CANDIDATE – PLEASE NOTE!

PRINT your name below and return this booklet with your answer sheet. Failure to do so may result in disqualification.

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TEST CODE **02107010**

FORM TP 2017151

MAY/JUNE 2017

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

BIOLOGY

UNIT 1 – Paper 01

1 hour 30 minutes

12 JUNE 2017 (a.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This test consists of 45 items. You will have 1 hour and 30 minutes to answer them.
2. In addition to this test booklet, you should have an answer sheet.
3. Do not be concerned that the answer sheet provides spaces for more answers than there are items in this test.
4. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
5. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

Sample Item

Which of the following metal atoms is present in a haemoglobin molecule?

(A) Iron
(B) Copper
(C) Calcium
(D) Magnesium

Sample Answer

● (B) (C) (D)

The correct answer to this item is "Iron", so (A) has been shaded.

6. If you want to change your answer, erase it completely before you fill in your new choice.
7. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, go on to the next one. You may return to that item later.
8. You may do any rough work in this booklet.
9. Figures are not necessarily drawn to scale.
10. The use of non-programmable calculators is allowed.

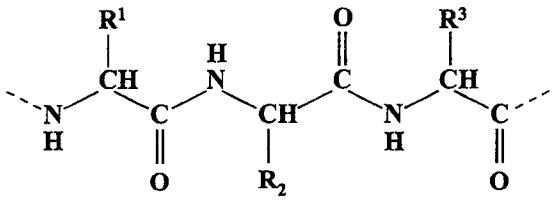
DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

1. *Pistia stratiotes* (water lettuce) is a rosette-like plant found floating in ponds and natural waterways.

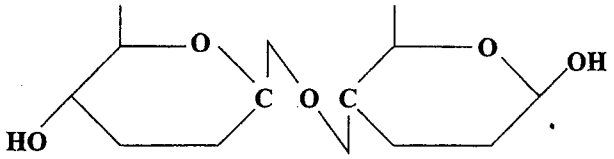
Which of the following properties of water assists the plants to float?

(A) High cohesion
(B) High specific heat
(C) High latent heat of fusion
(D) High latent heat of vaporization

Item 2 refers to the following structures of two biological molecules.



I



II

2. Which of the following combinations correctly describes the structure of Molecules I and II?

	I	II
(A)	2 amino acids joined by a peptide bond	2 α–glucose residues joined by a 1,4 glycosidic bond
(B)	2 amino acids joined by a glycosidic bond	2 β–glucose residues joined by a 1,4 peptide bond
(C)	3 amino acids joined by 2 peptide bonds	2 β–glucose residues joined by a 1,4 glycosidic bond
(D)	3 amino acids joined by 2 glycosidic bonds	2 α–glucose residues joined by a peptide bond

3. A diet high in triglycerides may lead to obesity. The feature of triglycerides which MOST likely contributes to this is that they

(A) are insoluble in water
(B) have many C–H bonds
(C) contain glycerol molecules
(D) have many –OH groups

4. Which of the following combinations of properties of glucose is as a result of its simple ring structure?

I. It can be rapidly oxidized to release energy.
II. It is a relatively unreactive molecule.
III. It is an important monomer of polysaccharides.

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

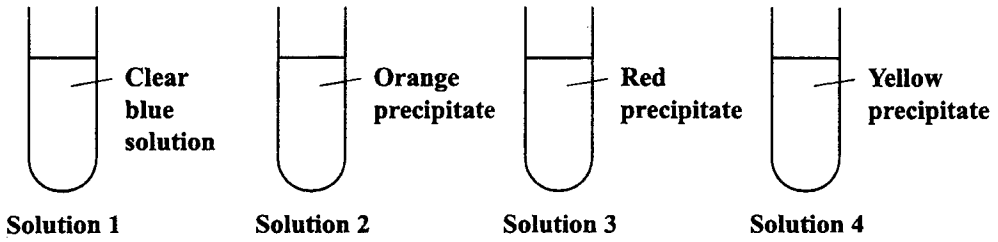
GO ON TO THE NEXT PAGE

5. What is the HIGHEST level of protein structure exhibited by haemoglobin?

(A) Primary
(B) Secondary
(C) Tertiary
(D) Quaternary

Item 6 refers to the following information.

