SMART EXAM RESOURCES
TOPIC QUESTIONS: NUCLEIC ACID AND PROTEIN SYNTHESIS
SUB-TOPIC: DIAGRAM BASED QUESTIONS
SET-1-QP-MS

1 DNA and RNA are important biological molecules that are involved in the production of polypeptides.

(a) Fig. 4.1 shows two nucleotides joined by a covalent bond.

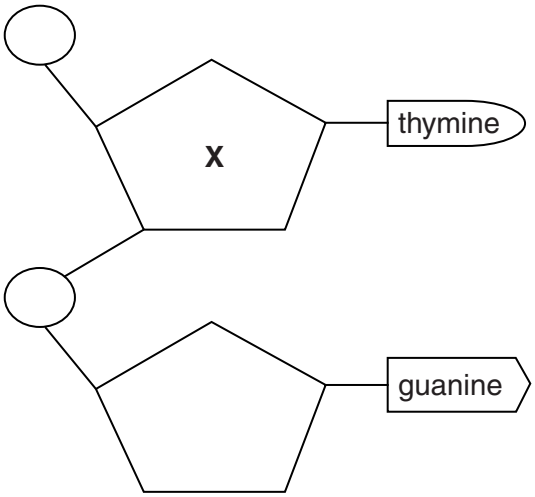

Fig. 4.1

(i) Fig. 4.1 represents part of a DNA molecule, **not** part of an RNA molecule.

Explain why.

.....

.....

..... [1]

(ii) Name the covalent bond between the two nucleotides.

..... [1]

(iii) Name component **X**.

.....

..... [1]

MARK SCHEME:

(i) *DNA because*
RNA (has uracil) does not have thymine ; [1]

(ii) phosphodiester ; [1]

iii) deoxyribose ; [1]

2 Red blood cells are formed from cells called reticulocytes. Stem cells in the bone marrow produce reticulocytes which differentiate into red blood cells. During differentiation haemoglobin is produced.

Fig. 6.1 shows the structure of small sections of DNA and messenger RNA (mRNA) in the nucleus of a reticulocyte during transcription.

