat P6: Only a thin layer of air is trapped between the hair // Heat loss through conduction</p>	1 1 1 1 1 1 1	5

	and radiation to the environment is increased		
(ii)	P1: skeletal muscles are stimulated to contract and relax frequently causing shivers P2: Heat is produced to increase the body temperature P3: Adrenal gland is stimulated to secrete adrenaline P4: which speed up the conversion of glycogen to glucose P5: this increases the metabolic rate and increases heat production P6: thyroid gland is stimulated to produce thyroxine P7: this increases the metabolic rate and increases heat production	1 1 1 1 1 1 Any 5	5
(c)	- X is the pancreas gland - it secretes insulin and glucagon hormones -if the concentration of glucose higher (exceed 80mg/100cm ³). X glands secrete insulin to convert excess glucose to glycogen then store in liver -if glucose concentration is lower (less than 80 mg/100cm ³), X glands secrete glucagons hormone to convert glycogen in liver to glucose	1 1 1 1 Any 4	4

5(a)	-Auxins are produce in the apical meristem of the root tip (in the cell division zone) -the high concentration of auxin in the shoot tip stimulate cell elongation but the high concentration of auxin in the root tips inhibits cell elongation -the stimulation of light cause auxins diffuse away from light -(therefore) the concentration of auxins higher in the shaded region/light protected region// the rate of cell elongation is higher (to cause root tip bend)	1 1 1 1	4						
(b)	<table border="1"> <thead> <tr> <th>Type of hormones</th> <th>Function</th> <th>Uses in agriculture</th> </tr> </thead> <tbody> <tr> <td>Auxins</td> <td>(a)Stimulate growth and cell elongation. Auxins promote elongation of cells in shoots and roots</td> <td>To promote growth in plants</td> </tr> </tbody> </table>	Type of hormones	Function	Uses in agriculture	Auxins	(a)Stimulate growth and cell elongation. Auxins promote elongation of cells in shoots and roots	To promote growth in plants	1	6
Type of hormones	Function	Uses in agriculture							
Auxins	(a)Stimulate growth and cell elongation. Auxins promote elongation of cells in shoots and roots	To promote growth in plants							

	b)Stimulate the growth of adventitious roots	To promote the growth of adventitious roots, so that the cuttings may grow faster	1
	c) Stimulate ovaries in flowers to form fruits without being fertilised. The process is called parthenocarpy	The stigma and ovaries of certain flowers are sprayed with auxins to form fruits without being fertilised	1
	d)inhibit the growth of weeds in high concentration	Used as a herbicide (weed killer)	1
	e)prevent the developing fruits and leaves from falling off prematurely	Sprayed on fruits a few days before harvest to ensure the fruits do not fall off the plant before they are ripe	1
	a)stimulates the ripening of fruits	Sprayed in air-tight storage rooms with fruits such as bananas, water melon and tomatoes to stimulate the ripening of fruits.	1
	b)Stimulate the falling of (abscission) of leaves and fruits	Sprayed on fruits before harvest to promote abscission	1
	a)stimulate cell division and cell elongation	Used in tissue culture to promote cell division and growth	1

		b)delay the aging and death (senescence) of leaves	Sprayed on vegetables to ensure that the leaves are green and fresh during packaging		
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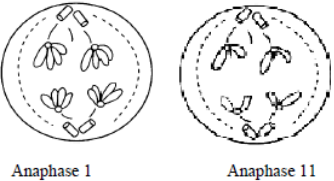
(d)	-to inhibit the secretion of FSH and LH from pituitary gland -no development of follicle / secondary oocyte -then the secretion of oestrogen is reduced -repair / rejuvenation of endometrium is not happened -hence no new embryo develops	1 1 1 1	3
(e)	- the sperms are collected from the husband / taken from sperm banks -and inserted directly into the fallopian tube of the wife during ovulation phase	1 1	2

