

## **A Level Biology B**

**H422/02** Scientific literacy in biology

### **Question Set 3**

1. (a) (i) There is evidence that heart rate increases when people experience pain. Heart rate is one physiological factor that is regulated tightly and kept within narrow limits.

Name the process by which the internal environment of an organism is kept within narrow limits.

[1]

- (ii) A student made the following revision notes about the control of heart rate.

Complete the student's notes using the most appropriate word(s).

'The resting heart rate of an adult human is about 70 beats per minute.

This is known as the set point. There are two types of receptor that control heart rate:.....in the walls of the carotid artery that detect changes in blood pH and pressure receptors in the carotid artery and the aorta. When blood pressure rises, pressure receptors transmit nervous impulses to the which decreases heart rate via the..... nervous system. This is an example of..... !

[4]

- (iii) Some doctors who study pain ask patients to give an estimate of the level of their pain by using a scale of 1 to 10.

Explain why some researchers think that measuring heart rate is a more accurate way of determining the level of pain.

[1]

- (b) (i) Neuropathic pain is a type of pain caused by neurones malfunctioning following nerve damage. When this happens, some voltage-gated sodium ion channels (VGSCs) in pain receptors open spontaneously.

Explain how the spontaneous opening of a VGSC in a pain receptor leads to the generation of a nerve impulse in the sensory neurone attached to the pain receptor.

[3]

- (ii) Three different types of VGSC in different parts of the nervous system have been linked to neuropathic pain. Drugs to treat neuropathic pain are now being developed that specifically block these types of VGSC.

Suggest why it is important to develop drugs that only block these three types of VGSC.

[2]

- (c) (i) Single nucleotide polymorphisms (SNPs) have been detected in the genes coding for several types of VGSC. It is thought that these SNPs might alter the response of different patients to drugs that block VGSCs.

Describe the steps involved in identifying the SNPs present in a DNA sample from a patient.

[2]

- (ii) Screening for other SNPs is used in the study, diagnosis, and treatment of cancer.

A mutation in either the *BRCA1* or *BRCA2* gene increases the risk of breast cancer.

Explain why screening for these mutations is only offered to individuals with a strong family history of breast cancer and a living relative with breast cancer.

[2]

**Total Marks for Question Set 3: 15**

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