

Exam

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1 Cell membrane

What is the main component of the plasma membrane (cell membrane)?

Select one alternative:

- ☐ Lipid monolayer
- ☒ Phospholipid bilayer
- ☐ Purely a protein layer
- ☐ Triglyceride layer

2 Central dogma

The central dogma of molecular biology is a theory stating that genetic information flows only in one direction, from DNA, to RNA, to protein, or RNA directly to protein.

The process of creating protein from mRNA is called.....

Select one alternative:

- ☐ Transcription
- ☒ Translation
- ☐ Replication
- ☐ Reverse transcription

3 Krebs cycle

The production of Adenosin triphosphate (ATP) is necessary for life. ATP is the primary energy carrier in the cell.

Kreb's cycle is the basis of most of the energy production in a cell (aerobic respiration). Where does this process take place?

Select one alternative:

- ☐ The cytoplasm
- ☐ Smooth endoplasmic reticulum
- ☒ The mitochondria
- ☐ The nucleus

4 Sodium potassium

What is the function of the sodium-potassium pump?

Select one alternative:

- ☐ Equalize extracellular and intracellular concentration of Sodium and Potassium.
- ☐ Utilises the concentration gradient of sodium and potassium for synthesis of ATP.
- ☒ Building up the membrane potential, by active transport of Sodium and Potassium from low to high concentration
- ☐ Levelling the membrane potential by transports of sodium and potassium from high to low concentration

5 Myelin sheaths

Multiple sclerosis (MS) is an autoimmune disease where immune cells can damage myelin sheaths in the nervous system. The damage of myelin sheaths causes....

Select one alternative:

- ☒ Decreased signal conduction
- ☐ Loss of protection against infections
- ☐ Increased signal conduction
- ☐ Stronger action potential

6 Cerebral stroke

A patient presents with sudden one-sided paresis in the emergency room. A cerebral stroke is suspected. What is the most common cause of cerebral stroke?

Select one alternative:

- ☐ Vasospasm of cerebral artery
- ☒ Blood clot - thrombosis or embolism
- ☐ Fat embolism
- ☐ Haemorrhaging (bleeding)

7 Autonomous NS

Which part of the autonomous nervous system: increases visceral activity, relaxes blood vessels, increases blood flow to internal organs and reduces heart rate.

Select one alternative:

- ☐ Parasympathetic
- ☒ Sympathetic
- ☐ Autonomous motor neuron system
- ☐ Somatic sensory neurons

8 Motor unit in muscle contraction

What best describes a motor unit in the context of muscle contraction?

Select one alternative:

- ☒ A motor unit refers to a single muscle fiber and all the nerve cells connected to it
- ☐ A motor unit refers to a single nerve cell and all the muscle fibers it innervates
- ☐ A motor unit refers to a group of muscle fibers that contract independently of each other
- ☐ A motor unit refers to a group of nerve cells that control a single muscle fiber

9 Stroke volume

A patient has a resting cardiac output (CO) of 4.5 l/min. The heart rate is 70 beats per minute. What is the stroke volume?

Select one alternative:

☐ 77 ml

☐ 45 ml

☐ 52 ml

☒ 64 ml

10 HR in Heart failure

A patient with heart failure has an end diastolic left ventricular volume of 200 ml, an ejection fraction of 25%. What would the resting heart rate have to be, to maintain a normal cardiac output of 4.5 l/min?

Select one alternative:

☐ 177 beats/min

☐ 75 beats/min

☐ 50 beats/min

☒ 90 beats/min

11 Cardiac output in infant

An infant is admitted to the intensive care unit with myocarditis (inflammation of the myocardium) and heart failure. Ejection fraction (a measure of ventricular function) is 20%. Left ventricular end diastolic volume is 20 ml and his heart rate is 160 beats/min. Calculate his cardiac output (CO).

Select one alternative:

- ☐ 800 ml/min
- ☐ 960 ml/min
- ☒ 640 ml/min
- ☐ 1280 ml/min

12 Ejection Fraction

The ejection fraction is used as a measure of ventricular function. A patient with heart failure has an end diastolic left ventricular volume of 220 ml. During rest, she has a normal cardiac output of 4.5 litres /min with a heart rate of 92 beats / min. What is the resting ejection fraction?

