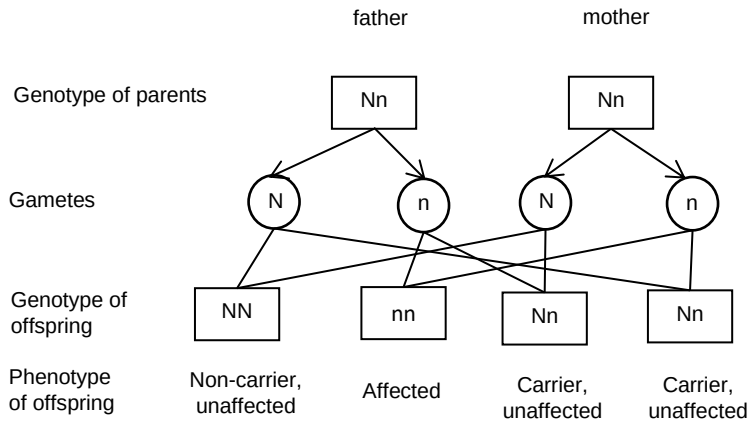
6093 Biology Yearly TYS 2021

No	Paper 1	Marks	Remarks
1	C	1	
2	B	1	
3	D	1	
4	D	1	
5	A	1	
6	D	1	
7	C	1	
8	C	1	
9	B	1	
10	A	1	
11	B	1	
12	A	1	
13	B	1	
14	B	1	
15	A	1	
16	D	1	
17	C	1	
18	A	1	
19	C	1	
20	D	1	
21	A	1	
22	A	1	
23	D	1	
24	D	1	
25	D	1	
26	C	1	
27	B	1	
28	C	1	
29	C	1	
30	C	1	
31	B	1	
32	C	1	
33	C	1	
34	B	1	
35	A	1	
36	C	1	
37	D	1	
38	B	1	
39	A	1	
40	D	1	
	Total	40	

	Paper 2 Section A		
No	**Answers**	**Marks**	**Remarks**
1a	P: vena cava Q: right atrium	1 1	
1b	contains oxygenated blood from the aorta; transporting oxygen and digested food/nutrients to heart muscles;	1 1	type content
1c	oxygen dissolves in the thin layer of moisture lining the alveolar walls; oxygen diffuses from the thin layer of moisture through the alveolar walls and the capillary walls into the bloodstream; oxygen diffuses into the red blood cells and combines with haemoglobin to form oxyhaemoglobin; red blood cells carry oxygen from the capillaries to the pulmonary veins to the left atrium, followed by left ventricle, out of the heart through the aorta to the renal artery to the kidneys;	1 1 1 1	dissolves in TLM diffuse out of alveoli diffuse into RBC pathway to kidney
1d	When blood vessels are damaged, damaged tissues and platelets releases thrombokinase, which catalysed the conversion of prothrombin into thrombin in the presence of calcium ions; thrombin catalyses the conversion of soluble fibrinogen into insoluble fibrin threads that entangle blood cells forming a clot;	1 1	action of thrombo-kinase action of thrombin
	Total	10	

