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



**1** Switching genes on and off allows proteins to be synthesised only when required.

Processes **P** and **Q** occur when a gene is switched on, as shown in Fig. 4.1.

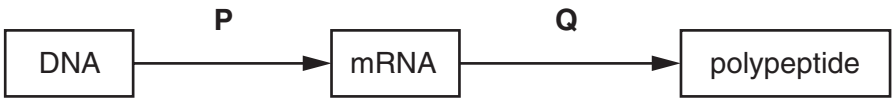


**Fig. 4.1**

**(b)** Name processes **P** and **Q**.

**P** .....

**Q** .....[1]

## MARK SCHEME:

**P** = transcription
**Q** = translation ; [1]

**2** Some people who move to live at high altitudes can develop chronic mountain sickness. One feature of this condition makes it difficult for the heart to pump blood around the body owing to the increased production of red blood cells.

The *EPAS*1 gene codes for a type of protein called a transcription factor, which helps to regulate the transcription of genes involved in red blood cell production. Some people have a mutated version of this gene that prevents the over-production of red blood cells.

**(i)** Explain what is meant by *transcription*.

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.....[3]

**(ii)** Describe how a mutated version of the *EPAS*1 gene can cause a change in the transcription factor protein produced.

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.....[3]

**(iii)** Some transcription factors may prevent transcription.

Suggest two ways in which they may do this.

1. .....

.....

2. .....

.....

[2]

## MARK SCHEME:

**(i)** making a (complementary) copy of, DNA**;** **A** a gene
ref. information / **AW**, for production of a polypeptide **;**

one (DNA) strand acts as a template **;** **AW**
production of (pre) mRNA **;**
detail of process **;** e.g. assembly of nucleotides
RNA polymerase [max 3]

**(ii)** nucleotide / base, sequence of, DNA / gene, changed / **AW ;**
**A** new allele (formed)

*ref. to* altered mRNA / **AW ;**
*this may be in context of a named type of mutation*
*consequence on tRNA*

tRNA / anticodon, with different amino acid (to ribosome) **;**
**A** tRNA with different anticodon

change in amino acid(s) / different amino acid sequence / change in primary structure **;**

affects, secondary structure / tertiary structure / 3D shape / function, of protein ;

*ref. to* one type of mutation **;**
e.g. base substitution means
deletion / insertion, leads to frameshift
ref. to premature stop codon [max 3]

**(iii)** *may prevent*
breaking of hydrogen bonds between, base pairs / bases / nucleotides,
(and access of RNA polymerase) **;**

attachment of, RNA polymerase (to DNA) **;**

progress / functioning, of RNA polymerase (along gene) **;**

synthesis / elongation of (pre) mRNA **;**

AVP **;** e.g. interfere with action of helicase [max 2]