CHAPTER 4

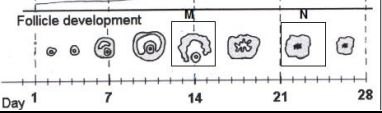
a)Objective

1.	B	2.	C	3.	B	4.	D	5.	D
6.	B	7.	D	8.	B	9.	B	10.	C
11.	B	12.	B	13.	D	14.	C	15.	D
16.	A	17.	A	18.	D	19.	A	20.	B
21.	D	22.	A	23.	B				

b) Structure

1(a)(i)	P: Chromatid / chromosome Q: Centromere	1 1	2
(ii)	Prophase 1	1	1
(iii)	F: Crossing over E: exchange of genetic material occur // forming new genetic composition	1 1	2
(b)	 Anaphase 1 Anaphase 1	1 1	2
(c)(i)	Testis	1	1
(ii)	M: mitosis N : differentiation	1 1	2
(iii)	Primary spermatocyte : 46 Sperm : 23	1 1	2

3(a)	P :Graafian follicle R: Corpus luteum	1 1	2
(b)	P1: by ovulation P2: due to high concentration of LH P3: Cause rupture of Graafian follicle	1 1 1	2
C(i)	P1: R secretes progesterone P2: to thicken the endometrium P3: for implantation of embryo in uterus	1 1 1	2
(ii)	P1:placenta will take over the role of R P2: by secreting progesterone P3: to maintain the thickness of endometrium	1 1 1	2
d)	P1: colostrum is rich with antibodies from mother P2: provide temporary immunity to baby against infection P3: give passive natural immunity	1 1 1	2
e)	P1: carry out in vitro fertilisation (IVF) or GIFT P2: ovum from the wife and sperm from the husband are fertilised in the test tube containing culture solution P3: then embryo is inserted into the wife's uterus for implantation	1 1 1	2

2(a)	P: LH/ Luteinising hormone R: oestrogen	1 1	2
(b)		1	1
c)	-after ovulation, M/ corpus luteum secretes S / progesterone -the level of S/progesterone increases to maintain the thickness on the endometrium -when the M/corpus luteum degerates, the level of S/progesterone decreases, the endometrium begin to disintegrate	1 1 1	3

4(a)	A: ovulation B: secondary oocyte / ovum C : fallopian tube 3 correct =2 marks 2correct = 1 mark	2	2
(b)(i)	Mitosis	1	1
(ii)	Circle / Mark on along the fallopian tube	1	1
(iii)	-zygote undergoes series of mitosis - to produce solid ball /morula -the growing mass of hundreds of cells forms a hollow ball / blastocysts	1 1 1	3

c)	-2 ovum/eggs are fertilized by two different sperms -these zygotes will implant in the endometrium -each foetal have developed in their own placenta	1 1 1	3
(d)	-forms a selective barrier between the mother's blood and the foetal blood -allows some substance / oxygen / nutrient / glucose / amino acid / lipid / vitamin/ antibodies/ to pass from mother to the foetus -allows substances / carbon dioxide / nitrogenous waste materials / urea to pass from the foetus to the mother -secretes progesterone and estrogen to maintain the thickness of uterine wall -to prevent the action of maternal hormones other chemical in the mother's blood that can harms the development of the foetus -to protect the foetus from the high blood pressure of the maternal circulation that can cause the foetal capillaries burst	1 1 1 1 1 1 1 1	Any 2 2
			12

	P4: when pollen tube reaches the embryo sac, pollen tube will enter ovule through micropyle P5: tube nucleus degenerate and the end of the pollen tube burst	1	
c)	F1: R contain ovum and two polar nuclei while in ovary of human contain ovum only P1: one male gamete fertilises with ovum (to form diploid zygote) P2: the other male gamete fertilise with two polar nuclei (to form triploid nucleus) P3: while in human male gamete /sperm only fertilise with ovum F2: Fertilisation in R produce diploid zygote and triploid nucleus while in human produce diploid zygote only	1 1 1 1	3
(d)	P1: Fruit cover seeds P2: and help to disperse the seeds apart from the tree P3: to avoid intraspecific competition P4: and ensure the successfulness of plant survival in new habitat	1 1 1 1 Any 2	2