Select one alternative:

- ☐ 36%
- ☐ 49%
- ☒ 22%
- ☐ 32%

13 Cath O2 uptake

We do a heart catheterization in the same patient, and measure a hemoglobin of 13.5 g/dl, an arterial oxygen saturation of 100%, and a mixed venous saturation of 70%. One gram of hemoglobin binds 1.4 ml of oxygen. The patient weighs 67 kg. What is her oxygen uptake during the procedure? (this is the same patient as in the previous question with $\text{CO} = 4,5\text{L/min}$ and $\text{EDV} = 220\text{ml}$)

Select one alternative:

- ☐ 3,0 ml/kg/min
- ☐ 8,9 ml/kg/min
- ☒ 3,8 ml/kg/min
- ☐ 12,7 ml/kg/min

14 Sensitivity

What is the sensitivity of a certain diagnostic test?

Select one alternative:

- ☐ The probability of being ill if you have a positive test
- ☐ The probability of having a negative test if you are healthy
- ☐ The probability of being healthy if you have a negative test
- ☒ The probability of having a positive test if you are ill

15 Type II error

What is a type II error?

Select one alternative:

- ☐ The power
- ☐ Accepting a false result as true (false positive)
- ☐ The confidence interval
- ☒ Discarding a true result as false (false negative)

16 NPV

What do we mean by the negative predictive value of a test:

Select one alternative:

- ☒ The probability of being healthy, if the test shows the patient to be healthy
- ☐ The probability of being ill if the test shows the patient to be ill
- ☐ The probability of being healthy, despite the test showing the patient to be ill
- ☐ The probability of being ill, despite the test showing the patient to be healthy

17 Specificity

Calculate the specificity for this diagnostic test for disease X based on the information provided in this table:

	Positive test	Negative test	Total
Healthy	50	950	1000
Ill/sick	350	100	450
Total	400	1050	1450

Select one alternative:

☒ 95%

☐ 87,5%

☐ 77%

☐ 90%

18 PPV

Calculate the positive predictive value for the same diagnostic test as in the previous question:

	Positive test	Negative test	Total
Healthy	50	950	1000
Ill/sick	350	100	450
Total	400	1050	1450

Select one alternative:

☐ 77%

☒ 87,5%

☐ 90%

☐ 95%

19 NNT

Understanding the Number Needed to Treat (NNT) in Clinical Studies

Recent reports are saying that influenza virus is on the rise in Trondheim this Christmas.

Oseltamivir (Tamiflu) is an antiviral drug that sometimes is used in treatment against influenzae infections. In a study it was found that the Number Needed to Treat (NNT) with Oseltamivir (Tamiflu) to avoid hospitalization of otherwise healthy adults with Influenza infection, was 200. What does it mean that NNT was 200 in this context?

Select one alternative:

- ☐ 200 people will be cured of influenza after taking Oseltamivir.
- ☒ 200 people need to be treated with Oseltamivir to prevent one additional hospitalization.
- ☐ 200 people will benefit from treatment after taking Oseltamivir.
- ☐ 200 people will be hospitalized after treatment with Oseltamivir

20 Study power

“Study power” is a measure of the probability of proving a given hypothesis by a clinical study. What factors influence the power of a study?

Select one alternative:

- ☐ Only variability of the outcome variable
- ☐ Only the desired significance level
- ☐ Only study size
- ☒ All of the above

21 Type II error

A certain study has a study power of 80% and a significance level of 5%. What is the probability of a type 2 error?

Select one alternative:

☐ 80%

☐ 5%

☐ 95%

☒ 20%

22 Evidence based practice

What is evidence based medical practice?

Select one alternative:

☐ Practice that is founded in solid physiological experiments as evidence

☐ Practice that is only founded in clinical studies

☐ Practice that is founded on large epidemiological studies

☒ Practice that takes into account both clinical studies, medical background knowledge and patients experience and preferences

23 HT and stroke

The association between hypertension (high blood pressure) and stroke was examined in a cohort study. The study showed that the relative risk of stroke was 3 among people with hypertension, compared with people without hypertension. What is the correct interpretation of this result?

Select one alternative:

- ☐ When people with hypertension got a stroke, they had a 3 times higher probability of dying from the disease, compared with people without hypertension.
- ☐ The brain area affected in stroke patients was on average 3 times larger in people with hypertension, compared with people without hypertension.
- ☒ People with hypertension had a 3 times higher probability of getting a stroke, compared with people without hypertension.
- ☐ The prevalence of stroke was 3 times higher among people with hypertension, compared with people without hypertension.

