Name of Candidate: _____( ) Class: _____ Calculator Model: [ ]

BUKIT PANJANG GOVERNMENT HIGH SCHOOL

Preliminary Examinations 2014

SECONDARY FOUR EXPRESS

BIOLOGY **5158/01**

Paper 1

Date: 20 August, 2014
Duration: 1h
Time: 1100 – 1200h

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and register number on this question paper and the Optical Answer Sheet (OAS).

There are forty questions in this paper.
Answer all questions.
For each question there are four possible answers A, B, C and D.
Choose the one you consider correct and record your choice in soft pencil on the OAS.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this question paper.

For Examiner's Use	
Total	/ 40

Setters: Ms Jessie Lee & Ms Ding Ying Jye [Turn over

This paper consists of 20 printed pages.

1. A list of functions in cells is listed below. Match the functions with the structures stated in the table.

(i) where carbon dioxide is reduced to carbohydrate
(ii) where glucose is oxidized and energy is released
(iii) a fully permeable outer layer
(iv) a selectively permeable outer layer
(v) the centre of protein synthesis

	(i)	(ii)	(iii)	(iv)	(v)
A.	mitochondrion	chloroplast	cell membrane	cell wall	nucleus
B.	ribosome	mitochondrion	cell membrane	cell wall	nucleus
C.	chloroplast	ribosome	cell wall	cell membrane	mitochondrion
D.	chloroplast	mitochondrion	cell wall	cell membrane	ribosome

2. Which of these activities cannot be performed by an erythrocyte?

A. release of oxygen
B. release of energy
C. replication of DNA
D. uptake of glucose

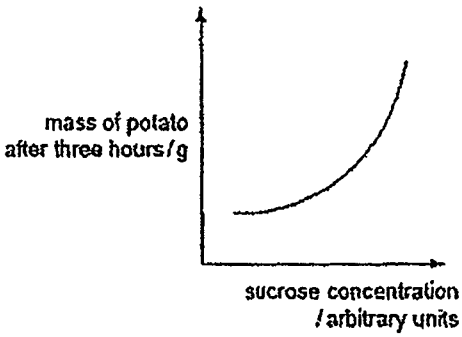
3. What is the main disadvantage of a spherical cell doubling its diameter without dividing?

A. The amount of food diffusing into the cell is increased.
B. The effectiveness of diffusion is reduced.
C. The nucleus is not able to fully control the cellular activities.
D. There is an increase in volume for stored food.

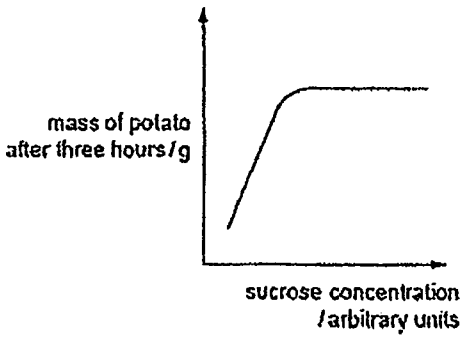
4. Identical pieces of potato are placed in sucrose solutions of different concentrations. After three hours, the mass of each potato piece is measured.

   Which graph shows the results of the experiment?

A



B



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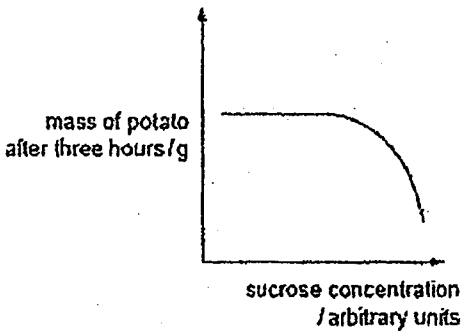
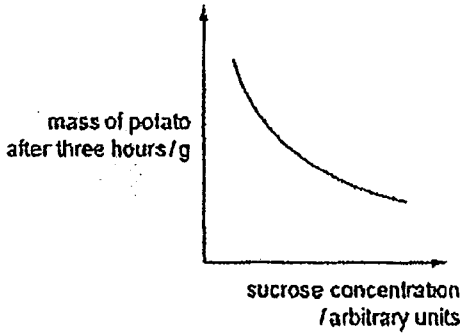
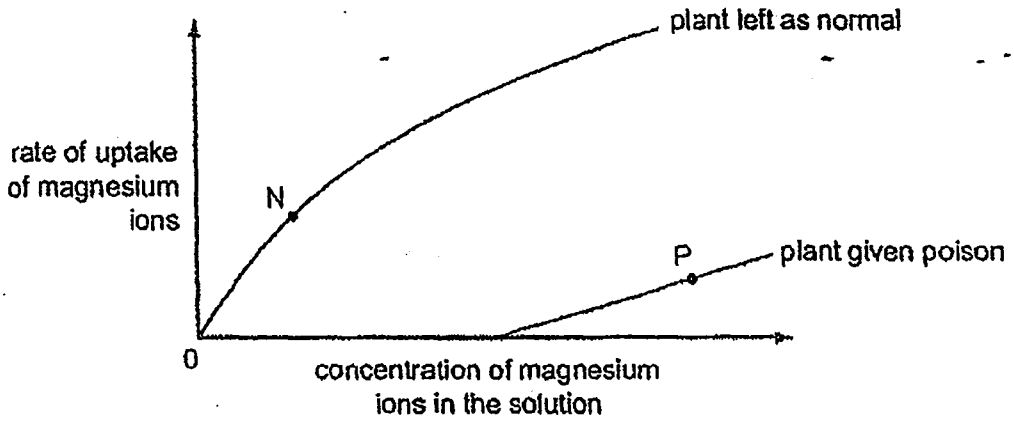


D



5. An experiment measured the rate at which plants take up magnesium ions from solution. One plant was given a poison that stops respiration. Another plant was left as normal. The graph shows the results.



How are magnesium ions being absorbed by the plants at points N and P?

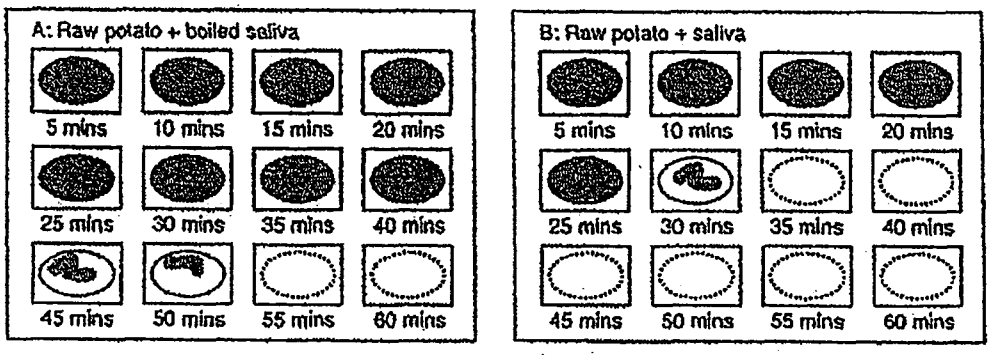
	N	P
A.	active transport	active transport
B.	active transport	diffusion
C.	diffusion	active transport
D.	diffusion	diffusion

6. Trypsinogen is added to a sample of protein in a test tube and incubated at 37°C for 25 minutes at pH 2. What substance(s) is/are left at the end of the experiment?

   A. protein only
   B. protein and polypeptide
   C. protein and lipids
   D. protein and monosaccharide

7. An investigation of the activity of amylase was set up below. Discs of similar sizes were removed from a potato and placed in two different solutions at 40°C. Solution A contained boiled saliva while solution B contained saliva. At every five minute intervals, a disc from each solution was removed and placed in iodine solution.

   The results are shown below.



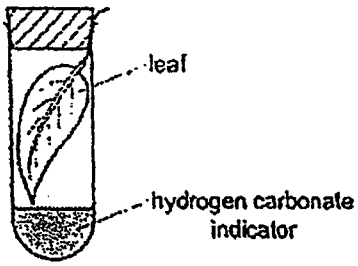
   Which of the following is the best explanation for the results obtained in set-up A?

