Higher Homework

Protein Synthesis & Secretion

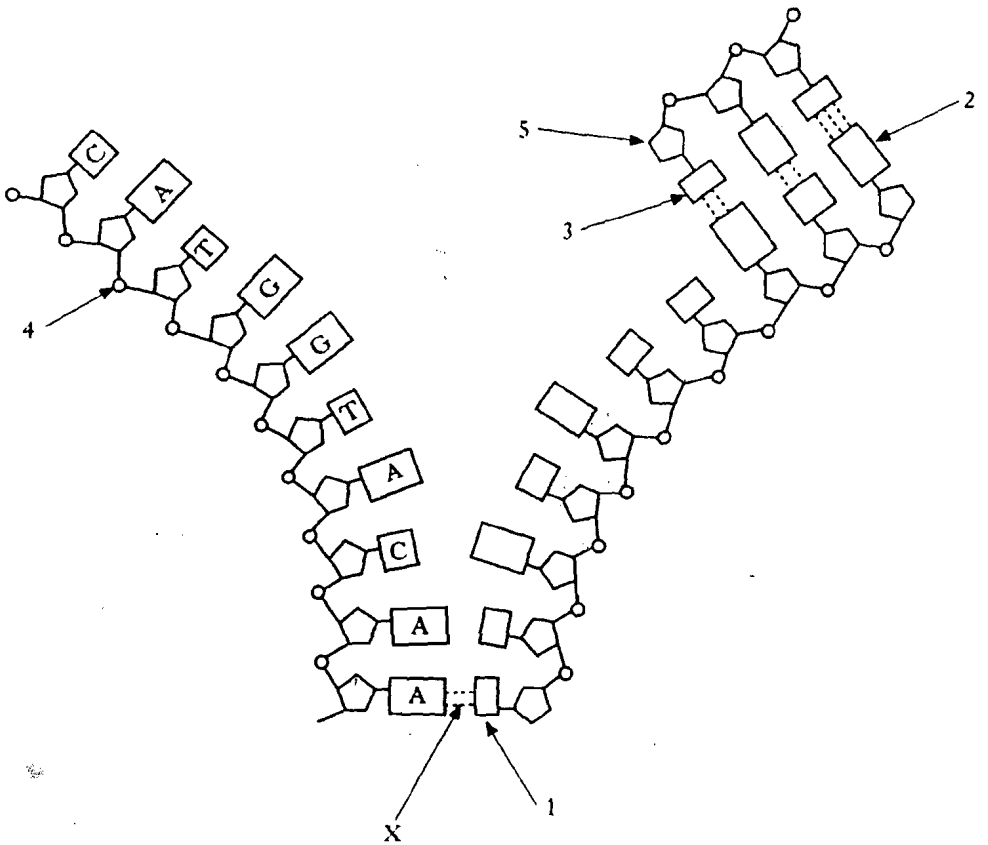
Pupil's name

Question	Mark
1	/10
2	/9
3	/5
4	/4
5	/3
6	/4
7	/4
8	/4
9	/4

List the areas you have done well in

List any facts you must learn

1. (*a*) The diagram below represents part of a molecule of DNA on which a molecule of m-RNA is being synthesised.



(i) From the diagram, identify bases 1, 2 and 3.

1. _____

2. _____

3. _____ (3)

(ii) Name the type of bond labelled as X in the diagram.

Type of bond _____ (1)

(iii) Name components labelled 4 and 5 in the diagram.

4. _____

5. _____ (2)

1 continued

Mar

(*b*) In a DNA molecule, the base sequence AGT codes for the amino acid serine.

Using the initial letters of the bases, write the base sequence of the anti-codon on the t-RNA molecule to which serine becomes attached.

Space for working

Anti-codon _____ (1)

(*c*) The table below refers to features of the nucleic acids present in a human cell.

Place ticks (✓) in the appropriate boxes to indicate which of the statements are true for DNA and which are true for m-RNA.

Statement	*DNA*	*m-RNA*
Made in the nucleus		
Forms genes		
Attaches to ribosomes		

(2)

(d) DNA controls the activities of a cell by coding for the production of

A proteins

B carbohydrates

C amino acids

D bases.

(1)

2

Marks

(*a*) You have to decide whether each of the following statements about nucleic acids is **TRUE** or **FALSE** and **tick the appropriate box**.