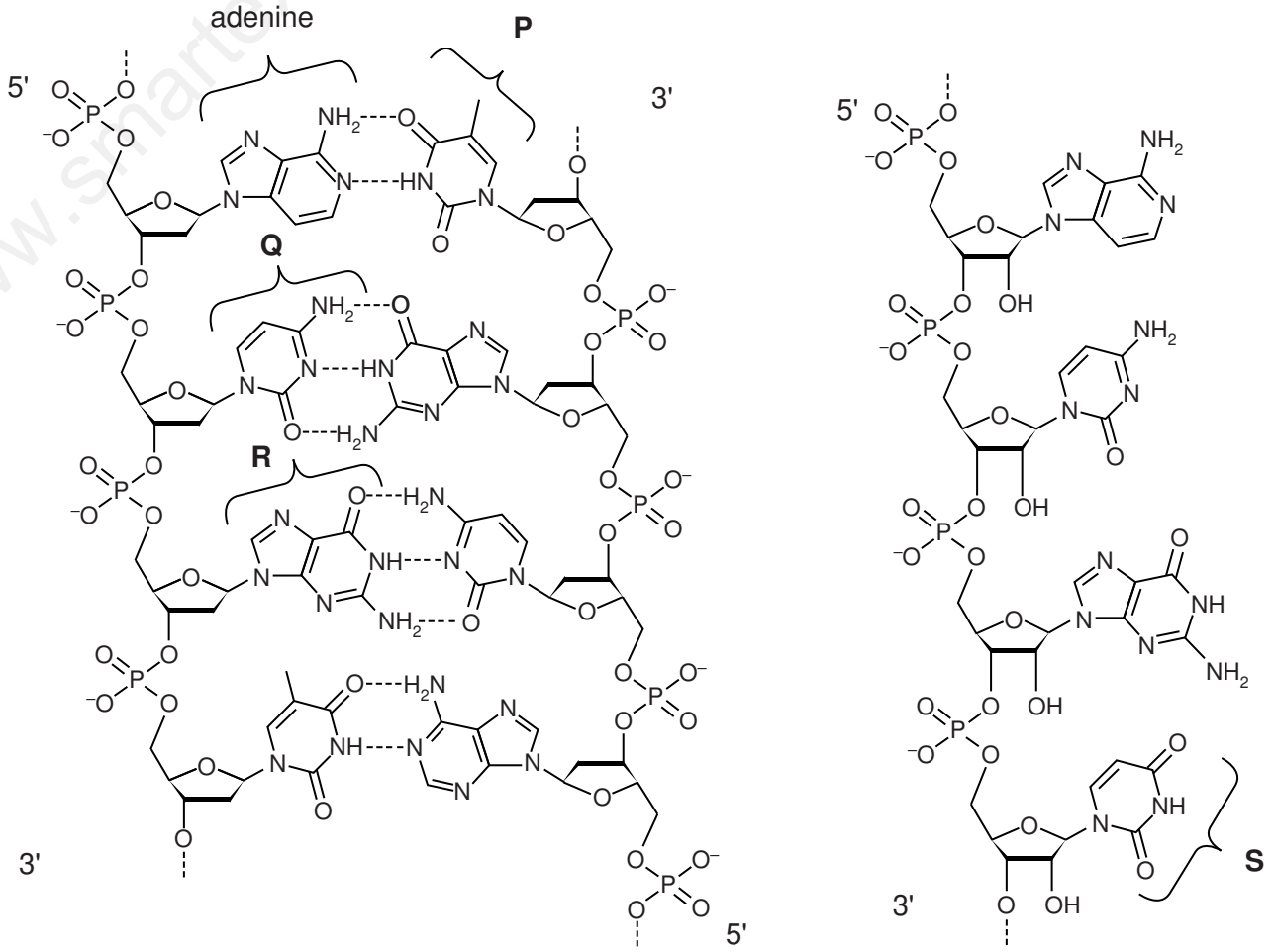

Fig. 6.1

(a) Name the bases **P** to **S**.

P .....

Q .....

R .....

S .....[4]

MARK SCHEME:

(a) **P** – thymine ; **R** thiamine / thiamin / thyamine
Q – cytosine ;
R – guanine ;
S – uracil ; [4]

3 Red blood cells are formed from cells called reticulocytes. Stem cells in the bone marrow produce reticulocytes which differentiate into red blood cells. During differentiation haemoglobin is produced.

Fig. 6.1 shows the structure of small sections of DNA and messenger RNA (mRNA) in the nucleus of a reticulocyte during transcription.