24 Confounding

How can confounding change the effect estimate (e.g. a relative risk) of a cohort study? The effect estimate

Select one alternative:

- ☐ will not change if the study is large enough
- ☐ can only become too large
- ☒ can become either too large or too small
- ☐ will not change

25 P-value

The significance (p value) of a controlled study result, is often given as a percentage, for instance 5%. What does this mean?

Select one alternative:

- ☐ The study effect (difference in outcome between groups) is 20%
- ☐ The probability of the study result being true (non random) is 5%
- ☐ The study effect (difference in outcome between groups) is 5%
- ☒ The probability of the study result being wrong (random) is 5%

26 Stenosis - CSA

A blood vessel has a narrowing (stenosis) in a short segment. In the normal part of the vessel, the cross sectional area is 1 cm² and blood flow velocity is 1 m/s. Through the stenosis, the blood velocity increases to 5 m/s. What is the cross sectional area of the stenosis?

Select one alternative:

- ☐ 0.25 cm²
- ☒ 0.2 cm²
- ☐ 0.5 cm²
- ☐ 5 cm²

27 Stenosis 2

A blood vessel has a narrowing (stenosis) in a short segment. In the normal part of the vessel the blood velocity is 1 m/s, through the stenosis the velocity increases to 5m/s. What is the pressure gradient over the stenosis?

Select one alternative:

- ☐ 25 mmHg
- ☒ 100 mmHg
- ☐ 50 mmHg
- ☐ 5 mmHg

28 US Resolution

Which of these factors are important for the resolution in an ultrasound image?

Select one alternative:

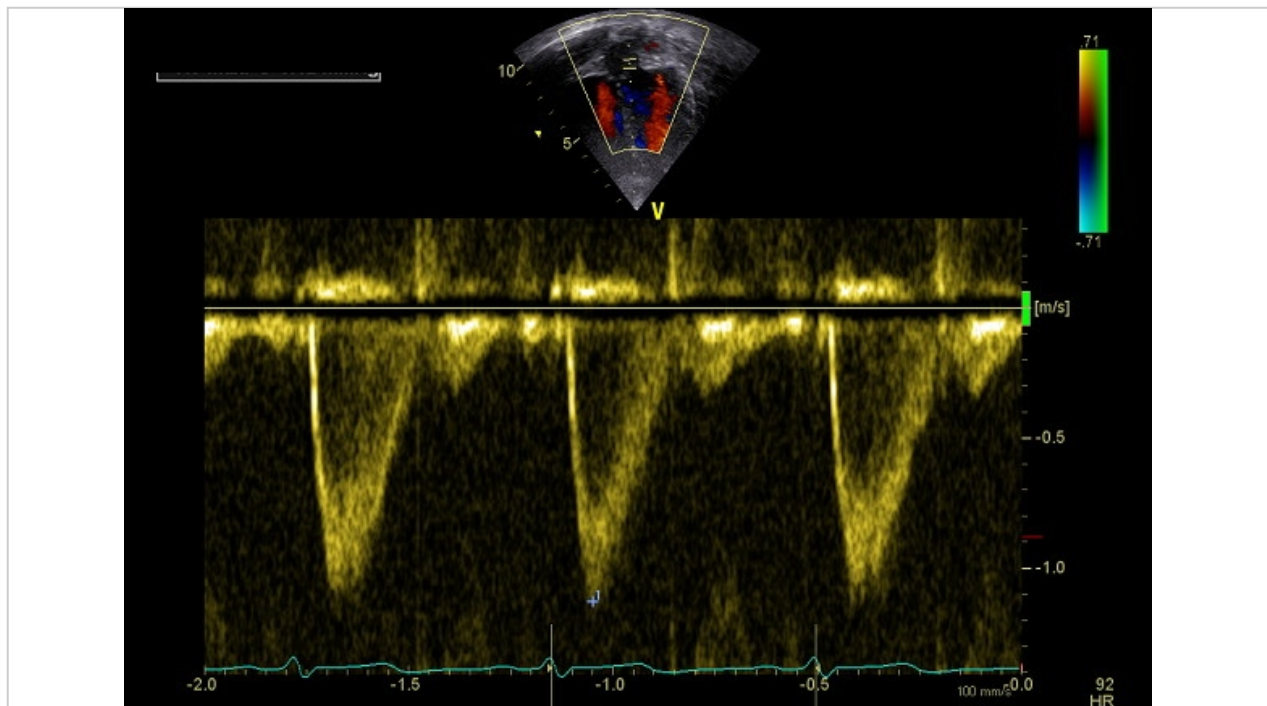
- ☐ Only the frequency
- ☐ Only the focal depth
- ☐ Only the probe aperture size
- ☒ All of the above