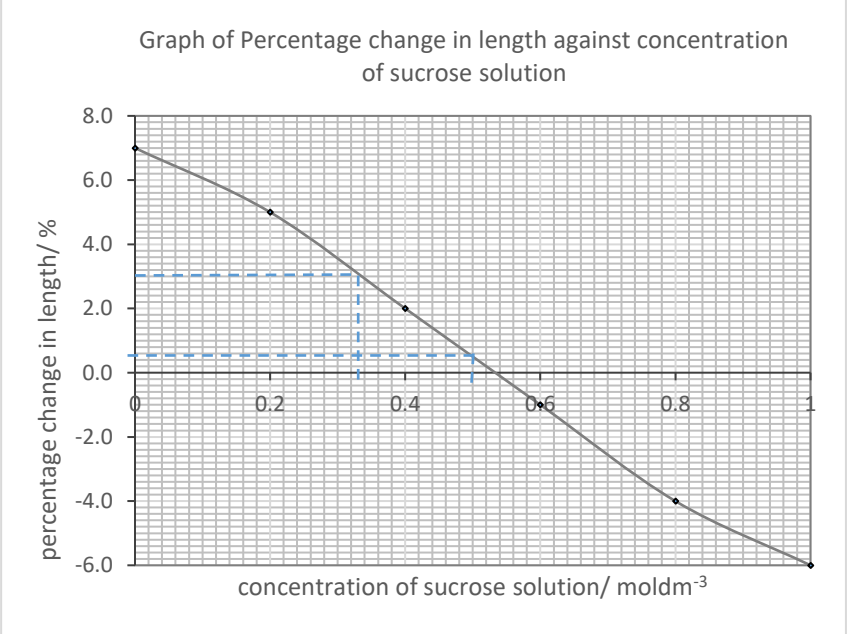
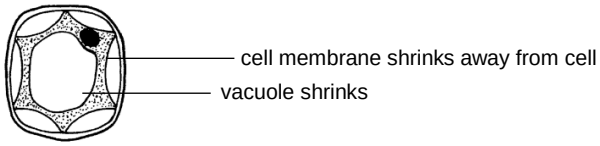
No	Answers (CLT)	Marks	Remarks
2ai	1 division → 90 au ÷ 36 divisions = 2.5 au 6 divisions → 2.5 au × 6 divisions = 15 au energy used for growth = 15 au/year	1	
2aii	heat/ thermal energy	1	
2aiii	90 – 15 – 25 = 50 au/year	1	
2b	$\frac{15}{90} \times 100\%$ $= 16.7\%$	1 1	
2c	when rate of respiration in animals increases due to increase movement/ <u>increase muscular contraction</u>, animal body temperature increases, resulting in an <u>increase in the release of heat from the body</u> by radiation, conduction and convection; restricting movement of animals will <u>reduce energy lost to the environment</u> in the form of heat and <u>increase energy available for growth</u>; <u>chemical potential energy</u> in food consumed by animals will be stored and used for <u>growth of muscle cells</u> resulting in <u>bigger size</u> animals that will produce <u>more meat</u> when slaughtered;	1 1 1	increase heat released reduce energy lost energy for growth
	Total	8	

No	Answers	Marks	Remarks
3a	B – salivary amylase; C – pancreatic amylase/ trypsin/ maltase/ lipase; A – pepsin;	2 2 2	
3b	digestive enzymes are specific in action whereby each chemical digestion is catalysed by a unique enzyme due to its three-dimensional shape; only a specific substrate can bind to the active site of enzyme to form an enzyme-substrate complex i.e. amylase can only bind to starch and maltase can only bind to maltose; digestive enzymes works best at an optimum temperature of about 37°C (body temperature) and at different optimum pH depending on location + denature at extreme pH values;	1 1 1	specificity e-s complex effect of pH & temp
	Total	9	

No	Answers	Marks	Remarks
4a		1 1 1 1	
4b	0.25 or 25% or ¼	1	
4c	mother can produce the enzyme needed to break down phenylalanine; enzymes <u>diffuses from the maternal blood system into the fetal blood system in the placenta</u> resulting in no build-up of amino acids in the fetal blood;	1 1	presence of enzyme diffusion
4d	Down's syndrome	1	
	Total	8	

No	Answers	Marks	Remarks
5a	Process by which metabolic waste products and toxic substances are removed from the body of an organism; Metabolism produces waste products which can be toxic when accumulated in the body and cause harm to the organism so must be removed immediately;	1 1	definition effect/ importance
5bi	one arrow labelled **T** to show direction from glomerulus to Bowman's capsule	1	
5bii	one arrow labelled **U** to show direction from PCT to blood capillaries	1	
5c	low concentration of ADH in the bloodstream stimulates cells in the walls of the **V** to become less permeable to water resulting in decrease water reabsorption from the **V** into the blood capillaries; high concentration of ADH in the bloodstream stimulates cells in the walls of the **V** to become more permeable to water resulting in increase water reabsorption from the **V** into the blood capillaries;	1 1	low ADH high ADH
5di	both dialysis fluid and blood plasma contains essential substances such as glucose, amino acids and mineral salts dissolved in water; dialysis fluid does not contain metabolic waste products but blood plasma contains metabolic waste products such as urea, uric acid, creatinine, excess water and excess mineral salts; dialysis fluid does not contain protein molecules but blood plasma contains protein molecules such as hormones;	1 1 1	similarity difference difference
5dii	maintains a steep concentration gradient for the removal of metabolic waste products from the blood; maintains a correct solute composition and water potential in the blood by allowing essential substances to diffuse from the dialysis fluid into the blood;	1 1	
	Total	11	