If you decide the statement is **FALSE**, you should then write the **correct word** in the right hand box to replace the word **underlined in the statement.**

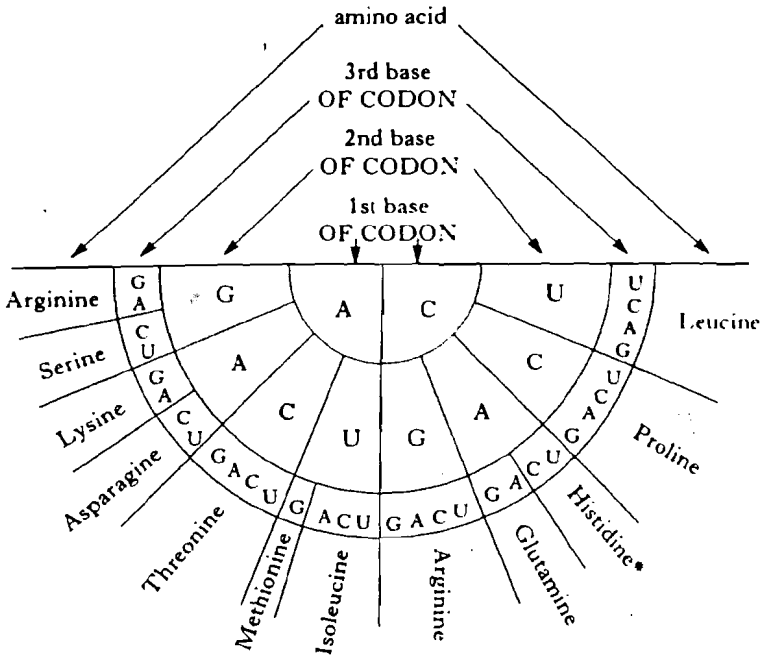
Statements	*True*	*False*	*Correct word*
During the formation of a new DNA molecule, base pairing is followed by bonding between deoxyribose and bases			
Synthesis of m-RNA takes place in the nucleus			
m-RNA consists of many codons, each consisting of a base, ribose and phosphate			

(3)

(*b*) m-RNA codes for the amino acids which bond to form a protein chain.

The diagram below can be used to identify the amino acids which are coded for by some m-RNA codons.

For example, the m-RNA codons with base sequences CAU and CAC both code for the amino acid histidine*.



2 continued

must not write in this margin

Marks

Use the information in the diagram to answer the following questions.

(*i*) DNA determines the base sequence on m-RNA.

Which base sequence in DNA would code for the amino acid methionine?

_____ (1)

(ii) Which amino acid is carried by the t-RNA molecule which has the anticodon GAC?

_____ (1)

(iii) A substitution mutation changes the first base in a codon.

1. Which amino acid will still be inserted correctly into the protein if the first base of one of its codons is changed from A to C?

Amino acid _____ (1)

2. Name the **four** amino acids which could still be inserted in the correct sequence despite any substitution in the third base of their codons.

Names 1. _____

2. _____

3. _____

4. _____ (2)

A fragment of DNA was found to have 60 guanine bases and 30 adenine bases. What is the total number of deoxyribose sugar molecules in this fragment?

A 30

B 45

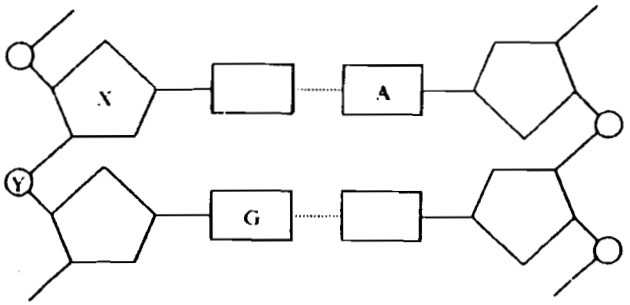
C 90

D 180

(1)

3

The diagram below represents part of a deoxyribonucleic acid (DNA) molecule. Adenine is indicated by the letter A.



(a) Complete the diagram by inserting the initial letter of each of the remaining bases. (1)

(b) Name the two components represented by X and Y on the diagram.

X _____

Y _____ (1)

(c) Give one structural feature of a DNA molecule which is not represented in the diagram.