5(a)(i)	Organ	1	1										
(ii)	<table border="1"> <tr> <td>Sexual reproduction</td> <td>Asexual reproduction</td> <td>1</td> <td rowspan="3">1</td> </tr> <tr> <td>Fertilisation occur</td> <td>No fertilisation occur</td> <td>1 Any 1</td> </tr> <tr> <td>Involves gametes</td> <td>Not involves gamete</td> <td></td> </tr> </table>	Sexual reproduction	Asexual reproduction	1	1	Fertilisation occur	No fertilisation occur	1 Any 1	Involves gametes	Not involves gamete			
Sexual reproduction	Asexual reproduction	1	1										
Fertilisation occur	No fertilisation occur	1 Any 1											
Involves gametes	Not involves gamete												
b(i)	F: by meiosis P1: P contain pollen mother cell / diploid microsporocyte cell P2: to produce four haploid cells	1 1 1	2 Any 2										
(ii)	F: pollination occur P1: mature pollen contains tube nucleus and generative nucleus P2: germinate and form pollen tube (at Q) P3: Generative nucleus divides by mitosis to form two male gametes	1 1 1 1	3 Any 3										

6(a)	Organ pembiakan jantan : stamen Organ pembiakan betina : pistil / karpel	1 1	2
(b)(i)	Permukaan debunga yang kasar	1	1
(ii)	P1: (debunga yang melekat pada stigma) merangsang tiub debung bercambah P2: membentuk tiub debunga P3: hujung tiub debunga akan merembeskan enzim yang mencerna tisu stil P4: supaya tiub debunga memanjang ke arah ovul	1 1 1 1 Any 2	2
c(i)	P1: Q ialah nucleus penjana P2 : membahagi secara mitosis P3 : membentuk dua nuklues / gamet jantan	1 1 1	2
(ii)	P1: (percantuman satu gamet jantan dengan dua nucleus kutub) menghasilkan (tisu) endosperma P2 : endosperma berkembang menjadi tisu penyimpan makanan P3: membolehkan biji benih bercambah P4: menjamin kejayaan biji benih menjadi anak tumbuhan	1 1 1 1 Any 3p	3

(d)	P1: ovul berkembang menjadi biji benih	1	2
	P2: integument berkembang menjadi kulit biji benih / testa	1	

c) Essay

1.	F1: X is follicle development (day 6 to 14)	1	Max 10
	P1: Primary follicle in the ovary develop into Graafian follicle which is stimulated by FSH	1	
	P2: primary oocyte (in the primary follicle) will develop and become secondary oocyte (in Graafian follicle)	1	
	P3: development of follicle in the ovary stimulate the secretion of oestrogen	1	
	P4: oestrogen helps repair endometrium wall after menstruation	1	
	P5: when the concentration of estrogen started to increase, production of FSH started to decrease	1	
	P6: development of follicle stopped	1	
	P7: when the concentration of estrogen is high enough, its stimulate the production of LH by pituitary gland / and inhibit the production of FSH	1	
	F2: Y is ovulation (day 14)	1	
	P8: stimulate by high level of LH	1	
	P9: stimulate Graafian follicle to release secondary oocyte into fallopian tube	1	
	P10: After ovulation, Graafian follicle become corpus luteum	1	
	F3: Z is corpus luteum stage (day 15 to 28)	1	
	P11: Corpus luteum secrete progesterone continuously	1	
	P12: Progesterone stimulate formation of more endometrium tissues and blood capillaries	1	
	P13 : to increase / maintains the thickness of endometrium wall for implantation of embryo	1	
	P14: If fertilisation occurs, corpus luteum remain and continue to secrete progesterone	1	
	P15: that maintain the thickness of endometrium wall	1	