   A. Boiled saliva took a longer time to break down the starch.
   B. The starch in the potato reacted with the boiled saliva to form a new substance.
   C. The potato might contain some amylase, which was responsible for digesting the starch.
   D. The starch in the potato was decomposed by exposure to air after 55 minutes.

8. Which of the following best describes the carbohydrates cellulose and sucrose?

		It is a reducing sugar.	It is a polysaccharide.	It produces monosaccharides upon complete hydrolysis.
A.	cellulose	✓	✓	X
	sucrose	✓	✓	X
B.	cellulose	X	✓	✓
	sucrose	✓	X	✓
C.	cellulose	✓	✓	✓
	sucrose	X	X	X
D.	cellulose	X	✓	✓
	sucrose	X	X	✓

9. A green leaf is picked at time 0700h and immediately placed in a sealed test-tube containing hydrogen carbonate indicator solution. The tube is kept near a window for 24 hours. The table shows how the indicator changes in colour.

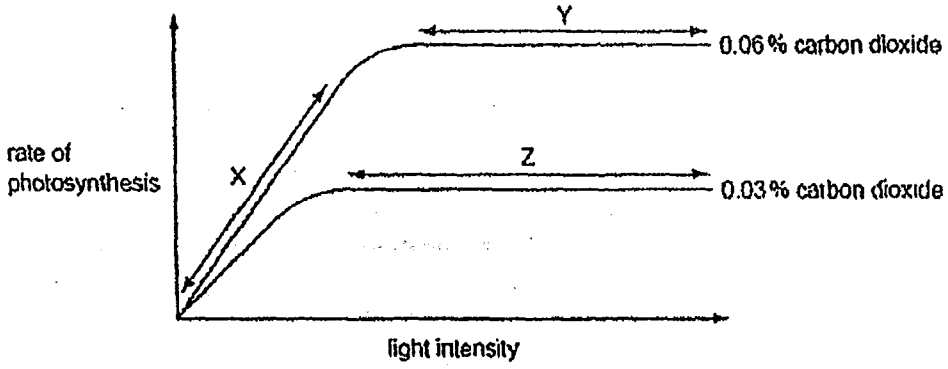


colour	amount of carbon dioxide compared to average atmospheric concentration
purple	less than normal
red	normal
yellow	more than normal

Which colour will the hydrogen carbonate indicator be at times 1200h and 2400h?

	1200h	2400h
A.	purple	yellow
B.	red	purple
C.	yellow	purple
D.	yellow	red

10. The graph shows the rate of photosynthesis of a plant with increasing light intensities at two different carbon dioxide concentrations. The temperature is kept constant.



Which of the following may be the limiting factors of photosynthesis at X, Y and Z?

	X	Y	Z
A.	carbon dioxide	light intensity	carbon dioxide
B.	carbon dioxide	light intensity	light intensity
C.	light intensity	carbon dioxide	carbon dioxide
D.	light intensity	carbon dioxide	light intensity

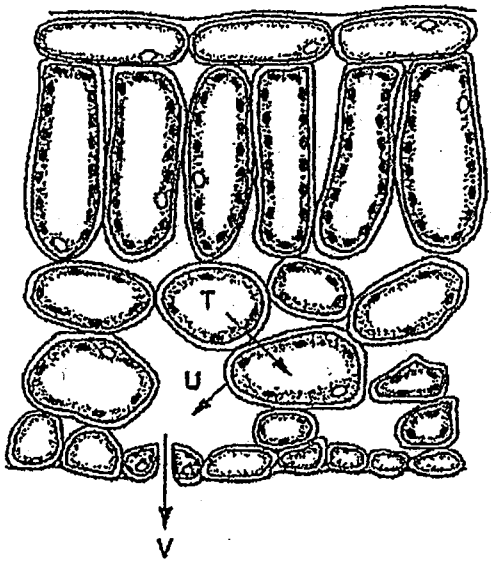
11. Different features of various vascular bundle components are listed below.

(i) presence of sieve plates
(ii) presence of companion cells
(iii) absence of cross walls
(iv) hollow lumen

Which of the above are not adaptations for the maintenance of transpiration streams in plants?

A. I and ii
B. i and iii
C. ii and iv
D. iii and iv

12. The diagram shows a transverse section of part of a leaf.



The arrows represent the movement of water vapour.
Which of the following correctly identifies the processes involved?

	T	U	V
A.	diffusion	diffusion	osmosis
B.	diffusion	evaporation	transpiration
C.	osmosis	evaporation	diffusion
D.	osmosis	transpiration	evaporation

13. Fitness training increases the concentration of lactic acid that runners can build up in their muscles before pain stops them from running.

What is a consequence of this increase?

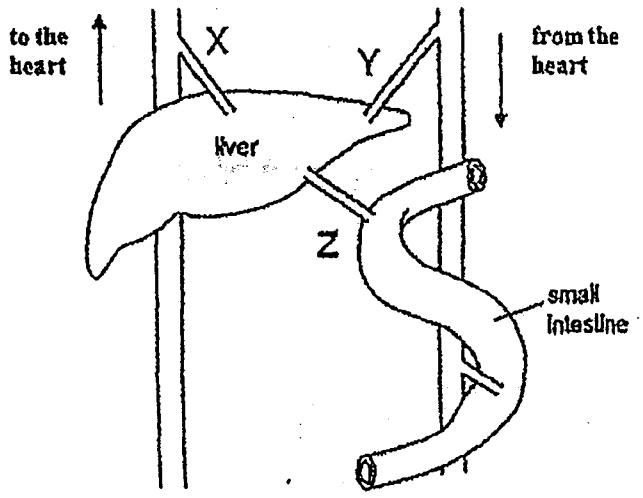
A. Aerobic respiration in muscles can be more rapid.
B. Blood flow to the muscles is increased.
C. More anaerobic respiration can take place in the muscles.
D. More energy is needed by the muscles.

14. In the human respiratory system, which features maintain the carbon dioxide gradient between the alveoli and the outside air?

(i) blood continually pumped to the alveoli
(ii) breathing in and out
(iii) moist alveolar surfaces
(iv) thin alveolar walls

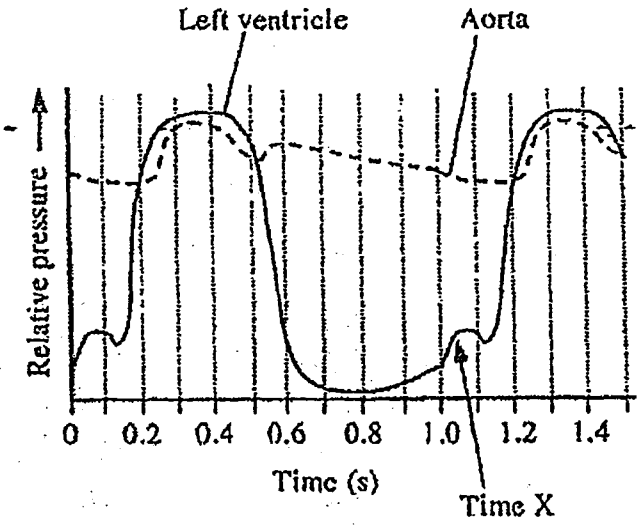
A. i and ii
B. i and iv
C. ii and iii
D. iii and iv

15. The diagram below represents the liver and the associated blood vessels X, Y and Z. Arrange the following vessels in descending sugar concentrations.



A. X, Y, Z
B. Y, X, Z
C. Z, X, Y
D. Z, Y, X

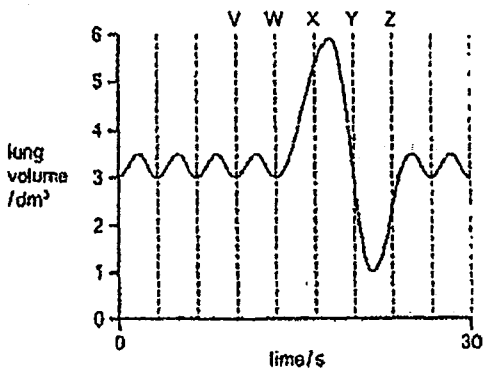
16. The diagram below shows the change of pressure in the left ventricle and in the aorta of a person during the beating of his heart.



Which of the following does not occur at time X?