**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.

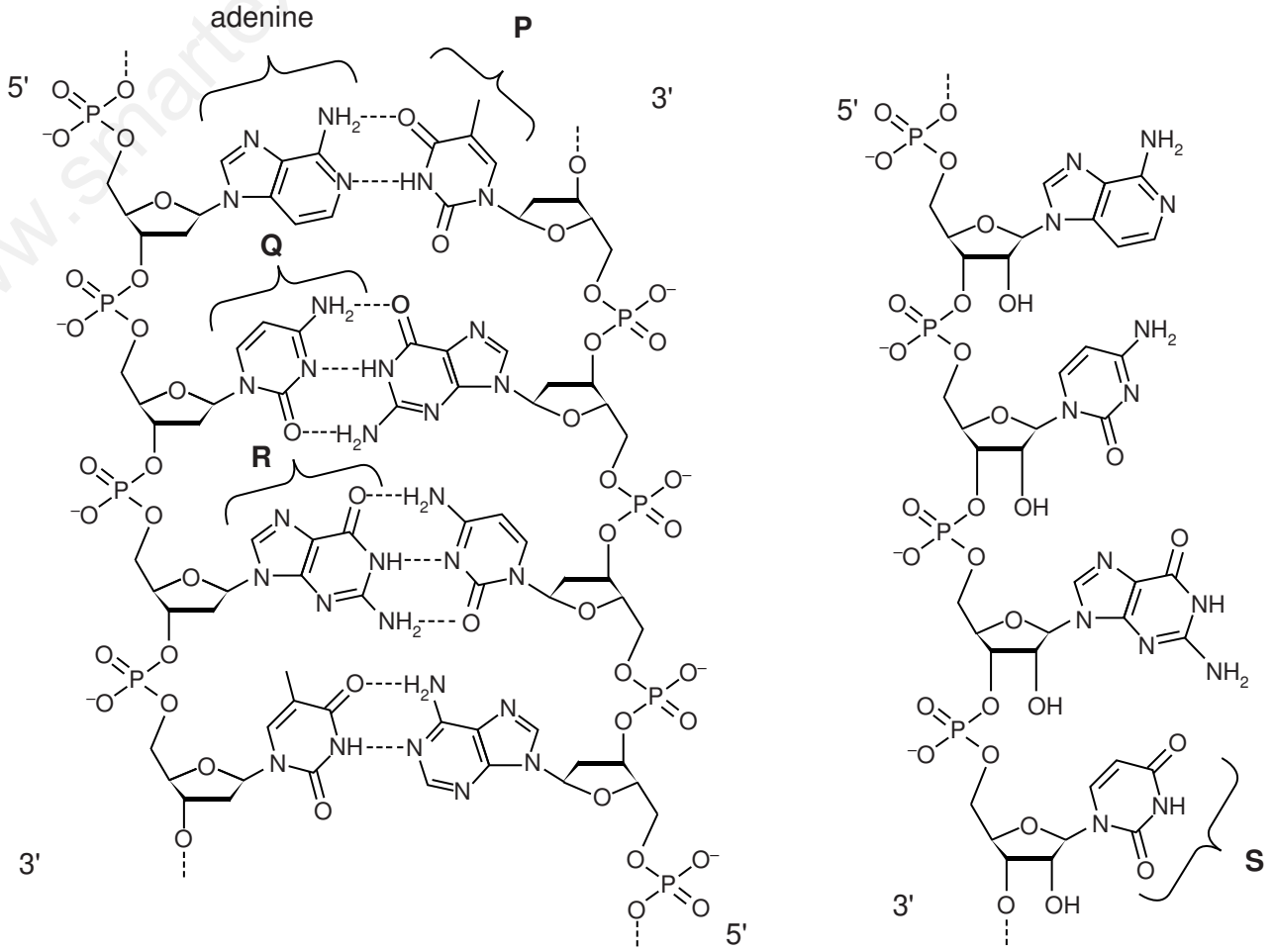


**Fig. 6.1**

**(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.

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.....

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.....

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.....[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.

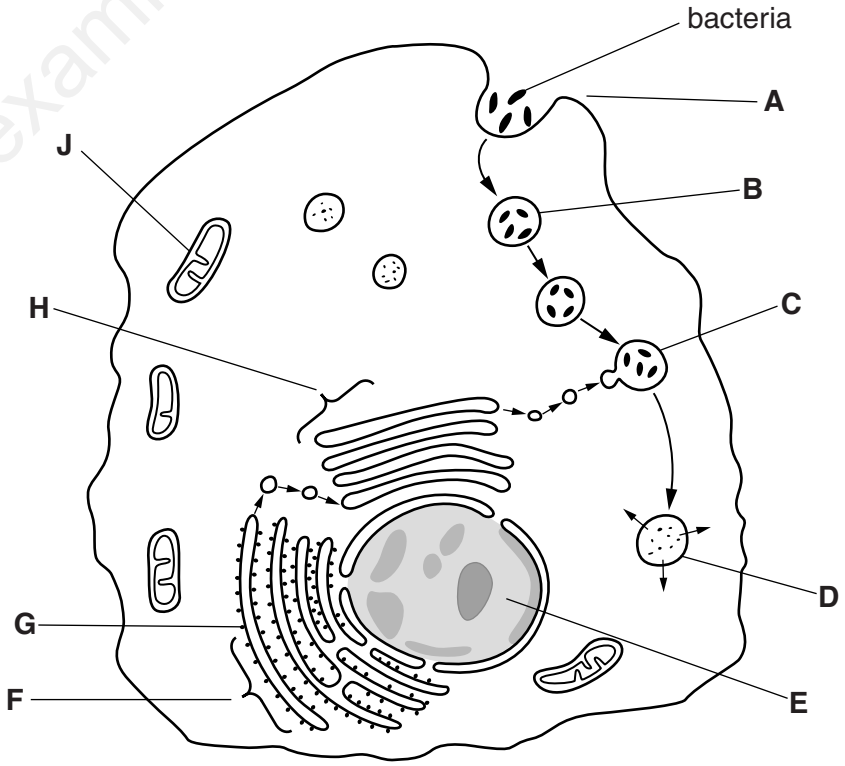


**Fig. 2.1**

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** Catalase is an enzyme with a molecular structure composed of four identical sub-units.