No	Answers	Marks	Remarks
6	a fragment of DNA in human chromosome that contains the insulin gene is obtainedby by using restriction enzymes to cut restriction site of insulin gene at the two ends of the gene to produce sticky ends;	1	cutting of insulin gene
	a plasmid from a bacterium is obtained by cutting plasmid with the same restriction enzymes producing complementary sticky ends to the ends of the insulin gene;	1	cutting of plasmid
	mix the plasmid with the DNA fragment containing the insulin gene to allow the DNA to bind to plasmid by the complementary base pairing between their sticky ends + DNA ligase is used to seal the bonds, forming a recombinant plasmid;	1	formation of recombinant plasmid
	mix recombinant plasmid with E.coli bacterium and apply temporary heat or electric shock to open up pores in the cell surface membrane of the bacterium for the plasmid to enter, forming a transgenic bacterium;	1	formation of transgenic bacterium
	Total	8	

	Section B		
No	**Answers**	**Marks**	**Remarks**
7ai		4	
	Axes labelled + all ticks labelled at equal intervals; Best fit line + no shading + smooth curve; All points plotted accurately; Maximise the size of grid provided;		
7aii	0.33 mol dm^{-3}	1	±0.1
7aiii	0.50 %	1	±0.1
7b	when water potential in the potato cells is <u>lower</u> than water potential in the sucrose solution, <u>water molecules enter</u> the potato cells <u>down water potential gradient by osmosis</u>; causing potato cells to <u>increase in length</u> resulting in the <u>positive percentage change</u> in length of potato strip; when water potential in the potato cells is <u>higher</u> than water potential in the sucrose solution, <u>water molecules leave</u> the potato cells <u>down water potential gradient by osmosis</u>; causing potato cells to <u>decrease in length</u> resulting in the <u>negative percentage change</u> in length of potato strip;	1 1 1	cause of increase length cause of decrease length both effects
7c	vacuole shrinks/ cell membrane shrinks away from cell wall 	1	
	Total	10	

<table>
<tr><th>No</th><th>Answers</th><th>Marks</th><th>Remarks</th></tr>
<tr><td>8a</td><td>
<table>
<tr><td>structure</td><td>name</td><td>explanation</td></tr>
<tr><td>1</td><td>hair</td><td>hair erector muscles in skin contract causing hair to stand on ends, trapping more air around the skin to reduce heat lost from the body</td></tr>
<tr><td>2</td><td>thermoreceptor</td><td>detect temperature changes; when stimulated, produces nerve impulses sent to the sensory neurone;</td></tr>
<tr><td>3</td><td>sensory neurone</td><td>transmits nerve impulses from the thermoreceptors to the relay neurone to stimulate hypothalamus;</td></tr>
<tr><td>4</td><td>subcutaneous fat</td><td>made up of adipose tissues that serves as an insulating layer to reduce heat loss</td></tr>
<tr><td>5</td><td>capillary</td><td>constriction of arterioles and dilation of shunt vessels causes less blood flow through the capillaries, reducing heat lost by convection, conduction and radiation</td></tr>
</table>
</td><td>1

1

1

1

1</td><td>contraction of muscles

detect stimulus

transmission of nerve impulses

insulation

blood flow</td></tr>
<tr><td>8b</td><td>homeostasis is the maintenance of a constant internal environment and conditions within the body of an organism consisting of blood and tissue fluid;

receptors detect stimulus and body reacts to give an opposite/reverse effect, restoring the normal condition of the internal environment to its original state through a negative feedback process;</td><td>1

1</td><td>definition

negative feedback</td></tr>
<tr><td>8c</td><td>when an increase in body temperature is detected by thermoreceptors, nerve impulses are produced and sent to the sensory neurone, which transmits nerve impulses to the relay neurone to the hypothalamus;

hypothalamus sends nerve impulses to the relevant body parts to activate the corrective mechanism to decrease heat released in the body and increase heat loss from the body;

when body temperature decreases to normal level, a feedback is sent to the receptor to stop producing and sending nerve impulse to the hypothalamus;</td><td>1