A. The bicuspid valve is opened.
B. The atria are contracting.
C. The ventricles are being filled with blood.
D. The ventricles are forcing blood out.

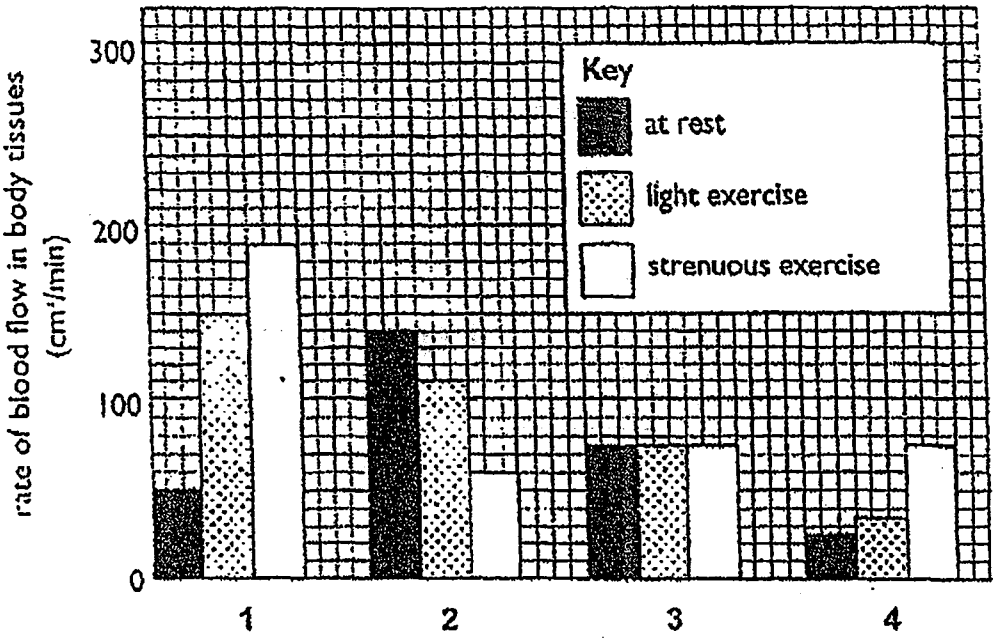
17. The graph shows the changes in the amount of air in a person's lungs over a period of 30 seconds.



Between which time periods is the rate of breathing fastest?

A. V to W
B. W to X
C. X to Y
D. Y to Z

18. The bar graph below shows the rate of blood flow in four various parts of the body when the body is in different states of activity.



Which of the following correctly represents blood flow in the following organs?

	small intestine	heart	pancreas
A.	1	4	2
B.	2	1	4
C.	4	1	3
D.	3	4	2

19. Which reaction(s) is catalyzed by carbonic anhydrase when red blood cells pass through the lungs?

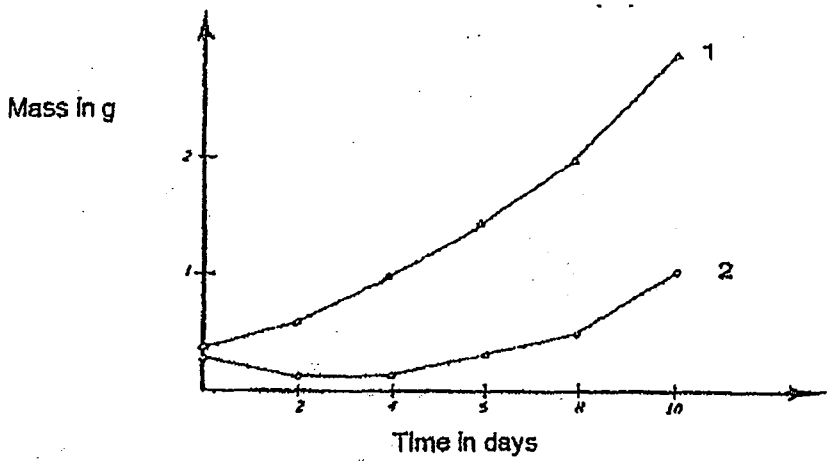
(i) $CO_2 + H_2O \rightarrow H_2CO_3$
(ii) $HCO_3^- + H^+ \rightarrow H_2CO_3$
(iii) $H_2CO_3 \rightarrow CO_2 + H_2O$
(iv) $H_2CO_3 \rightarrow H^+ + HCO_3^-$

A. i and ii
B. i and iii
C. ii and iv
D. iii and iv

20. A man, whose heart rate was 80 beats per minute, took up vigorous training in an attempt to become fitter. After 6 weeks, his heart rate had dropped to 68 beats per minute. Which of the following is the most likely explanation for this?

A. The blood vessels had enlarged thus aiding blood flow.
B. The heart improves its capacity to pump more blood per minute.
C. As he trained he lost weight, so there was less tissue to supply blood.
D. His cellular respiration had become more efficient so that the blood was more oxygenated.

21. Sixty mung beans were grown in identical conditions. Ten plants were removed from the sample and the average dry mass determined every two days and the results were shown in the graph below.



Which of the following graphs correctly represents
(i) the change in dry mass, and
(ii) the reason for the change?

	(i) graph	(ii) reason
A.	1	Photosynthesis exceeded respiration.
B.	2	A slight decrease in mass for the first few days because food storage is used for respiration.
C.	1	Respiration exceeded photosynthesis.
D.	2	A slight decrease in mass for the first few days because leaves has not developed.

22. Which of the following is an example of excretion?

A. release of adrenaline from the adrenal glands
B. release of sweat from the sweat glands
C. removal of carbon dioxide from the lungs
D. removal of faeces from the alimentary canal

23. Samples of blood from the renal artery and the renal vein were analysed.

The blood in the renal artery contains _____.

A. less carbon dioxide and more urea than the renal vein
B. more carbon dioxide and less urea than the renal vein
C. less oxygen and more urea than the renal vein
D. more oxygen and less urea than the renal vein

24. The following statements describe parts P and Q of the nervous system.

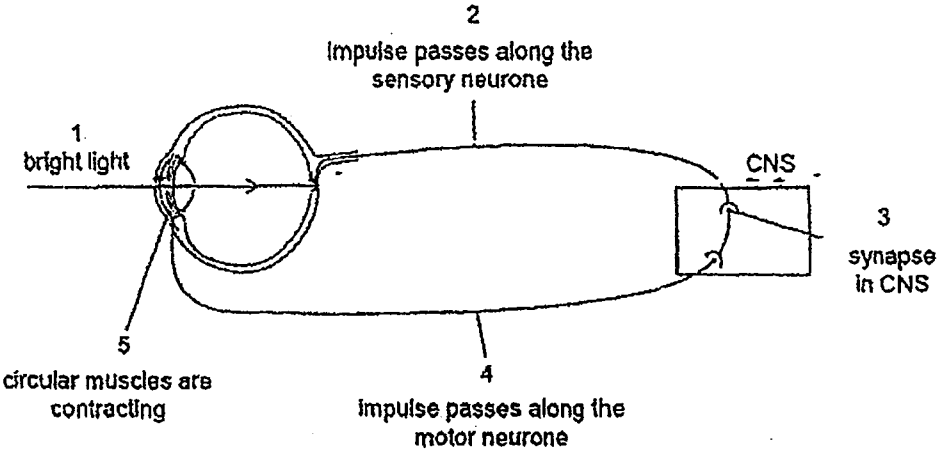
Part P: Site where the cell bodies of the motor neurones gather together.

Part Q: Site where axons of motor neurones are found.

Identify parts P and Q.