	P16: progesterone inhibit secretion of FSH and LH by pituitary gland //prevents ovulation and development of another follicle during pregnancy	1		
	P17: if fertilisation does not occur, corpus luteum degenerate and level of progesterone decrease	1		
	P18: endometrium wall breakdown and excrete from the body as menstruation (during first day of menstrual cycle)			
	Any 1P from any F			
b)	F1: no fertilisation occurs in fallopian tube	1	Max 4	
	P1: secondary oocyte is not fertilised	1		
	P2: secondary oocyte is not released from ovary into fallopian tube	1		
	P3: ovulation does not take place	1		
	F2: No pregnancy	1		
	P4: due to zygote failed to implant in the uterus	1		
	P5: endometrium will not thicken and development of more blood capillaries does not take place	1		
	F3: no menstruation	1		
	P6: Endometrium wall does not breakdown	1		
	P7 : secretion of hormones FSH/LH/estrogen are not stimulated to produce	1		
				20

2.	F –in vitro technique		
	P1-means fertilization occurs outside of the body		
	P2: wife was injected with hormone to fasten the development of the secondary oocyte. Ovum in ovary		
	P3:secondary oocyte /ovum release out by using laparoscope (from ovary before ovulation)		
	P4: sperms from husband fertilize with the secondary oocyte in a petri dish (contains culture medium)		
	P5: (after fertilization) zygote will divide by mitosis		
	P6: (after 2 days) formed embryo until 8 cells stage		

P7: embryo transferred to the endometrium of the uterus wall through cervix (using pipette)		
P8: embryo implanted at the endometrium of uterus wall and develop		
P9: baby that is delivered is call test tube baby		
P10: the technique is complicated / expensive and the probability of success is low		

3(a)	<table border="1"> <thead> <tr> <th>Parts</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>P is anther</td> <td>-to produce pollen grains for fertilization -as male reproductive organ</td> </tr> <tr> <td>Q is ovary</td> <td>-contain ovule/embryo sac fertilization -Becomes fruits after fertilization -as female reproductive organ</td> </tr> <tr> <td>R is petal</td> <td>-colourful to attract pollination agent/insects for pollination</td> </tr> </tbody> </table>	Parts	Function	P is anther	-to produce pollen grains for fertilization -as male reproductive organ	Q is ovary	-contain ovule/embryo sac fertilization -Becomes fruits after fertilization -as female reproductive organ	R is petal	-colourful to attract pollination agent/insects for pollination	2	6
	Parts	Function									
	P is anther	-to produce pollen grains for fertilization -as male reproductive organ									
	Q is ovary	-contain ovule/embryo sac fertilization -Becomes fruits after fertilization -as female reproductive organ									
R is petal	-colourful to attract pollination agent/insects for pollination										
		2									
		2									
(b)	<p>Formation of embryo sac</p> <p>F1: the ovule develops from ovarian tissue. It has a diploid embryo sac mother cell (2n)</p> <p>F2: embryo sac mother cell undergoes meiosis to form a row of four haploid cells called megaspores</p> <p>F3: three of the four megaspores degenerated, leaving one in the ovule</p> <p>F4: the megaspore continuous to grow and enlarges, filling up most of the ovule). The nucleus of the megaspore then undergoes mitosis three times to form eight haploid nuclei</p> <p>F5: three of the eight nuclei (migrate to one end of the cell) to form antipodal cells, another two nuclei to form polar nuclei and one of the three nuclei develops into an egg cell/female gamete/ovum and flanked two synergid cells</p> <p>Formation of pollen grain</p>	1 1 1 1 1 1	10								