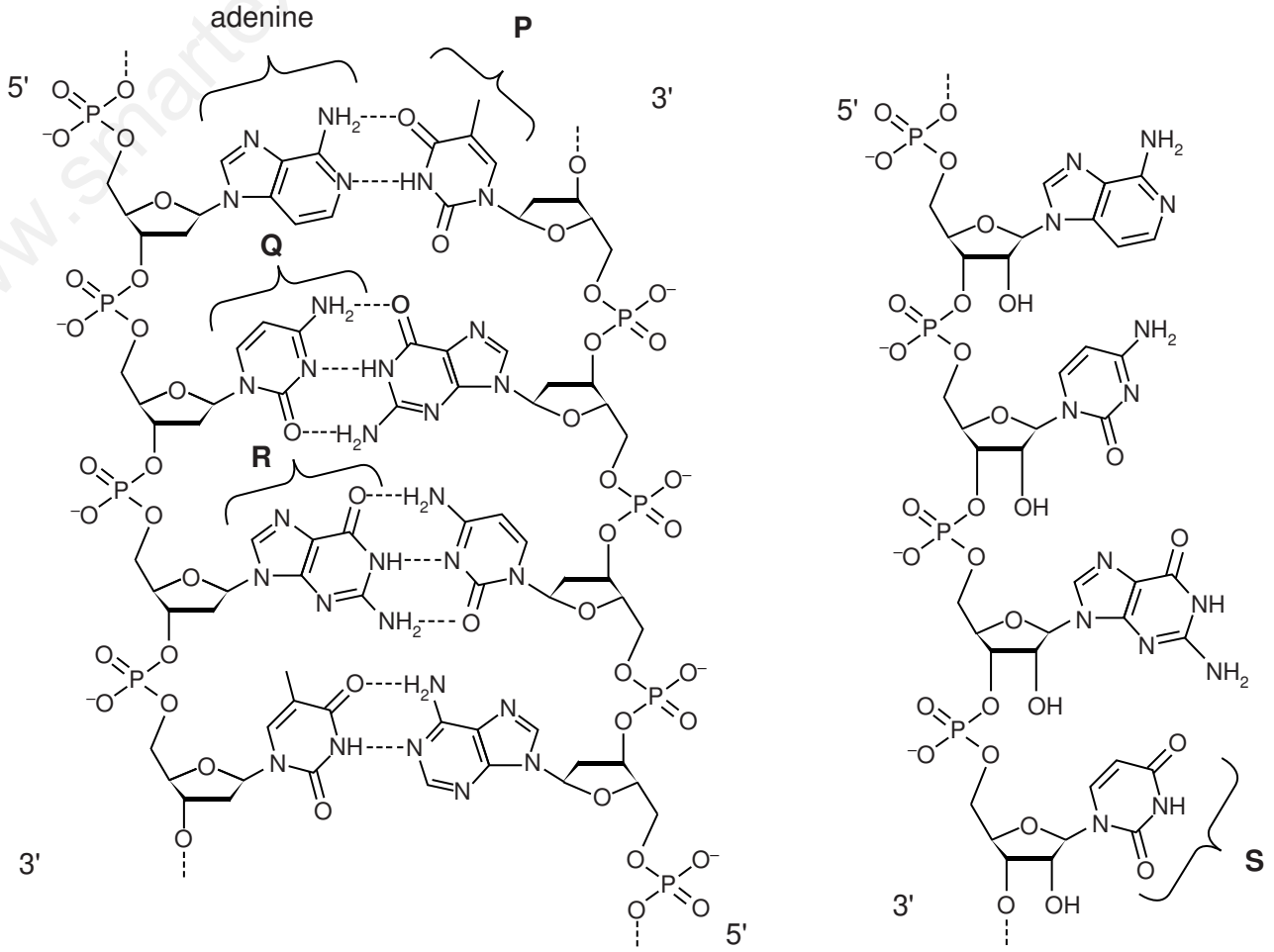

Fig. 6.1

(a) Name the bases **P** to **S**.

P .....

Q .....

R .....

S .....[4]

(b) Describe the role of the mRNA molecule shown in Fig. 6.1.

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 7]

MARK SCHEME:

(a) **P** – thymine **;** **R** thiamine / thiamin / thyamine
Q – cytosine **;**
R – guanine **;**
S – uracil **;** [4]

(b) **1** copy of the, DNA / gene, (coding) for a, polypeptide / globin **;** **A** protein

2 travels from, DNA / nucleus / chromosome, to ribosome **;**
A mRNA made in nucleus, attached to ribosome *so movement is implied*

3 for translation / for (haemo)globin production **;**

4 mRNA codes for, sequence / order, of amino acids **;** **A** for primary structure

5 *idea that* (nucleotide / base) sequence is a series of codons **;**

6 base pairing / AW, between codon on mRNA and anticodon on tRNA **;**
e.g. of AW
hydrogen bonds between bases
examples of base pairing: A–U / C–G
R binding between bases [max 3]

[Total: 7]

4 Macrophages synthesise intracellular enzymes.

Fig. 2.1 is a summary diagram of events that occur in a macrophage.