	P	Q
A.	white matter	ventral root
B.	grey matter	ventral root
C.	grey matter	dorsal root ganglion
D.	white matter	dorsal root

25. The flow diagram shows the pupil reflex.



Which of the following correctly names the receptor, central nervous system (CNS) and effector?

	receptor	CNS	effector
A.	nerve endings in iris muscles	brain	ciliary body
B.	nerve endings in cornea	spinal cord	iris muscles
C.	nerve endings in retina	spinal cord	ciliary body
D.	nerve endings in retina	brain	iris muscles

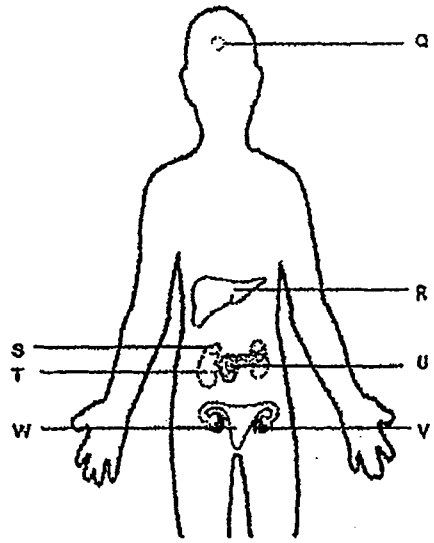
26. Which of the following statements best describe the cones present in the retina?

A. Cones are more sensitive to light than rods.
B. Cones contain visual purple which is bleached in bright light.
C. Cones absorb different wavelengths of light, primarily red, blue and green.
D. Cones are thermoreceptors which are sensitive to light.

27. Which of these statements describes control by negative feedback?

A. An injury to body tissue activates platelets in the blood and these activated platelets release chemicals which activate more platelets.
B. During the menstrual cycle, luteinising hormone stimulates the release of oestrogen which in turn stimulates the release of more luteinising hormone.
C. The onset of contractions during childbirth causes the release of a hormone which stimulates further contractions.
D. When blood pressure is high, nerve impulses from the brain cause the blood vessels to dilate and blood pressure is reduced.

28. Structures Q to W are either endocrine glands or target organs in the body. Which of the following incorrectly matches the endocrine gland to its associated target organ?



	endocrine gland	target organ
A.	Q	T
B.	R	U
C.	S	R
D.	V	W

29. The following investigation was carried out using flower buds growing on three plants on the same species.

Plant 1 → The anthers were carefully removed and the buds left open to air.
Plant 2 → The anthers were left untouched and a paper bag was tied tightly around each bud.
Plant 3 → The anthers were carefully removed and a paper bag was tied tightly around each bud.

Although all flowers later opened normally, only those on Plant 1 produced seeds. What does the result show about this species?

A. only cross-pollination can take place
B. only wind-pollination can take place
C. only insect-pollination can take place
D. both self and cross-pollination can take place

30. A new life form is discovered. It has a genetic code much like those of organisms on earth except that there are three different DNA bases instead of four, and the base sequences are translated as quadruplets (sets of four) instead of triplets (sets of three). How many different amino acids could be accommodated by this genetic code?

A. 9
B. 12
C. 64
D. 81

31. A student obtained a sample of DNA. mRNA was transcribed from this DNA and the two samples were subsequently purified. He then separated the two strands of the DNA sample. The base compositions of each strand and that of the mRNA were analysed.
The results of the analysis are shown in the table below.

	A	G	C	T	U
DNA strand 1	19.1	26.0	31.0	23.9	0.0
DNA strand 2	24.2	30.8	25.7	19.3	0.0
mRNA	19.0	25.9	30.8	0.0	24.3

Which of the following statements correctly show the relationship between DNA strand 1, DNA strand 2 and mRNA?

A. Strand 1 is the coding strand for mRNA synthesis.
B. Strand 2 is the coding strand for mRNA synthesis.
C. mRNA is complementary to DNA strand 1.
D. mRNA is the template for DNA synthesis.

32. A strand of DNA which codes for part of a polypeptide has the following base sequence.

Start C A A T C T G G T T C T G G T T C T T C T End

Hydrolysis of the polypeptide (coded for by the base sequence above) yields different amino acids in the numbers as shown in the table below.

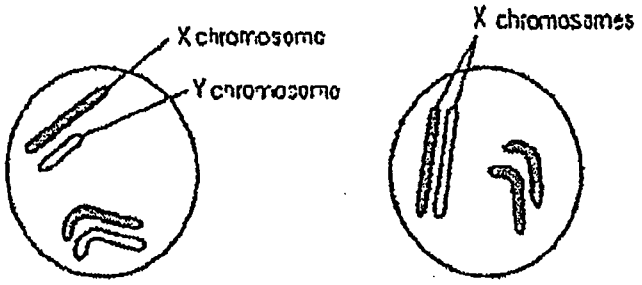
Amino acid	Symbol	Number found in polypeptide
Valine	Val	1
Proline	Pro	2
Arginine	Arg	4

[Turn over

Which of the following correctly shows the sequence of amino acids in the polypeptide?

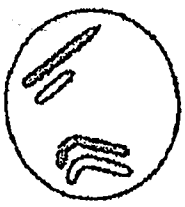
A. Pro-Arg-Val-Arg-Pro-Arg-Arg
B. Val-Arg-Pro-Arg-Pro-Arg-Arg
C. Val-Arg-Pro-Arg-Pro-Arg-Val
D. Val-Pro-Arg-Pro-Arg-Pro-Pro

33. The diagram shows two pairs of chromosomes in the nuclei of body cells of a male and female animal.



Which of the following shows a combination of chromosomes that cannot possibly occur in a zygote formed from the gametes of the male and female animal?

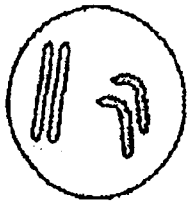
A



B

C

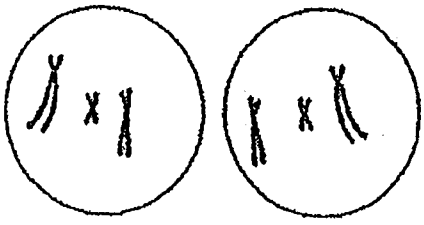
D



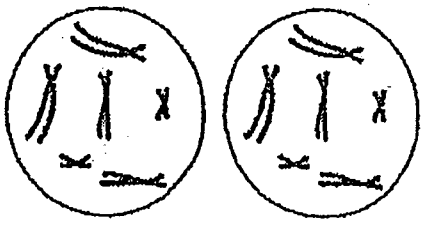
34. The diagram shows the chromosomes in a cell at the beginning of meiosis.

Which diagram shows the likely product of one division of the cell at end of meiosis I?

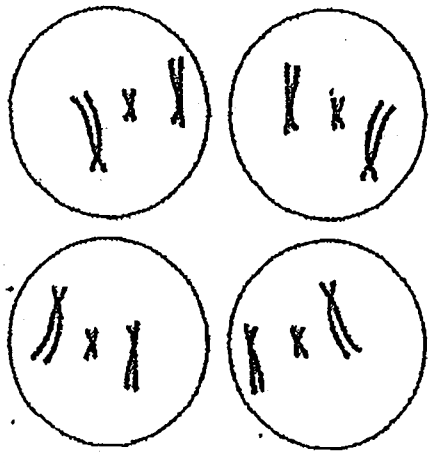
A



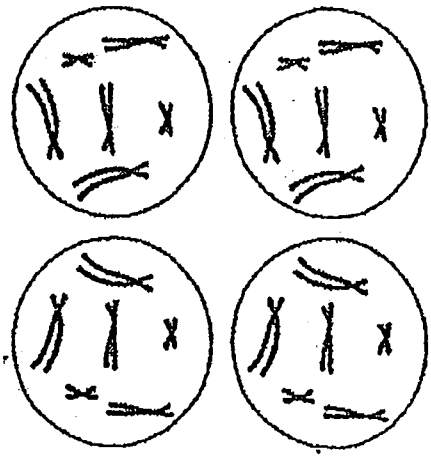
B



C



D

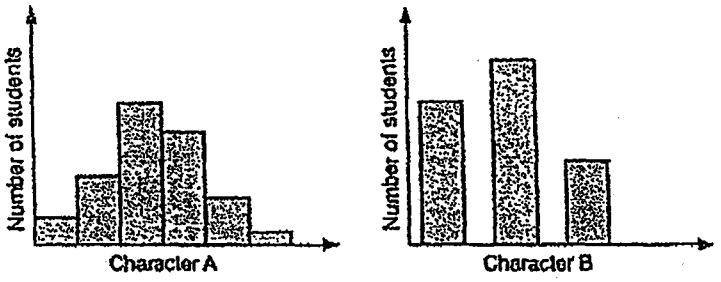


35. Mammalian skin cells in tissue culture were supplied with a source of radioactive thymine.

At which stage of the cell cycle will the radioactive thymine be incorporated into the nuclei?