F1: pollen grain are formed in the anther, an anther has four pollen sacs	1		
F2: Each pollen sac contains hundreds of cells called pollen mother cells (2n)	1		
F3: Each pollen mother cell undergoes meiosis to produce four haploid microspores (n)	1		
F4: the nucleus of each microspores then divided by mitosis to form a tube nucleus and generative nucleus	1		
F5: the microspores develop into pollen grains			
(c)	<p>P1: when pollen/pollen grains landed on stigma, sucrose solution is secreted</p> <p>P2: to stimulate germination of pollen</p> <p>P3: pollen tube grows from the pollen</p> <p>P4: in the pollen tube, generative nucleus divides by mitosis to form two male gametes</p> <p>P5: the pollen tube nucleus leads the male gametes towards the ovary</p> <p>P6: when the pollen tube reach the ovary, the tube nucleus disintegrates and burst open the pollen tube</p> <p>P7: to allow the male gametes to enter the ovary through the micropyle</p>	1 1 1 1 1 1 1	4 Any 4
(d)	<p>P1: penebungaan berlaku//butir debunga dari anter dipindahkan ke stigma (bunga yang sama)</p> <p>P2: debunga matang mengandungi dua nukleus iaitu nukleus tiub dan nukleus penjana</p> <p>P3: (debunga di atas stigma akan) bercambah membentuk tiub debunga</p> <p>P4: percambahan ini dirangsang oleh sukrosa/rembesan bergula (dari sel epidermal stigma)</p> <p>P5: tiub debunga tumbuh dalam stil kearah ovari</p> <p>P6: nukleus tiub mengawal arah pertumbuhan tiub debunga</p> <p>P7: semasa pertumbuhan tiub debunga, nukleus penjana membahagi/ mitosis menghasilkan 2 nukleus/gamet jantan (haploid)</p> <p>P8: Dua gamet jantan bergerak (mengikuti nukleus tiub dalam tiub debunga) sehingga ke pundi</p>	1 1 1 1 1 1 1 1	10 Any 10

	-mitosis: the cells in human undergo mitosis all the time, but in insect, mitosis only occurred at certain time (during ecdydis) -absorption of air: in human, there are no absorption of air, but in insect, during ecdysis	1	
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	plant that undergo secondary growth live longer P7: produce large quantities of fruit for local consumption and export	1	
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CHAPTER 5

a)Objective

1.	B	2.	A	3.	B	4.	A	5.	B
6.	A	7.	C	8.	D	9.	B	10.	C
11.	D	12.	D	13.	A	14.	D	15.	A
16.	B	17.	A	18.	A	19.	C		

5(a)	F1:vascular cambium divides actively radially E1: forming cambium ring / intervacular cambium F2: Cambium cells divides tangently E2: cell in the outside differentiate to form secondary phloem E3: while the inner cell differentiate to form secondary xylem E4: primary xylem pushed towards the pith E5: and primary phloem pushed towards the epidermis E6: the walls of secondary xylem will be thickened with lignin E7: this give tissues mechanical strength to support the plant E8: the tissues outside become increasingly compressed E9: the circumference /diameter increased caused the epidermis to be stretched E10:the ruptured epidermis will be replaced by cork as a result of the activity of cork cambium F3: cork cambium divides tangently E11: form secondary cortex/ inner cell and cork/outer cell		6
(b)	P1: increase the diameters of the plant stems and roots for additional mechanical support P2: produces secondary xylem called wood to support and strengthen the growing plant P3:produces more secondary phloem and secondary xylem to accommodate the increase in demand for water, mineral and organic nutrient P4: produced new phloem and xylem tissues to replace old and damaged ones P5: produces a thick and tough bark which reduces evaporation of water from the surface of stem, also protects the plant against of insect and parasite fungi P6: increase the opportunities to produce seeds and propagate as	1 1 1 1 1 1	4