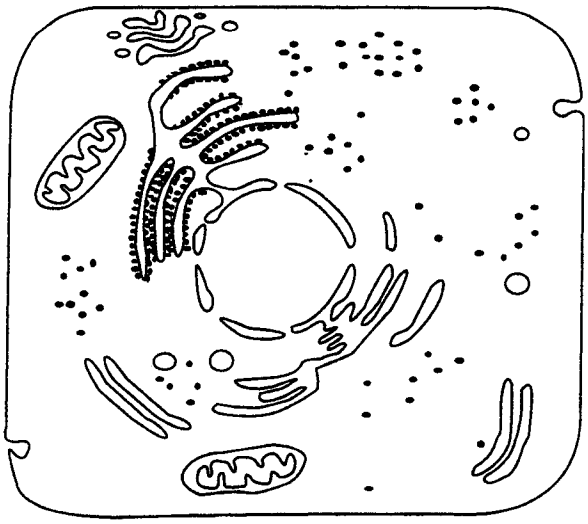
Students conduct the Benedict's test on four different clear solutions containing varying amounts of a reducing sugar. The results, indicating the degree of colour change, are shown below.



6. Which of the following combinations shows the correct sequence of the solutions, in ascending order, from the LEAST amount of reducing sugar to the MOST?

	Solutions			
(A)	1	2	3	4
(B)	1	4	2	3
(C)	2	4	1	3
(D)	3	2	4	1

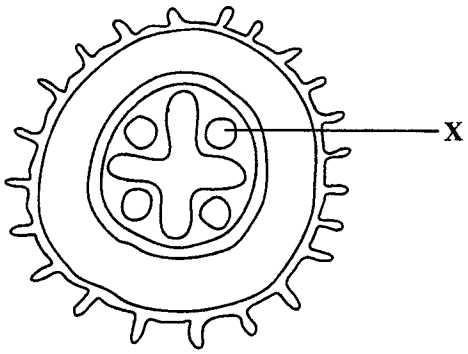
Item 7 refers to the following diagram representing the structure of an animal cell as seen under an electron microscope.



7. Which of the following structures, present in this cell, would NOT be seen in a bacterial cell?

(A) Ribosomes
(B) Cytoplasm
(C) Cell membrane
(D) Nuclear membrane

Item 8 refers to the following diagram which shows a transverse section of a plant structure.



8. The area labelled X represents

(A) a cell
(B) a tissue
(C) an organ
(D) a system

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9. Which of the following combinations correctly identifies structures typical of a eukaryotic cell?

	Endoplasmic Reticulum	**Mitochondria**	**Nuclear Membrane**	**70 S Ribosome**
(A)	x	√	√	x
(B)	√	√	√	x
(C)	x	x	x	√
(D)	√	√	x	√

Key √ = present
x = absent

GO ON TO THE NEXT PAGE

10. Bobby is given a tropical freshwater fish for his birthday. Experimenting with the fish, he places it in seawater and it dies. Which of the following statements MOST likely explains the reason for its death?

(A) Water diffuses out of the fish.
(B) Water diffuses into the fish.
(C) Ions diffuse from the fish to the seawater.
(D) Less oxygen is in seawater than freshwater.

11. When a plant cell is placed in a solution with a less negative water potential than its cell sap, the cell becomes more

(A) turgid because water diffuses into the cell
(B) flaccid because water diffuses out of the cell
(C) turgid because the solution diffuses into the cell
(D) flaccid because the solution diffuses out of the cell

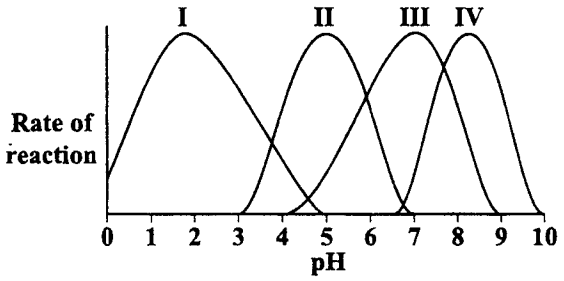
12. Which of the following is NOT a role of phospholipids in cell membranes?