(1)

(d)

If a DNA molecule contains 8000 nucleotides of which 20% are adenine, then the number of guanine nucleotides present is

A 1600

B 2000

C 2400

D 3200. (1)

(e)

Which of the following is composed of protein?

A Antibody

B Glycogen

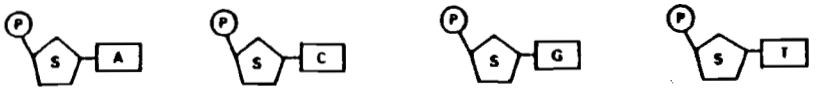
C Nucleotide

D Polysaccharide (1)

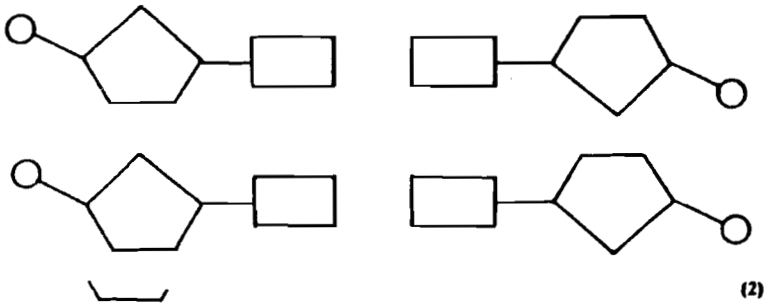
4

(a) The diagrams represent the four nucleotide components of DNA. The symbols represent the following:

A adenine; C cytosine; G guanine;
T thymine, S sugar; P phosphate.



Join these four nucleotides, represented below, to form part of a double strand of DNA and insert the appropriate letters to indicate a possible arrangement of the four bases.



(2)

The following section of mRNA codes is for a peptide made of ten amino acids. The sequence of bases is shown below:

Code starts ↓ Code ends ↓

A-U-G-G-C-U-G-C-U-A-G-U-A-G-U-C-G-A-A-G-U-A-U-G-A-G-U-G-C-U

When the peptide was analysed, four types of amino acids were identified in the quantities shown in the table.

Amino acids	
Name (letter)	*Number*
Methionine (M)	2
Alanine (L)	3
Arginine (R)	1
Serine (S)	4

(i) How many consecutive bases in a codon specify a single amino acid?

_____ (1)

(ii) Work out the amino acid sequence in the peptide and write the correct sequence in the boxes provided, using the letters from the table.

M									

(1)

5

How many adenine molecules are present in a DNA molecule of 2000 bases, if 20% of the base molecules are cytosine?

A 200

B 300

C 400

D 600

Which of the following is composed of protein?

A Nucleotide

B Glycogen

C Antibody

D Polysaccharide

Which of the following identifies correctly the sequence in which organelles become involved in the production of an enzyme for secretion?

A Nucleus → Ribosomes → Golgi Apparatus → Rough ER

B Ribosomes → Vesicles → Rough ER → Golgi Apparatus

C Nucleus → Rough ER → Vesicles → Ribosomes

D Ribosomes → Rough ER → Golgi Apparatus → Vesicles

(3)

6 (*a*) A molecule of DNA (deoxyribonucleic acid) is composed of a chain of nucleotides. Each nucleotide is formed from three components which are represented below.

sugar base phosphate

In the space below, draw a diagram to show these units linked correctly to form a nucleotide.

(1)

(*b*) The table below lists some base triplets of m RNA (messenger ribonucleic acid). The amino acid, for which each triplet codes, is also given.

m RNA base triplet	*amino acid*
uracil — cytosine — uracil	serine
cytosine — cytosine — uracil	proline
cytosine — guanine — adenine	arginine

NOTE: In answering the following questions, use the letters indicated to represent the nucleic acid bases:

A — adenine, C — cytosine, G — guanine, T — thymine, U — uracil.

Part of a protein molecule contains the following amino acid sequence:

— serine — arginine — proline —

(i) From the above information, state the sequence of bases, in the m RNA, that codes for this sequence of amino acids.

..... (1)

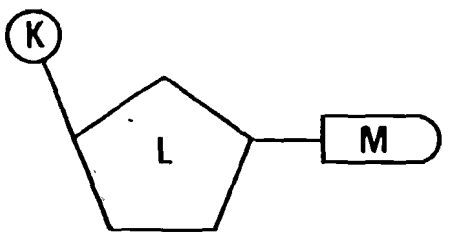
(ii) State the sequence of bases in the part of the DNA strand on which this segment of m RNA was formed.