b) Structure

1	S: Ww T : ww U : ww V : Ww	3-4 Correct 1-2 correct	2 1	2
(b)	<p>Parent Walnut comb Ww X Walnut comb Ww</p> <p>Gamete W w W w</p> <p>F1 WW Ww Ww ww</p> <p>Walnut comb Walnut comb Walnut comb Pea comb</p> <p>Genotype ratio : 1 WW:2Ww:1ww</p> <p>Phenotype ratio: 3 walnut comb: 1 pea comb</p>		1 1 1 1 1	5
c)	F: Allele W is dominant to allele w E1: If organism is homozygote dominant/ WW or heterozygote/Ww it shows the phenotype Walnut comb E2: if organism is homozygote / ww it shows the phenotype pea comb		1 1 1 Any 2	2
d)	F: both of their parent are walnut comb with genotype Ww E1: both their gamete have recessive allele w E2: when gamete w are fertilized with another		1 1 1	2

	gamete w, we can get chicken with pea comb	Any 2	
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	P1: Able to obtain good characteristics that can be used commercially (selectively) P2: can be conducted anytime does not need any pollinating agent as it carried out in the laboratory (F+any P)	1	
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2a(i)	Dominant : Black eyes, normal wings Recessive : Red eyes, short wings	1 1	2																									
a(ii)	MN,Mn,mN,mn Notes : 4 correct = 2 marks 2-3 correct = 1 mark 1 correct = 0 mark	2	2																									
(b)	<table border="1"> <tr> <th>Gamete</th> <th>MN</th> <th>mN</th> <th>Mn</th> <th>mn</th> </tr> <tr> <th>MN</th> <td>MMNN</td> <td>MmNN</td> <td>MMNn</td> <td>MmNn</td> </tr> <tr> <th>mN</th> <td>MmNN</td> <td>mmNN</td> <td>MmNn</td> <td>mmNn</td> </tr> <tr> <th>Mn</th> <td>MMNn</td> <td>MmNn</td> <td>MMnn</td> <td>Mmnn</td> </tr> <tr> <th>mn</th> <td>MmNn</td> <td>mmNn</td> <td>Mmnn</td> <td>mmnn</td> </tr> </table> <p>Notes: All gametes correct = 1 mark All genotypes correct = 1 Mark</p>	Gamete	MN	mN	Mn	mn	MN	MMNN	MmNN	MMNn	MmNn	mN	MmNN	mmNN	MmNn	mmNn	Mn	MMNn	MmNn	MMnn	Mmnn	mn	MmNn	mmNn	Mmnn	mmnn	1	1
Gamete	MN	mN	Mn	mn																								
MN	MMNN	MmNN	MMNn	MmNn																								
mN	MmNN	mmNN	MmNn	mmNn																								
Mn	MMNn	MmNn	MMnn	Mmnn																								
mn	MmNn	mmNn	Mmnn	mmnn																								
C(i)	1:1	1	1																									
(ii)	9:1	1	1																									
(iii)	Mmnn, MMnn	1	1																									
d(i)	Mutation	1	1																									
(ii)	P1: X-rays causes changes in the genetic composition / genotype P2: the mutated genetic composition will be inherited to the offspring	1 1	2																									

4(a)	DNA	1	1										
(b)	Carbon, hydrogen, oxygen, nitrogen and phosphorus	1	1										
(c)	-Carry genetic information -Direct protein synthesis	1 1	2										
(d)	Nucleotide	1	1										
(e)i	X : Phosphate group Y : pentose sugar/ sugar Z: Nitrogenous base	1 1 1	3										
(iii)	Z	1	1										
e)	RNA	1	1										
f)	<table border="1"> <tr> <th>P</th> <th>Q</th> </tr> <tr> <td>Adenine</td> <td>Thymine</td> </tr> <tr> <td>Cytosine</td> <td>Guanine</td> </tr> <tr> <td>Thymine</td> <td>Adenine</td> </tr> <tr> <td>Guanine</td> <td>Cytosine</td> </tr> </table>	P	Q	Adenine	Thymine	Cytosine	Guanine	Thymine	Adenine	Guanine	Cytosine	1 1 Any 2	2
P	Q												
Adenine	Thymine												
Cytosine	Guanine												
Thymine	Adenine												
Guanine	Cytosine												