(A) Act as a barrier for movement of materials
(B) Form vesicles in the process of phagocytosis
(C) Maintain the cell and organelles within a fluid environment
(D) Directly move material along a concentration gradient

13. Which of the following is the BEST example of anabolism?

(A) Glycogen is converted to glucose.
(B) Peptide bonds are hydrolysed by peptidases.
(C) Amino acids joined by peptide bonds to form a polypeptide.
(D) Amylose and amylopectin combine to form starch molecules.

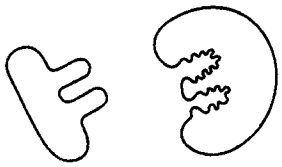
Item 14 refers to the following graph which shows the effect of pH on the activity of enzymes.



14. Pepsin is an enzyme found in the human alimentary system. Which of the above activity curves BEST represents the action of pepsin?

(A) I
(B) II
(C) III
(D) IV

Item 15 refers to the following diagrams which represent an enzyme and a substrate molecule, labelled X and Y. In a timed enzyme-catalysed investigation to measure reaction rate, equal amounts of the molecules are mixed.



X Y

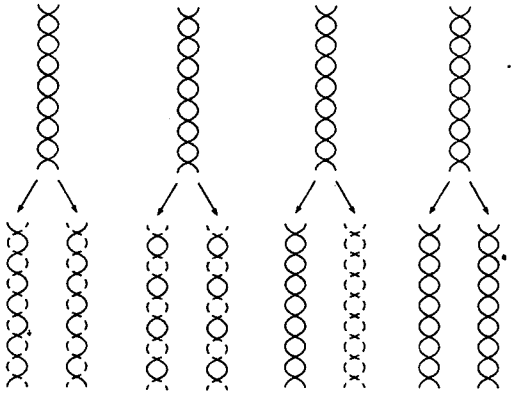
15. With reference to the diagrams, which of the following is correct about the rate of reaction between X and Y?

(A) The reaction would progress rapidly from start to finish.
(B) The reaction rate would be slow initially then increase rapidly.
(C) There would be a very slow reaction rate throughout the progress of the reaction.
(D) There would be no reaction between Molecules X and Y.

16. Which of the following is found in both DNA and transfer RNA?

(A) Uracil
(B) Ribose
(C) Sugar-phosphate backbone
(D) Double helix structure

17. Which of the following diagrams illustrates the semi-conservative method of replication of DNA?



I II III IV

(A) I
(B) II
(C) III
(D) IV

Item 18 refers to a piece of a DNA strand showing the triplet codons, and a table which shows the triplet codons and their relative amino acids.

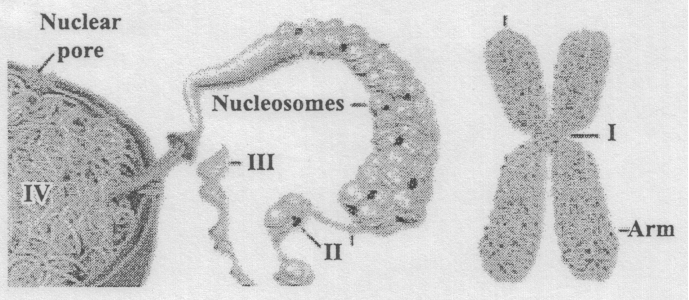
DNA strand 5' TATGTATTTCGAAAGAGA 3'