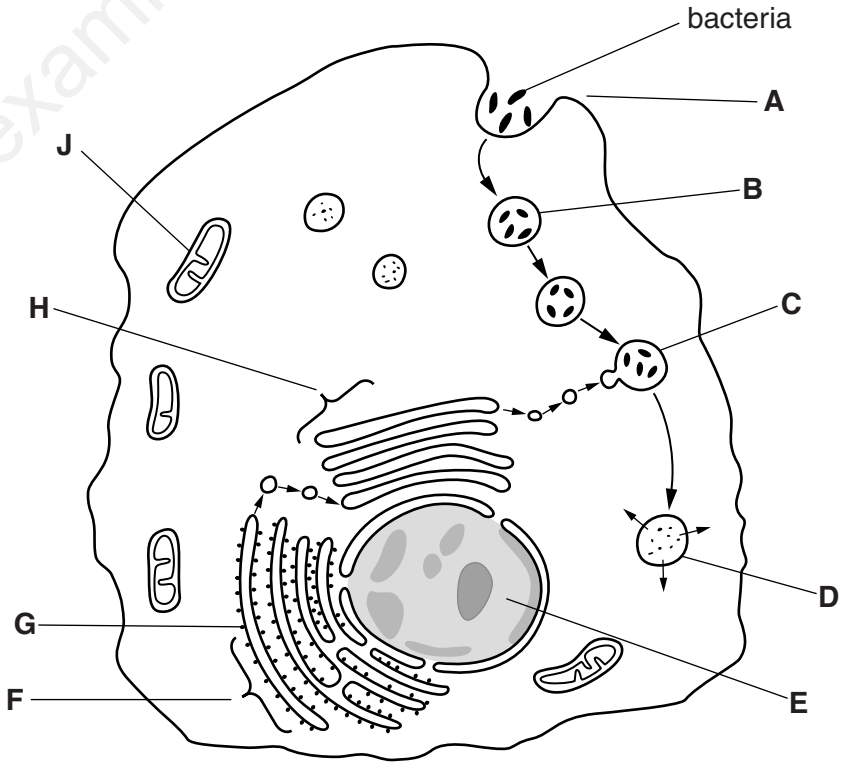

Fig. 2.1

Name the stages of protein synthesis that occur at **E** and at **F**.

E .....

F .....[2]

MARK SCHEME:

E transcription ;
F translation ; **A** post translation(al) modification [2]

5 In 1953, James Watson and Francis Crick published details about the structure of DNA. They used experimental results from other scientists to help them work out the structure and then built a model of a section of a DNA molecule, using pieces of wire and metal, with clamp stands to hold the model in place. This is shown in Fig. 2.1.

Fig. 2.1

(a) Watson and Crick used results from work carried out by Erwin Chargaff. He found that the proportions of the bases A, T, C and G were different in different species, but **within** each species:

- the proportion of A was equal to the proportion of T
- the proportion of G was equal to the proportion of C.

(i) Name the bases A, T, G and C.

A .....

T .....

G .....

C .....

[2]

(ii) Suggest **and** explain how Chargaff's findings helped Watson and Crick work out the structure of DNA.

.....

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.....[3]

(b) Phoebus Levene isolated the nucleotides of DNA and identified the carbohydrate component of each nucleotide.

State the name of this carbohydrate component.

.....[1]

(c) Before the discovery of the structure of DNA as the molecule of inheritance, scientists thought that proteins were most likely to be the molecules that carried information.

Suggest how the structure of proteins made scientists think that these were the molecules that carried information.

.....

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.....

.....

.....[2]

[Total: 8]

MARK SCHEME:

(a)(i)	A = adenine T = thymine **R** thiamine / thyamine G = guanine C = cytosine *all correct = 2 marks* *one, two or three correct = 1 mark*	**2**

(a)(ii)	*three from:* 1 complementary base pairing / complementary bases / base pairing / base pairs / complementary pairing ; 2 A with T and G with C ; 3 hydrogen bonding / hydrogen bonds ; *in context of between base pairs / holding strands together* 4 ref. to purines with pyrimidines ; 5 double ring (bases) with single ring (bases) ; **A** *idea of* longer base with shorter base 6 two (DNA), strands / polynucleotides ; **A** two chains **A** double helix (as double implies two strands) 7 strands (anti)parallel / distance between strands always the same ;	**3**
(b)	deoxyribose ; **A** 2-deoxyribose / 2-deoxy-D-ribose	**1**
(c)	*two from:* (information could be) sequence of amino acids ; **A** idea that a polypeptide/protein has amino acids arranged in an order / AW **I** primary structure / chains of amino acids (different) proteins have, different / specific, sequences (of amino acids) ; (up to) 20 different amino acids in proteins ; **A** approximately 20 *idea that* there is a great variety in protein structure ; **I** have many functions	**2**