3(a)	P1: haemophilia is inherited by a recessive allele that P2: linked to the X chromosome	1 1	2
b(i)	<p>Genotype of parents : Father (X^HY) Mother (X^HX^h) Gametes : X^H, Y and X^H, X^h Genotype of offspring : X^HX^H, X^HX^h, X^HY, X^hY</p>	1 1 1	3
(ii)	25%	1	1
c)	P1: none of the girls are carriers because they receive one dominant allele (X ^H) from their father And P2: one dominant allele (X ^H) from their mother P3:None of the boys are haemophiliacs because they receive dominant allele (X ^H) from their mother	1 1 1	3
d)	F: tissue culture	1 1	2

c) Essay

1(a)(i)	<table border="1"> <tr> <th></th> <th>Genotip</th> <th>Fenotip</th> </tr> <tr> <td>Q</td> <td>I^AI^O</td> <td>Kumpulan darah A</td> </tr> <tr> <td>R</td> <td>I^BI^O</td> <td>Kumpulan darah B</td> </tr> <tr> <td>S</td> <td>I^OI^O</td> <td>Kumpulan darah O</td> </tr> </table>		Genotip	Fenotip	Q	I ^A I ^O	Kumpulan darah A	R	I ^B I ^O	Kumpulan darah B	S	I ^O I ^O	Kumpulan darah O	1 1 1	3
	Genotip	Fenotip													
Q	I ^A I ^O	Kumpulan darah A													
R	I ^B I ^O	Kumpulan darah B													
S	I ^O I ^O	Kumpulan darah O													
(ii)	P1:Hukum Mendel Pertama menyatakan bahawa sesuatu ciri pada organisma ditentukan oleh sepasang alel P2:semasa pembentukan gamet, pasangan alel bersegregasi/berpisah semasa meiosis 1 P3:hanya salah satu alel sahaja daripada pasangan alel ini akan hadir dalam satu gamet	1 1 1	3												
b)	P1:Individu ini mengalami sindrom klinefeter P2: akibat berlebihan satu kromosom X	1 1	6												

P1: Makanan GMF mempunyai ciri-ciri pilihan/contoh yang bersesuaian	1	
P2: mempunyai kerintangan terhadap penyakit/serangan perosak	1	
P3: Penghasilan makanan yang mempunyai nutrisi yang tinggi	1	
P4: Hasil yang lumayan	1	
P5: mengurangkan masalah kekurangan makanan	1	
P6: Mana-mana jawapan yang sesuai		
Sekurang-kurang 1P		
Keburukan:	1	
B1: kepupusan spesies	1	
B2: perubahan kepada genetic manusia	1	
B3: kesan jangkamasa panjang /kesan sampingan terhadap kesihatan	1	
B4: penyalahgunaan teknologi untuk menguasai pasaran dunia	1	
B5: mana-mana jawapan yang sesuai		
Sekurang-kurang 1P		

	-Body height is controlled by many pairs of alleles but finger prints is controlled by a pair of alleles - Body height is a quantitative character (can be measured and graded from one extreme to the other) but type of finger prints is a qualitative character (they cannot be measured or graded from one extreme to the other)	2	Any 2
c)	- some individuals adapt better to environment condition -these individuals are better adapted for survival // they can transmit the advantageous genes to their offspring // camouflage from their predator	1 1	2
d)(i)	P: Deletion Q: Duplication	1 1	2
(ii)	-Mutation that occurs in a somatic cell (e.g. bone marrow of liver) may damage the cells -this makes the cell cancerous // kill the cell	1 1	2