UUU	Phe	UCU	Ser	UAU	Tyr	UGU	Cys
UUC		UCC		UAC		UGC	
UUA	Leu	UCA		UAA	Stop	UGA	Stop
UUG		UCG		UAG	Stop	UGG	Trp
CUU	Leu	CCU	Pro	CAU	His	CGU	Arg
CUC		CCC		CAC		CGC	
CUA		CCA		CAA	Gln	CGA	
CUG		CCG		CAG		CGG	
AUU	Ile	ACU	Thr	AAU	Asn	AGU	Ser
AUC		ACC		AAC		AGC	
AUA		ACA		AAA	Lys	AGA	Arg
AUG	Met	ACG		AAG		AGG	
GUU	Val	GCU	Ala	GAU	Asp	GGU	Gly
GUC		GCC		GAC		GGC	
GUA		GCA		GAA	Glu	GGA	
GUG		GCG		GAG		GGG	

18. Which of the following represents the sequence of amino acids in the polypeptide chain from the DNA strand?

(A) Serine – Lysine – Histidine – Phenylalanine – Glycine – Tyrosine
(B) Serine – Phenylalanine – Alanine – Lysine – Histidine – Tyrosine
(C) Tyrosine – Glycine – Phenylalanine – Histidine – Lysine – Serine
(D) Tyrosine – Histidine – Lysine – Alanine – Phenylalanine – Serine

Item **19** refers to the following diagram which shows nuclear material in a cell (not drawn to scale).



19. Which of the following matches each structure with its correct name?

	I	II	III	IV
(A)	Chromosome	Chromatid	Histone	DNA
(B)	Chromosome	Histone	DNA	Chromatin
(C)	Chromatid	DNA	Chromatin	Chromosome
(D)	Chromatid	Histone	DNA	Chromosome

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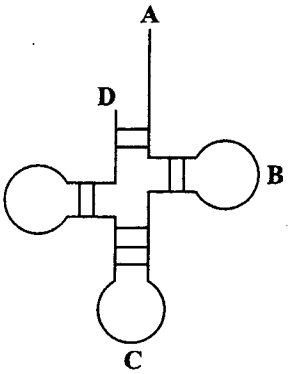
20. The following diagram shows the structure of a tRNA molecule. Which letter, A, B, C or D, indicates the position on the molecule where the amino acid would be attached?



21. Which of the following BEST explain why DNA replication is important in maintaining genetic stability?

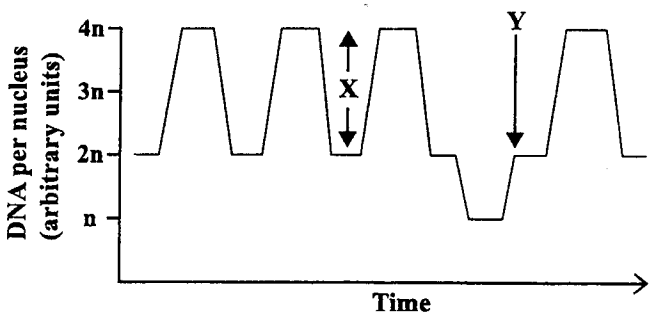
I. DNA has to replicate accurately to allow offspring to inherit genes from parents.

II. When new cells are made, each must receive two exact copies of the instructions to function properly.

III. DNA must be replicated for cell division to produce cells that function efficiently.

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

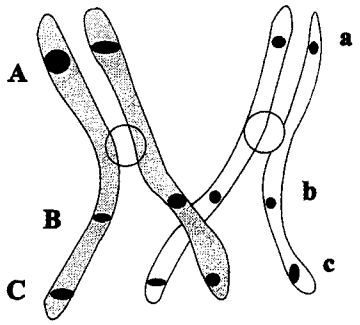
Item 22 refers to the following diagram which represents the relative amounts of DNA per nucleus during many cell divisions in an animal cell.



22. Which of the following processes are occurring at X and Y?

	X	Y
(A)	Fertilization	DNA synthesis
(B)	DNA synthesis	Separation of chromosomes
(C)	DNA synthesis	Fertilization
(D)	Fertilization	Cytokinesis

Item 23 refers to the following diagram showing a pair of homologous chromosomes during Prophase I of meiosis.



23. Which of the following is the genotype of one of the recombinants?

(A) ABc
(B) aBc
(C) ABC
(D) AbC

Items 24–25 refer to the following information.

Fur colour in mice is controlled by a pair of genes occupying different loci. "W" represents the presence of colour, "w" represents albino. The allele for brown fur is "A" and for black fur is "a".