..... (1)

(iii) Name the substance responsible for transporting free amino acids from the cytoplasm to the site of protein synthesis

7

The diagram shows a nucleotide from a molecule of DNA. *Marks*



(a) Name the parts labelled K, L and M.

K _____

L _____

M _____ (1)

(b) Part of a DNA molecule has the sequence of bases shown.

Write the sequence of bases in the corresponding part of the molecule of mRNA synthesised on the DNA.

DNA molecule	A	T	C	G	C	G
mRNA molecule						

(1)

(c) The percentage of bases in one strand of a DNA double helix is as follows

T = 40% and C = 22%

(i) What is the percentage of bases A and G together in the same strand of DNA?

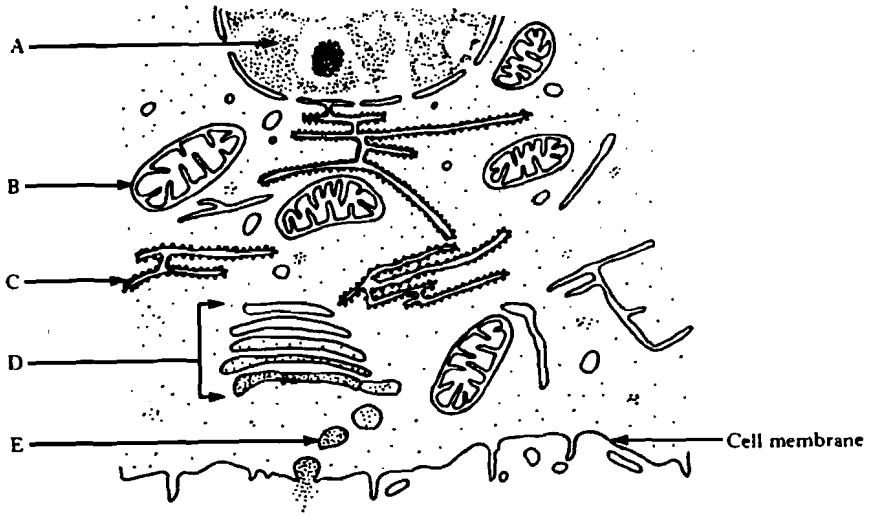
Percentage of A and G together: _____ (1)

(ii) What is the percentage of bases A and G together in the complementary strand of DNA?

Percentage of A and G together: _____ (1)

8

The diagram below represents part of an electron micrograph of a cell which secretes a hormone such as insulin.



Complete the table below by naming the structures B – E and stating how each is involved in the production or secretion of such a hormone.

Label	*Name of structure*	*Involvement in hormone production or secretion*
A	Nucleus	Controls the synthesis of RNA
B		
C		
D		
E		

(4)

9.

a

The function of tRNA in cell metabolism is to

A transport amino acids to be used in synthesis

B carry codons to the ribosomes

C synthesise proteins

D transcribe the DNA code.

b

The sequence of triplets on a strand of DNA is shown below.

ATTACACCGTACCAATAG

During translation of mRNA made from the above sequence, how many of the tRNA anticodons will have at least one uracil base?

A 3

B 4

C 5

D 7

c

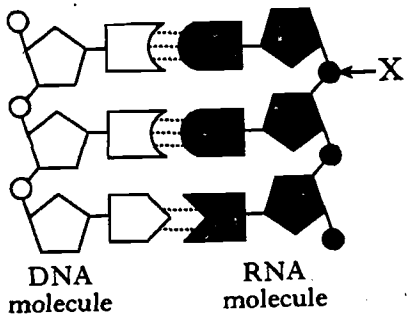
The table below contains statements which may be TRUE or FALSE concerning DNA replication and mRNA synthesis.

Which line in the table is correct?

	Statement	*DNA replication*	*mRNA synthesis*
A	Occurs in the nucleus	TRUE	FALSE
B	Involved in protein synthesis	TRUE	TRUE
C	Requires free nucleotides	TRUE	FALSE
D	Involves complementary base pairing	TRUE	TRUE

d

The diagram represents part of a molecule of DNA on which a molecule of RNA is being synthesised.



What does component X represent?

A Ribose sugar

B Deoxyribose sugar

C Phosphate

D Ribose phosphate

(4)