Fig. 4.1 is a diagram that shows how catalase is produced in cells.

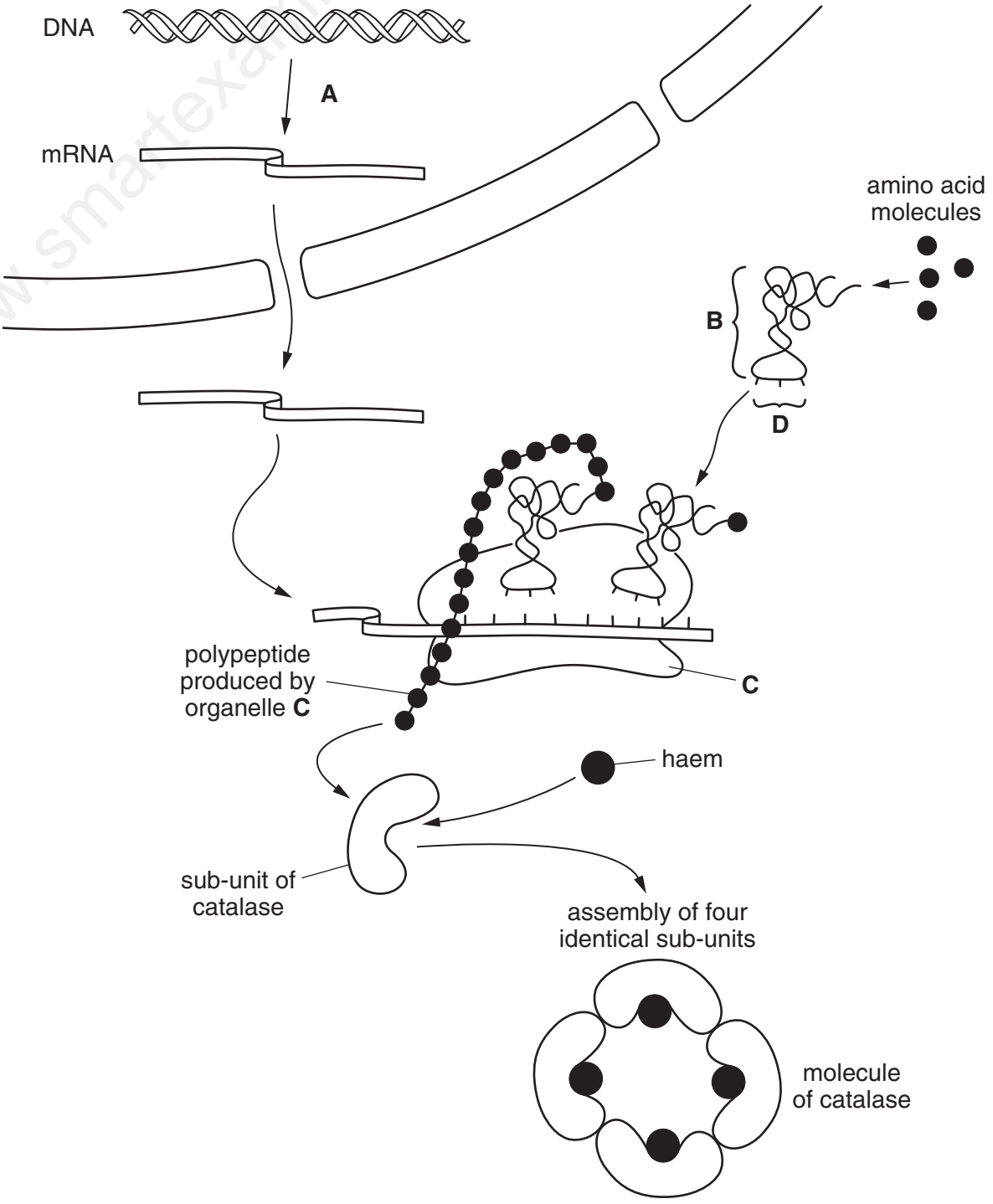


**Fig. 4.1**

**(a)** With reference to Fig. 4.1,

**(i)** name

process **A** .....

molecule **B** .....

structure **C** .....

sequence of bases **D** .....[4]

## MARK SCHEME:

**(a) (i) A transcription ;**
**B tRNA / transfer RNA ;**
**C ribosome ; A subunit of ribosome / ribosomal subunit**
**treat 70S / 80S or small / large as neutral**
**D anticodon ; [4]**