24. The genotype wwAa is

(A) brown
(B) black
(C) albino
(D) grey

25. What is the phenotypic ratio of the F_2 from a cross between two F_1 with the genotype WwAa?

(A) 3 brown : 4 black : 9 albino
(B) 3 brown : 9 black : 4 albino
(C) 9 brown : 3 black : 4 albino
(D) 9 brown : 4 black : 3 albino

26. Which of the following is considered an advantage of somatic gene therapy?

(A) It can be used to treat genetic disorders.
(B) The genes and vectors prompt immune responses.
(C) Alleles are always delivered to all cells in a tissue.
(D) It is a relatively inexpensive technology.

27. Which of the following describes protogyny?

(A) Anthers mature before stigmas.
(B) Stigmas mature before anthers.
(C) A plant has separate male and female flowers.
(D) There are separate male and female plants.

28. In populations of Pacific salmon, most fish are either very large or very small. This is because sperm from medium-sized fish seldom fertilize the eggs. The allele frequency of medium-sized fish is therefore very low. This MOST likely is an example of

(A) artificial selection
(B) stabilizing selection
(C) directional selection
(D) disruptive selection

29. Mutations can have varying effects on an organism depending on when it occurs. The occurrence of a mutation has the GREATEST effect during

(A) translation
(B) RNA synthesis
(C) DNA replication
(D) somatic cell formation

30. Which type of isolation plays the MOST significant role in allopatric speciation?

(A) Geographical
(B) Temporal
(C) Ecological
(D) Behavioural

31. In plant tissue culture, small pieces of tissue can grow into whole new plants. In addition to inorganic ions and sucrose, which of the following essential growth requirements are needed to make this possible?

I. Auxins
II. Vitamins
III. Cytokinins

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

32. Sexual reproduction would be MOST advantageous for the survival of a species if

(A) a new viral disease appears
(B) environmental conditions remain stable
(C) there is catastrophic environmental change
(D) there is a large densely distributed population

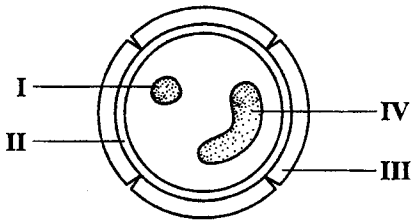
33. A horticulturalist has bred a *Hibiscus* variety which bears violet flowers. Which method of propagation would be MOST appropriate for rapid production of a large number of clonal plants?

(A) Tissue culture
(B) Fragmentation
(C) Cutting
(D) Seed

34. Which of the following methods of asexual reproduction is INCORRECT, either by its definition or its examples?

	Type of Reproduction	Definition	Examples
(A)	Binary fission	Splitting into two daughter cells of similar size	*Amoeba* Bacteria
(B)	Fragmentation	Splitting into several pieces, each of which regrows	Flatworms *Spirogyra*
(C)	Budding	Producing an outgrowth from the parent, which breaks off and becomes a separate individual	Hydra Yeast fungus
(D)	Spore formation	Producing small, lightweight spores, to assist air dispersal	*Hibiscus* Flamboyant

Item 35 refers to the following diagram showing a mature pollen grain.



35. Which of the labelled structures will give rise to two male gametes?

(A) I
(B) II
(C) III
(D) IV

36. Which of the following does NOT promote cross-pollination?

(A) Cleistogamy
(B) Protogyny
(C) Protandry
(D) Self-incompatibility

37. In plants, the ovary is BEST described as the

(A) tip of a carpel
(B) basic unit of the gynoecium
(C) swollen base of a single carpel
(D) female reproductive parts of the flower

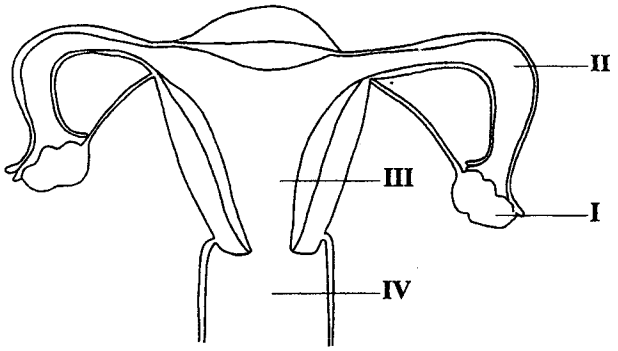
38. The following are advantages of two types of pollination.