1

1</td><td>stimulus, receptor

activate corrective mechanism

negative feedback

A: decrease body temp</td></tr>
<tr><td></td><td>Total</td><td>10</td><td></td></tr>
</table>

No	Answers	Marks	Remarks
9aE	**R** is at an intersection point between the 2 graphs	1	
9bE	at 6a.m., rate of p/s is zero because the sun has not risen so the light intensity is zero + p/s is an enzyme-catalysed reaction so at low temperatures, enzymes are inactive;	1	no light intensity
	from 6.a.m to about 9 a.m., rate of p/s increase to 17.5 au because the sun has risen and light intensity increases + temperature also increases, enzymes become more active, hence increasing rate of collisions between enzymes and substrates, increasing the formation of enzyme-substrate complexes;	1	increase light intensity and temp
	from 9 a.m. to 12 noon, rate of p/s exceeds rate of r/p, and increases to 50 au because carbon dioxide is used up so rate of diffusion of carbon dioxide into the leaves through the stomata increases;	1	exceeds rate of r/p
	at 12 noon, rate of p/s is the maximum at 50 au because the light intensity is the highest and temperature is optimum so enzymes are most active;	1	maximum
	from 12 noon to 6 p.m., rate of p/s decreases to zero because light intensity decreases when the sun sets + temperature decreases and enzymes become less active;	1	decrease light intensity and temp
9cE	glucose produced through p/s is used immediately in aerobic respiration to release energy for cellular activities such as active transport;	1	immediate use
	excess glucose produced through p/s are converted to starch in leaves which is then converted back to glucose for use in aerobic respiration in darkness;	1	starch
	glucose is converted to sucrose and transported to storage organs + glucose forms fats for storage but may have been converted back to glucose for respiration;	1	sucrose
	overall mass is not increasing because most of the energy is temporarily stored in the form of chemical potential energy and is converted to other forms of energy;	1	conversion of energy
	Total	10	

No	Answers	Marks	Remarks
9aO	ovaries produces female sex hormones progesterone and oestrogen, which are responsible for the development and maintenance of secondary sexual characteristics in females; oestrogen stimulates the uterine lining to repair and thicken and progesterone stimulates the uterine lining to further thicken and become vascularised; ovaries produces eggs by developing a primary follicle into a Graafian follicle which eventually develop into a mature egg which is released into the fallopian tube during ovulation in a menstrual cycle;	1 1 1	female sex hormones functions of hormones mature egg
9bO	progesterone levels in a healthy young woman who is not pregnant increases after ovulation, followed by a gradual decrease to a low level *but* for a pregnant woman there progesterone level does not decrease; progesterone level in a healthy young woman who is not pregnant remains low during menstruation of the next menstrual cycle *but* for a pregnant woman, progesterone level remains high with no menstruation; every menstrual cycle, progesterone level increase to a maximum of 25 au and decrease to a low level over the 9 months due to no implantation of embryo in a healthy young woman who is not pregnant; *but* in a pregnant woman, progesterone level remains high at about 25 au during the first 3 months of pregnancy, increase by 4 times to about 100 au in the 3rd to 6th month of pregnancy, increase further by 6 times in the 6th to 8th month of pregnancy and increase by 10 times in the 8th to 9th month of pregnancy;	1 1 1 1	compare levels after ovulation compare levels during menstruation trend over 9 months for woman who is not pregnant trend over 9 months for woman who is pregnant
9cO	pollen grain germinates after coming in contact with stigma, in response to the sugary fluid secreted by the mature stigma; pollen tube grows out of each pollen grain and male gametes enter the pollen tube + pollen tube secretes enzymes to digest the surrounding tissue of the stigma and style; pollen tube grows down the style into the ovary + pollen tube enters the ovule through the micropyle + tip of pollen tube absorbs sap and burst releasing two male gametes;	1 1 1	germinate pollen tube + enzymes enters ovule + release gametes
	Total	10	