A. anaphase
B. interphase
C. metaphase
D. prophase

36. Two phenotypes of a class of students were measured. The results obtained were recorded in the graphs below.



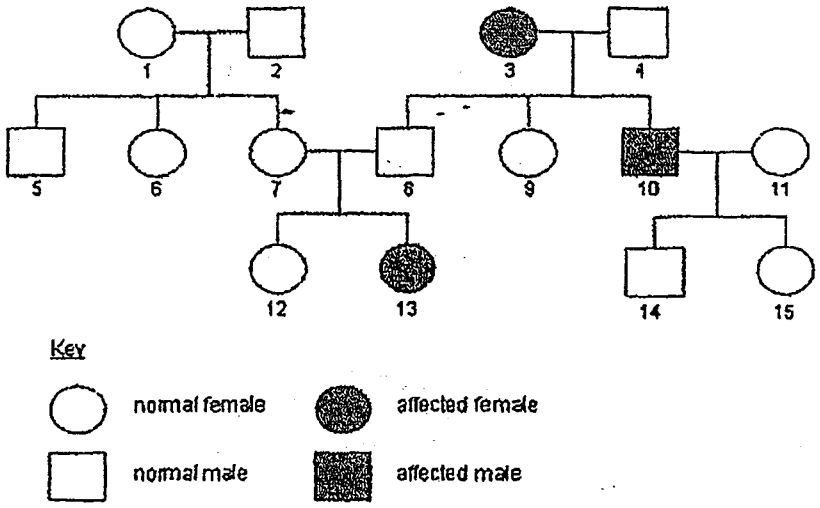
Which of the following statements is true?

A. Character A is determined by dominant alleles while character B is determined by recessive alleles.
B. Character A is not influenced by environmental factors while character B is.
C. Character A is determined by the additive effect of many pairs of alleles while character B is determined by one or a few pairs of alleles.
D. Ability to roll the tongue is an example of character A while blood group is an example of character B.

37. Which statement describes an example of artificial selection?

A. It has been found that some strains of bacteria produce antibiotics.
B. It is common practice to mate bulls with cows that produce the most milk.
C. It is possible to control caterpillars on food crops by releasing small wasps which lay their eggs in caterpillars and kill them.
D. Mosquitoes have developed strains that are resistant to insecticides.

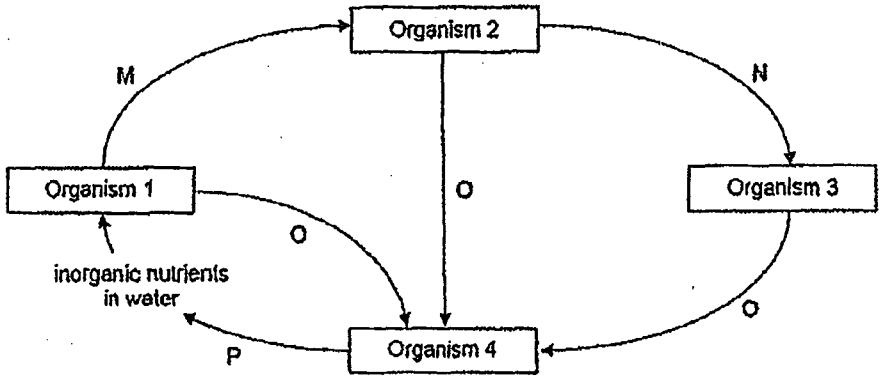
38. The diagram below shows the inheritance of phenylketonuria (PKU), a condition caused by a recessive allele r in the family.



Which of the females are certain to have the genotype Rr?

A. 1, 7 and 9
B. 1, 9 and 12
C. 7, 9 and 15
D. 9, 12 and 15

39. The diagram shows how nutrients can be recycled in an aquatic environment.



Which of the following matches of processes is **correct**?

	M	N	O	P
A.	photosynthesis	predation	feeding	decomposition
B.	feeding	excretion	predation	death
C.	feeding	predation	death	decomposition
D.	predation	feeding	respiration	photosynthesis

40. The oxygen requirements of water from a particular site are measured by taking a sample of the water and measuring its oxygen content with an electronic meter.

After keeping it sealed in the dark for 5 days at 20°C, the oxygen content is measured again. The rate at which the oxygen has been used up is known as the biological oxygen demand (BOD).

The BOD of an unpolluted river is about 3mg O_2 per litre of water while that of raw sewage is about 325mg O_2 per litre of water.

Which of the following reasons below explain the relatively high BOD of raw sewage?

(i) increased population of decomposing bacteria in raw sewage
(ii) decreased levels of carbon dioxide in raw sewage
(iii) increased levels of organic wastes in raw sewage
(iv) decreased amounts of dissolved oxygen in raw sewage

A. i and ii
B. i and iii
C. ii and iii
D. i and iv

~ This is the end of the paper. ~

Name of Candidate: _____( ) Class: _____ Calculator Model: [ ]

BUKIT PANJANG GOVERNMENT HIGH SCHOOL

Preliminary Examinations 2014

SECONDARY FOUR EXPRESS

BIOLOGY 5158/02

Paper 2

Date: 20 August, 2014
Duration: 1h 45min
Time: 0800 – 0945h

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A [50 marks]
Answer all questions.
Write your answers in the spaces provided on the question paper.

Section B [30 marks]
Write your answers on the graph and writing paper provided.

Write an E (for Either) or an O (for Or) next to the number 10 in the grid on the right hand side of this cover page to indicate which question you have answered.

You are advised to spend no longer than an hour on Section A and no longer than 45 minutes on Section B.

At the end of the examination, hand in Section A & B separately.

The number of marks is provided in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	/50
Q8	/10
Q9	/10
Q10	/10
Section B	/30
Paper 2	/80

[Turn over

This paper consists of 13 printed pages.

Section A [50 marks]

Answer all questions.
Write your answers in the spaces provided.

For Examiner's Use

1. A study was performed on osmoregulation in saltwater (marine) and freshwater fish. The salt concentration in the circulatory fluid of fish is generally higher than that of freshwater and lower than that of seawater. Both water and salts can move freely through the plasma membranes of fish cells.

   Use the information below in the table to answer the following questions.

	marine fish	freshwater fish
rate of water uptake (ml/h)	-3.5	4.0
rate of salt uptake (mg/h)	1.2	-2.3
rate of urine production (ml/h)	3.2	12.2
concentration of salt in circulatory fluid (mg/l)	2.0	2.0
concentration of salts in urine (mg/l)	5.0	2.0

(a) Explain the difference in water uptake between the marine fish and the freshwater fish. [2]

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(b) With reference to the function of the kidney nephron, explain how marine fish maintains the water potential of its circulatory fluid. [2]

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(c) Freshwater fish actively absorb salts from their surroundings through their gills to maintain a constant water potential in their circulatory fluid. With reference to osmoregulation, explain why maintaining a constant water potential is important to the health and survival of the fish. [2]

For Examiner's Use

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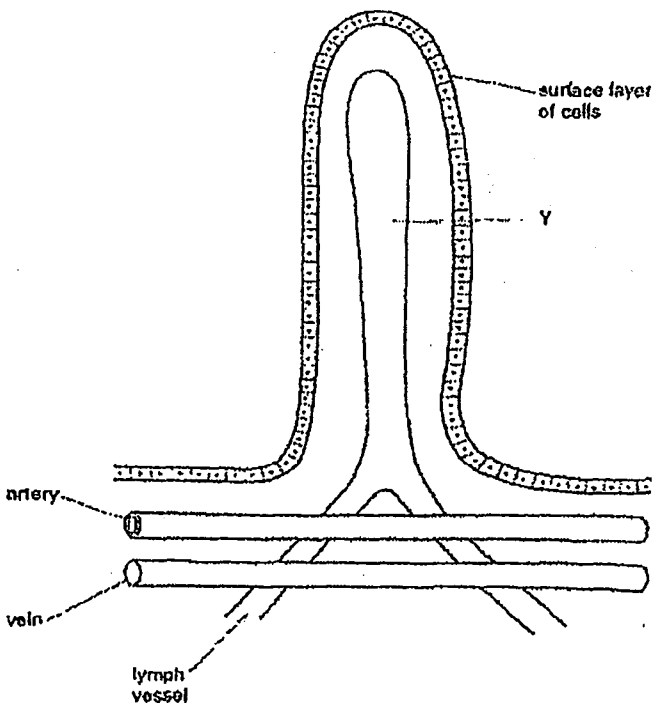
[Total: 6 marks]

2. The figure below shows a section through a villus in the small intestine. The blood capillaries are not shown.



(a) (i) On the figure above, draw the blood capillaries inside the villus and link it with the appropriate blood vessels. Draw arrows to show the direction of the blood flow in the capillary. [1]

(ii) Name the first organ to which blood flows from the small intestine and the vessel that transports this blood. [1]

For Examiner's Use

Organ: .....