I. No need for another plant
II. Increases vigour
III. Widens gene pool
IV. No loss of advantageous phenotypes

Which of the above are specific to cross-pollination?

(A) I and II only
(B) I and IV only
(C) II and III only
(D) I, II, III and IV

Item 39 refers to the following diagram of the human female reproductive system.



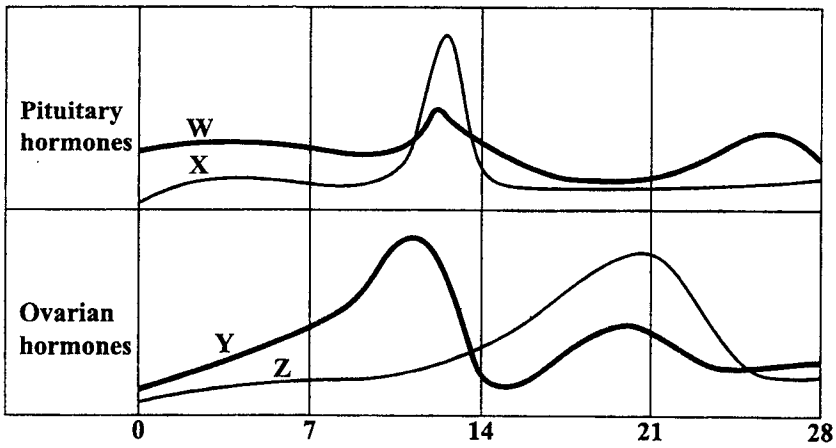
39. At which of the regions labelled I, II, III and IV does fertilization take place?

(A) I
(B) II
(C) III
(D) IV

40. How does a secondary oocyte differ from the ovum?

(A) The nucleus is haploid in the secondary oocyte and diploid in the ovum.
(B) The nucleus is diploid in the secondary oocyte and haploid in the ovum.
(C) There is one more polar body in the secondary oocyte than in the ovum.
(D) There is one more polar body in the ovum than in the secondary oocyte.

Item 41 refers to the following graph which shows the relative concentrations of the pituitary hormones W and X, and the ovarian hormones Y and Z during the menstrual cycle.



41. The hormones W, X, Y and Z are

	W	X	Y	Z
(A)	Progesterone	Oestrogen	ADH	FSH
(B)	FSH	LH	Oestrogen	Progesterone
(C)	Oestrogen	LH	Adrenaline	Progesterone
(D)	LH	Oestrogen	FSH	Progesterone

42. A sample of a woman's urine is tested at a laboratory and human chorionic gonadotrophin is detected. This indicates that

(A) ovulation has occurred
(B) menstruation has begun
(C) oestrogen levels have decreased
(D) implantation of an embryo has occurred

43. Which of the following pairs of structures contributes directly to the development of the placenta?

(A) Amnion and allantois
(B) Chorion and allantois
(C) Chorion and endometrium
(D) Amnion and endometrium

44. Oral birth control pills work MOST directly by

(A) interfering with the penetration of the ovum by spermatozoa
(B) suppressing follicle maturation and preventing ovulation
(C) preventing implantation of the fertilized ovum in the endometrium
(D) thickening of the cervical mucus thus preventing the spermatozoa from meeting the ovum

45. Pregnant women are advised to increase their intake of folate. Which of the following BEST explains this advice?

(A) Humans cannot synthesize folate.
(B) The foetus is at risk of developing spina bifida if it does not get sufficient folate.
(C) The foetus is at risk of having a deformed skeleton if it does not get sufficient folate.
(D) The foetus will withdraw folate from the mother's body thus putting the mother at risk of developing deformities.

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.