2(a)	Genotype of black colour wing: BB / Bb Genotype of pale and speckled wing: bb	1 1	2
(b)	Dominant trait: Black colour wing E1: More number of moth are black colour // There are three black colour moth and only one pale and speckled wing // 75% of the moth have black colour wing while 25% of the moth have pale and speckled wing // the presence of dominant gene / B	1 1	2
C)	P1: both parents are heterozygous / have genotype Bb P2: during meiosis P3: the (male) gamete receive allele B or b // the (female) gamete receive allele B or b P4: during fertilization P5: the male gamete with allele b fused with female gamete with allele b(so the offspring has genotype bb// pale and speckled wing)	1 1 1 1 Any 3	3
d)	P1: to have varieties in colour of the moth // variation P2: better adaptation to the environment // camouflage P3: better survival of the species // Any suitable explanation (Any 1)	1 1 1	1

CHAPTER 6

a)Objective

1.	D	2.	B	3.	A	4.	A	5.	D
6.	B	7.	D	8.	C	9.	D	10.	D
11.	D	12.	B						

b) Structure

1(a)(i)	Discontinuous variation Continuous variation	1 1	2
(b)	-Differences in body height are not clear/ distinctive but differences in fingerprints are clear and distinctive -Body height is controlled by environmental and genetic factors but finger prints are controlled by genetic factors only -graph for body height shows normal distribution but graph for finger prints shows discrete distribution -body height shows intermediate characters but type of fingerprints do not show intermediate characters	2 2 2 2 2	4

e)(i)	Mutation / Deletion / Chromosomal mutation	1	1
(ii)	F1: mutagen is radioactive radiation // X-ray / formaldehyde / carcinogens/ monosodium glutamate // Any suitable example E1: the mutagen has high penetrating power//high radiation//mutagen able to reach the DNA in the cells/ nucleus /chromosomes E2: causing (drastic) change to the structure of the chromosome E3: resulting section P to be deleted //gene P to be missing	1 1 1 Any 3	3

c) Essay

1(a)(i)	Example of continuous variation : Height or weight	1	2
	Example of discontinuous variation : ABO Blood group	1	
	Differences :		
	Continuous variation	Discontinuous variation	
	Graph distribution shows a normal distribution	Graph distribution shows a discrete distribution	
	The character are quantitative / can be measured and graded (from one extreme to the other)	The characters are qualitative / cannot be measured and graded (from one extreme to the other)	
	Exhibits a spectrum of phenotypes with intermediate character	Exhibits a few distinctive phenotypes with no intermediate character	
	Influenced by environmental factors	Is not influenced by environmental factors	
Two or more genes control the same character	A single genes determines the differences in		

		the traits of the character		
	The phenotype is usually controlled by many pair of alleles	The phenotype is controlled by a pair of alleles		
(ii)	P1: variation provided better adaptation for organism to survive in the changing environment P2: variations are essential for the survival of species / to survive more successfully P3: variation will enable organism to explore a new habitat P4: to ensure organism survival from predator		1 1 1 1 Any 3	3
(b)	F1: meiosis P1: produce gamete with different genetic content P2: through homologous chromosomes random assortment during metaphase I F2: crossing over P3: two homologous chromosomes are paired up / synapsis during Prophase I P4: crossing over occurs between non-sister chromatids at the chiasma P5: chromatids break and rejoin in such a way that segments of chromatids are exchange // causing a genetic recombination P6: genes in chromosomes is altered and gametes with various combinations of chromosomes are produced F3: Fertilization P7: random fertilization between sperm and ovum P8: produce zygote with varies genetic material		1 1 1 1 1 1 1 1 1 1 1	1 0

2(a)	-thin parents can have fat son even though the son inherits genes for thinness from his parents -body size is affected by environmental factors -continuous variation -due to diet, the size of body changes	1 1 1 1	6
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	-the ability to roll tongue is determined by genetic factors	1	
	-alleles for the ability to roll tongue can be inherited	1	
	-genes for this characteristic is dominant	1	
	-hence, the son can roll his tongue		
(b)	-over the time, one species better adapted to the environmental changing -example: camouflage of colour protects themselves from predator -that particular (white/black) species increase their population while others cannot -white species /black species becomes dominant in their community		4

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