Vessel: .....

(b) The surface layer of cells on the villus possesses projections known as microvilli. Microvilli aid in the absorption of food substances.
State and explain one other feature of the cells that aids in the absorption of food substances. [2]

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(c) Name structure Y. Describe the role of structure Y in the absorption of materials from the small intestine. [2]

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(d) Describe the role of the liver in digestion. [2]

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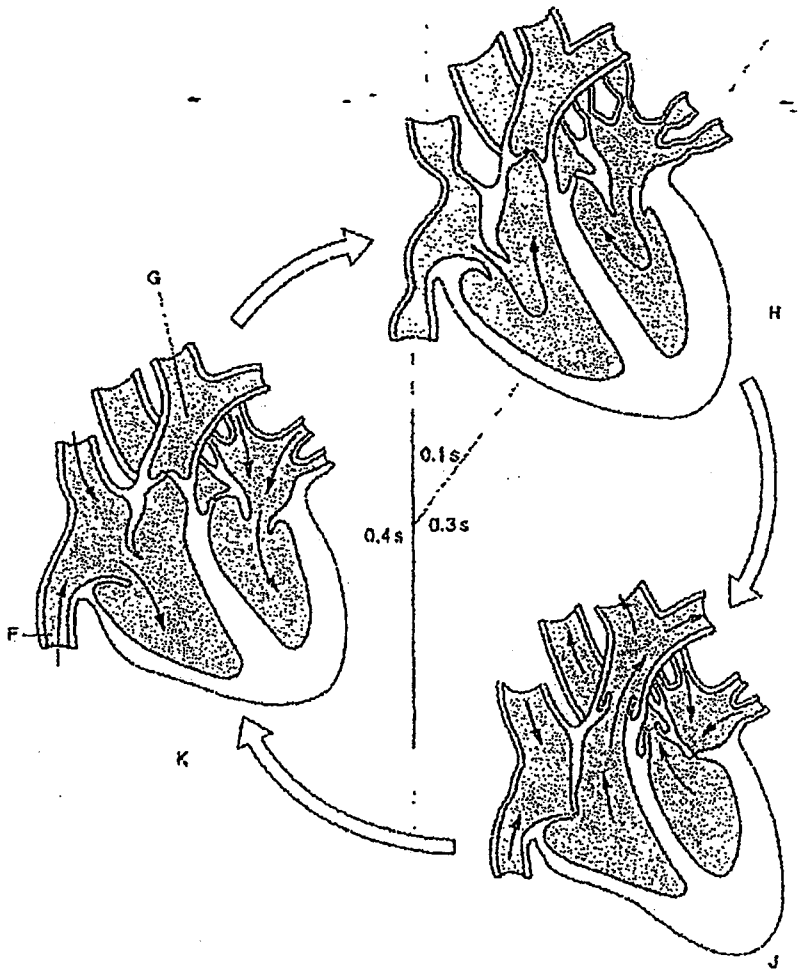
[Total: 8 marks]

3. The figure below shows three stages in the cardiac cycle.

For Examiner's Use



(a) Name blood vessels F and G. [1]

F: .....

G: .....

(b) Explain why the walls of the atria have a thinner muscular wall compared to those of the ventricles. [1]

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(c) Complete the table below, naming stages J and K, and show what is happening to the following parts of the left side of the heart at each of the stages, H, J and K as shown in the previous diagram: [6]

For Examiner's Use

- Left atrium
- Left ventricle

Stage	Left atrium	Left ventricle
H: Atrial systole	contracts to force blood into left ventricle	....
J:	....	....
K:	....	relaxes and fills with blood from left atrium

(d) The valves of the heart open and close during the cardiac cycle. Explain the states of the aortic valve at stages J and K. [2]

Stage J: .....

.....

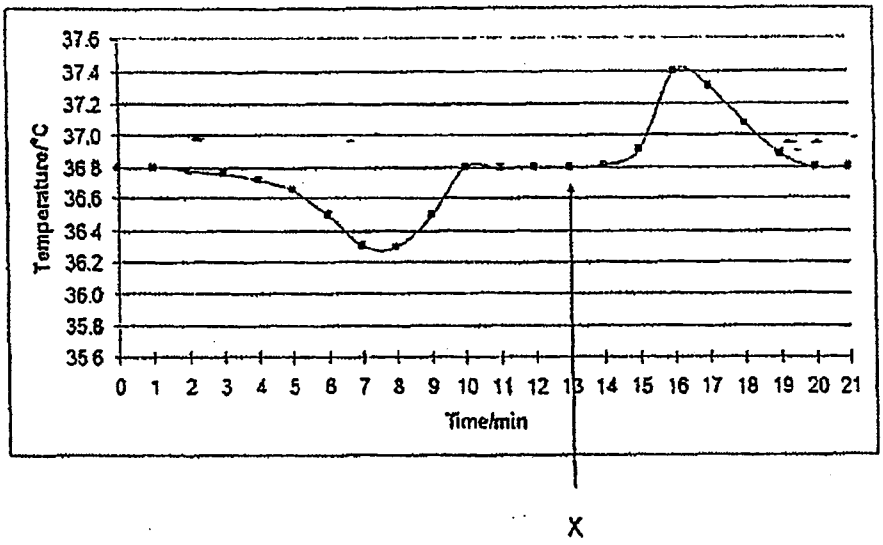
Stage K: .....

.....

[Total: 10 marks]

4. The graph below shows how the temperature of a person varies with time as he was driving.

For Examiner's Use



(a) At the 1st minute, the person switched on the air-conditioning in the car. Describe the mechanism that led to the change in temperature between the 8th and 10th minute. [2]

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(b) At point X, the car in front suddenly stopped, nearly causing an accident. This resulted in a change in temperature between the 14th and 16th minute. Using your knowledge of the endocrine and nervous systems, describe the mechanisms that led to this change. [3]

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(c) Explain how the negative feedback mechanism prevents the body temperature from rising further once the danger is past. [2]

For Examiner's Use

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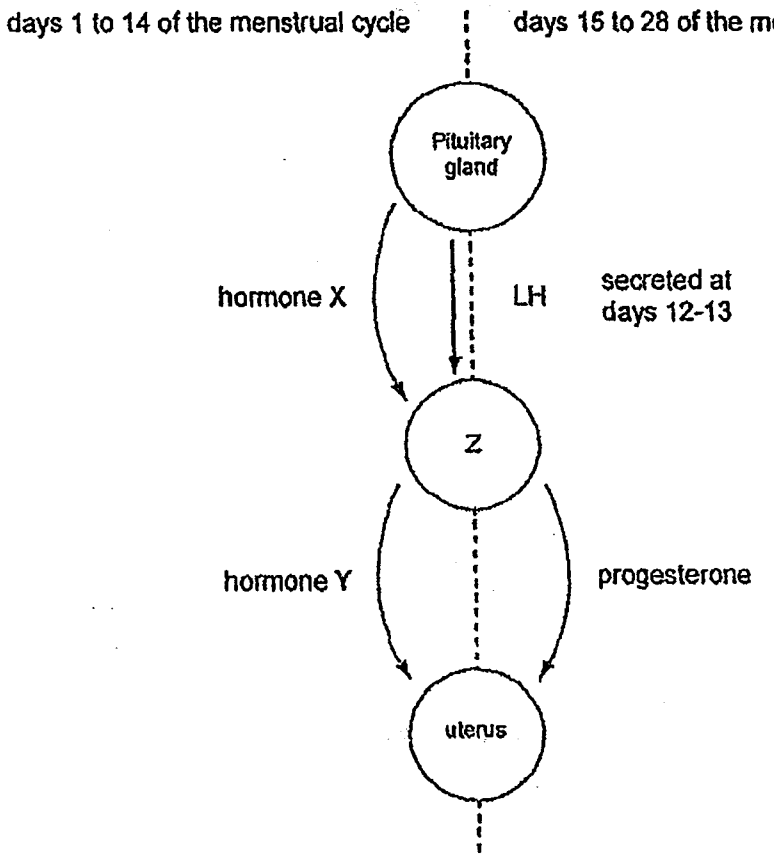
[Total: 7 marks]

5. The human menstrual cycle is controlled by four hormones. The figure below is a diagram that shows the site of production and the target organs of these hormones.



(a) Name hormones X and Y and organ Z. [3]

Hormone X: .....

Hormone Y: .....

Organ Z: .....

(b) What is the role of progesterone in the menstrual cycle? [1]

For Examiner Use

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(c) Day 1 of the menstrual cycle is the first day of menstruation. Suggest the cause of menstruation. [1]

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(d) Explain the process of the secretion of progesterone in a pregnant woman. [2]

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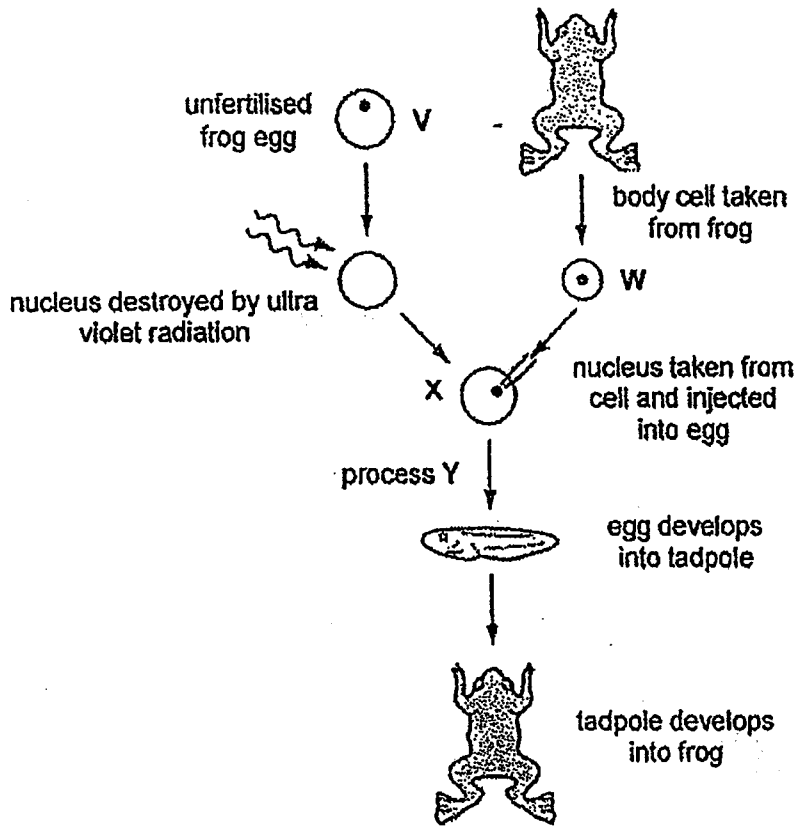
[Total: 7 marks]

6. The diagram shows how genetically identical frogs can be developed from unfertilized frog eggs. The diploid number (2n) for frogs is 26.

For Examiner's Use



(a) State the number of chromosomes found in cell V. [1]

.....

(b) State the number of chromosomes found in cell X. [1]

.....

(c) Name process Y. [1]

.....

(d) Would the phenotype of the final frog be identical to that of the frog that produced cell V or the frog that produced cell W? Explain your answer. [2]

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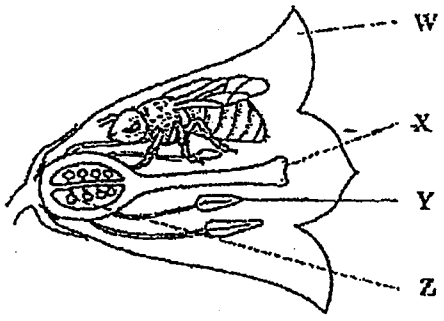
.....

[Total: 5 marks]

7. The diagram below shows a bee visiting a flower of genotype Rr after leaving another flower of the same plant. Assume no other flowers have been visited by this bee.

For Examiner's Use



(a) Name the parts of the flower. [2]

W: ..... X: .....

Y: ..... Z: .....

(b) What is the maximum number of offspring that could be produced from this flower based on the illustrated diagram? [1]

.....

(c) With the aid of a genetic diagram, determine the ratio of phenotypes in the offspring that could result from this bee's visit. [3]

(d) It was found that the offspring produced from this flower later bore flowers that all showed the dominant phenotype. Explain why this varies from the answer in (c). [1]

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[Total: 7 marks]

~End of Section A~

Section B [30 marks]

Answer three questions only.
Question 10 is in the form of an Either/Or question. Only one part should be answered.

8. In an experimental set-up, a plant is watered with water radioactively labelled with isotope ^{18}O. The plant is then placed in a sealed chamber and the radioactivity of the air in the chamber is measured over time. The table below shows the data that was obtained from the experiment.

Time/h	0	1	2	3	4	5	6	7
Radioactivity/Bq	0.0	10.0	20.0	35.0	48.0	55.0	58.0	60.0

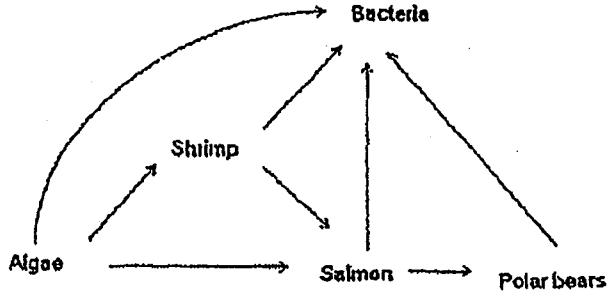
(a) Using the data above, draw a graph on the graph paper provided to show how radioactivity of the air changes with time. [4]

(b) For this experiment, describe the passage of a radioactively-labelled oxygen atom in water that is used in a plant. Your answer should begin from the point the atom is taken up at the roots to the point where it is released into the atmosphere. [6]

9. Energy is transferred along food chains from one level to the next.

(a) Explain why it is more efficient for a secondary consumer to feed on a producer instead of a primary consumer. [2]

(b) A simple food web is shown below.



(i) In the event of a nuclear explosion, many dust particles will be thrown into the atmosphere, thus reducing the amount of light reaching the earth. With reference to the given food web, state and explain how this decrease in the amount of light will affect the population of each organism. [5]

(ii) Explain how DDT can build up in large quantities in polar bears, which live in the North Pole. [3]

10. EITHER

(a) Explain the differences between mitosis and meiosis. Your explanation should include references to where the processes occur and why they occur. [5]

(b) Explain how it is possible that parents with different blood groups are able to produce only children with blood groups different from themselves, giving specific examples. [5]

OR

(a) State the differences between male and female human gametes in terms of size, numbers and motility. [3]

(b) Explain the disadvantages of self-fertilisation to a flowering plant. [3]

(c) State the differences between the reproductive parts of flowers of a wind-pollinated and an insect-pollinated plant. [4]

~This is the end of the paper. ☺ ~

Answers

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
D	C	B	D	B	A	C	D	A	C
11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
A	C	C	A	C	D	A	B	B	B
21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
B	C	A	B	D	C	D	B	A	D
31.	32.	33.	34.	35.	36.	37.	38.	39.	40.
A	B	D	A	B	C	B	C	C	B

Answers

	Answers	Mark
1a	- The freshwater fish cells have a lower water potential than the surrounding water, while the marine fish cells have a higher water potential than the surrounding water. - Water molecules diffuses into the freshwater fish cells by osmosis (gain) - Water molecules diffuses out of the marine fish cells by osmosis (lose)	1 ½ ½
1b	- The marine fish selectively reabsorbs more water - But does not selectively reabsorb more/reabsorbs less salts to remove the excess salts in the urine.	1 1
1c	- If circulatory fluid becomes too dilute/water potential is too high, water molecules will diffuse into the cells by osmosis and cells will swell and lyse/burst. - If circulatory fluid becomes too concentrated/water potential too low, water molecules will diffuse out of the cells by osmosis and cause cells to shrink/dehydrate/crenate.	1 1
2ai	- Capillary with correct links to artery and vein (no direction 0 marks)	1
2aii	- Organ: Liver - Vessel: Hepatic portal vein	½ ½
2b	- Presence of numerous mitochondria in cells - Site of respiration - Releasing of energy - Active transport	½ ½ ½ ½
2c	- Lacteal / lymphatic capillary - (Absorption of) fatty acids + glycerol / Fat globules - Ref. to (absorption into) lymphatic system/lymph vessel - Fat-soluble vitamins [bonus]	1 1 1 1 [max 2]
2d	- Secretion/production of bile to be stored temporarily in the gall bladder - Involved in fat emulsification OR physical digestion of large fats globules into smaller fat droplets (R: digestion of fat molecules)	1 1
3a	F: vena cava G: pulmonary artery	½ ½
3b	- Ventricles pump blood to lungs and whole body (longer distance) - Blood needs to be pumped at a higher pressure	½ ½
3c	Stages J: Ventricular systole K: Atrial & ventricular diastole Left atrium J: Relaxes, fills with blood from the pulmonary veins K: Relaxes, fills with blood from the pulmonary veins Left ventricle H: Relaxes, fills with blood from the left atrium J: Contracts, forcing blood into the aorta	 1 1 1 1 1 1
3d	Stage J: Aortic valve opens Pressure in left ventricle higher than that of aorta Stage K: Aortic valve closed Pressure in aorta higher than that of left ventricle	 1 1
4a	- Signal sent to arterioles to constrict - reducing blood flow to blood capillaries at skin surface	1 1

	- sweat glands less active - hair erector muscle contracts (R: increase in metabolic rate/shivering as a slight decrease in body temperature will not be enough to trigger these)	1 1
4b	- the sight of the other car sent impulses to be sent to the brain - the hypothalamus sends signals - to the adrenal gland - adrenaline secreted - increase in metabolic rates	
4c	- hypothalamus stimulated - adrenaline production ceases - existing adrenaline destroyed in the liver	1 1 1
5a	X: follicle-stimulating hormone (R:FSH) Y: oestrogen Z: ovary (R: ovaries)	1 1 1
5b	- thickens/maintains the endometrium/uterine lining of the uterus/womb - prepares endometrium for implantation of embryo - prevents menstruation/stops menstrual cycle - promotes development/maintenance of blood vessels in endometrium - prevents FSH secretion/prevents follicle development/inhibits LH	1
5c	Low levels of oestrogen and progesterone (both hormones must be mentioned)	1
5d	- progesterone will be secreted by the corpus luteum of the ovary - hormone (hCG – human chorionic gonadotropin) secreted by zygote maintains the corpus luteum for about 2-3 months - after 2-3 months, corpus luteum breaks down - placenta formed and takes over the progesterone production	½ ½ ½ ½
6a	13	1
6b	26	1
6c	Mitosis / Differentiation	1
6d	Frog that produced cell W	1
	Cell X contains entire nucleus of cell W Same DNA (genetically identical) as cell W	½ ½
7a	W: standard petal R:keel petal / wing petals X: stigma (R: style) Y: anther (R: filament) Z: ovule R: ovum	½ ½ ½ ½
7b	8	1
7c	Parental phenotype Parental genotype Gametes Offspring genotype Offspring phenotype Ratio (3:1 dominant:recessive)	½ ½ ½ ½ ½ ½
7d	Small sample size of 8 only	1
8a	- correctly plotted points - correctly labeled axis w units (x-axis: time/h, y-axis: radioactivity/Bq) - appropriate scale - best fit curve	1 1 1 1
8b	- Oxygen atom enters as water through root hair cells - via osmosis - diffuses from one cell to the adjacent cell - travels up xylem - drawn up by capillary action/ root pressure - transpiration pull - enters the mesophyll cells from xylem via osmosis	½ each [max 6]

	- photosynthesis equation - photolysis in the presence of light - H_2O molecule broken down - 24 hydrogen atoms and 6 oxygen molecules formed - oxygen diffuses from cell to cell - dissolves in moisture lining the spongy cells - diffuses through stomata into external environment	
9a	- energy is lost at each trophic level/more energy is available at lower trophic levels - energy is lost through heat/respiration, uneaten body parts, egested material, excreted material	1 1
9bi	- reduces the rate of photosynthesis - reduces population of algae (producer) - reduces population of shrimp, salmon and polar bears - bacteria population will increase as first as other organisms die (less competition for food) - but will eventually decrease	1 1 1 1 1
9bii	- DDT is insoluble and non-biodegradable/cannot be broken down by microorganisms - accumulate in the algae/shrimp/salmon (bioaccumulation) - concentrated in the fatty tissues of the final consumers (polar bears) when they feed on organisms lower down in food chain (bioamplification)	1 1 1

Either 10a	**Mitosis**	**Meiosis**	[max 5]
	Chromosome number maintained/diploid	Chromosome number halved/haploid	
	Genetically identical offspring/clones	Genetically non-identical daughter cells	
	2 offspring from 1 parent	4 offspring from 1 parent	
	Growth/repair of worn out cells	To produce gametes	
	Eg of where: Animals/humans/normal (somatic) body cells/bacteria	Eg of where: In gonads/testes/ovaries/anthers	
10b	- Correct parental blood groups identified (AB and O, OR A and B) - (in text or diagram) parents' genotypes identified as I^AI^B and I^OI^O, OR I^AI^A and I^BI^B - *Correct gametes identified for both parents - *the word gametes correctly used - Genotype of offspring ($I^AI^O + I^BI^O$ OR I^AI^B) shown - Blood groups of offspring identified as Group A and B OR AB *available with wrong genotypes as long as they match		[max 5]

Or 10ai		**Male gamete**	**Female gamete**
	Size	5µm Small in comparison to female gamete / egg/ ovum	120 µm Large and spherical
	Numbers	Millions produced upon ejaculation / upon puberty	A few thousand available at birth, one egg released (R: produced) every month upon start of puberty
	Motility	Motile	Non-motile, swept

<table>
<tr><td></td><td></td><td>(R: mobile), movement propelled by flagella</td><td>along fallopian tubes by sweeping action of cilia and peristaltic movement</td><td></td></tr>
<tr><td>10b</td><td colspan="3">- fewer or no new alleles/genes
- limited genetic variation
- limited evolution/less likely to adapt to/limited resistance to changes in environment
- likelihood of appearance of in-bred weaknesses AW / no hybrid vigour / decreased fertility AW
- increased likelihood of expressing harmful recessive traits to the offspring</td><td>1
1
1

1

1
[max 3]</td></tr>
<tr><td>10b</td><td colspan="3">Insect
stigma – small compact, do not protrude out of flower
stamen – non pendulous, do not protrude out of flower
pollen – fairly abundant , usually larger with rough surfaces

Wind
Stigma – large feathery, protrude out of flower
Stamen – long pendulous filament, protruding anthers
Pollen – more abundant, usually smaller and lighter and smooth surfaces

<table><tr><td></td><td>Insect pollination</td><td>Wind pollination</td></tr><tr><td>Stigma</td><td>Small and compact
Enclosed within flower</td><td>Large and feathery
Protrude out of flower</td></tr><tr><td>Stamen</td><td>Non-pendulous</td><td>Long and pendulous</td></tr><tr><td>Pollen grains</td><td>Larger, with rough / spikey surfaces
Abundant numbers</td><td>Smaller, with smooth surfaces
More abundant</td></tr></table></td><td>4</td></tr>
</table>