29 Bioeffects US

Ultrasound is a safe imaging modality. What are the main bio-effects of ultrasound?

Select one alternative:

- ☐ Chemical bio-effects
- ☐ Ionization
- ☐ Increase in muscle tone
- ☒ Thermal effects

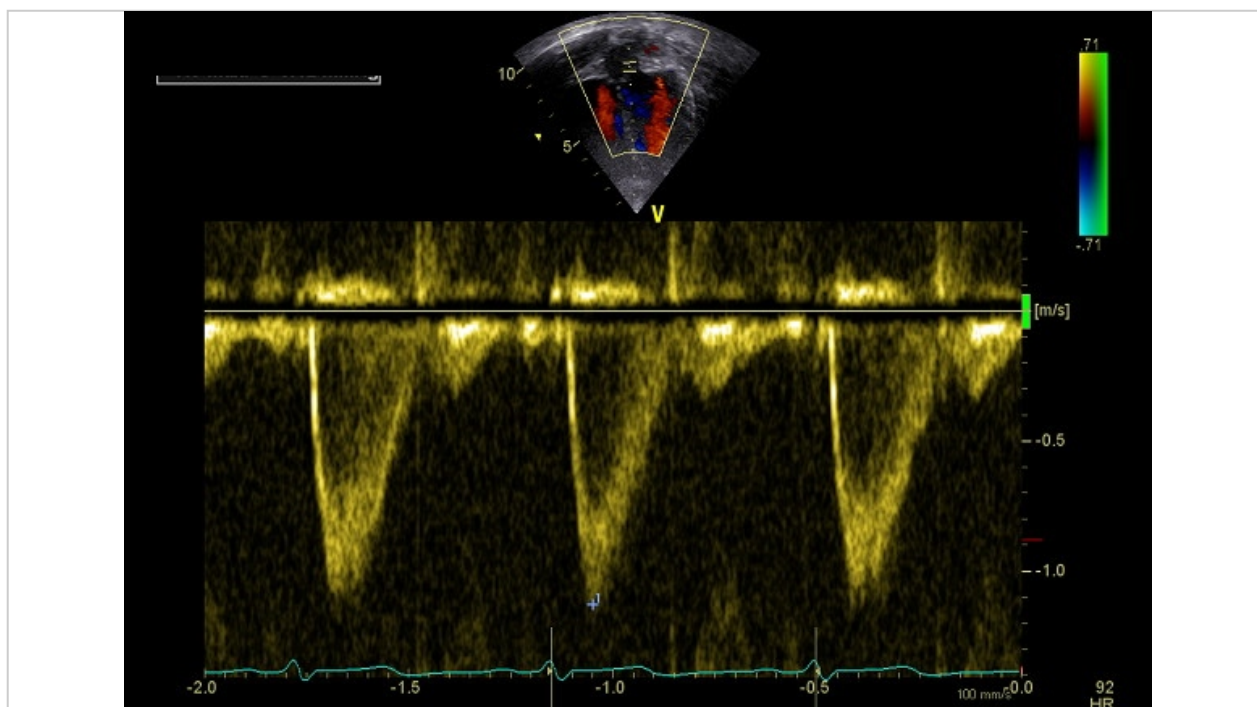
30 US mode

This is a picture from an ultrasound examination of the heart. An ultrasound beam is used to record the velocity spectrum that is printed along a time axis, giving a diagram of blood velocities in a specific position in the heart. What is this ultrasound modality called?

Select one alternative:

- ☐ M-mode
- ☐ A-mode
- ☒ Doppler mode
- ☐ B-mode

31 Depth specificity US



This is the same picture as in the previous question.

Velocity traces are sampled from a specific depth along the ultrasound beam. How is the depth selectivity achieved?

Select one alternative:

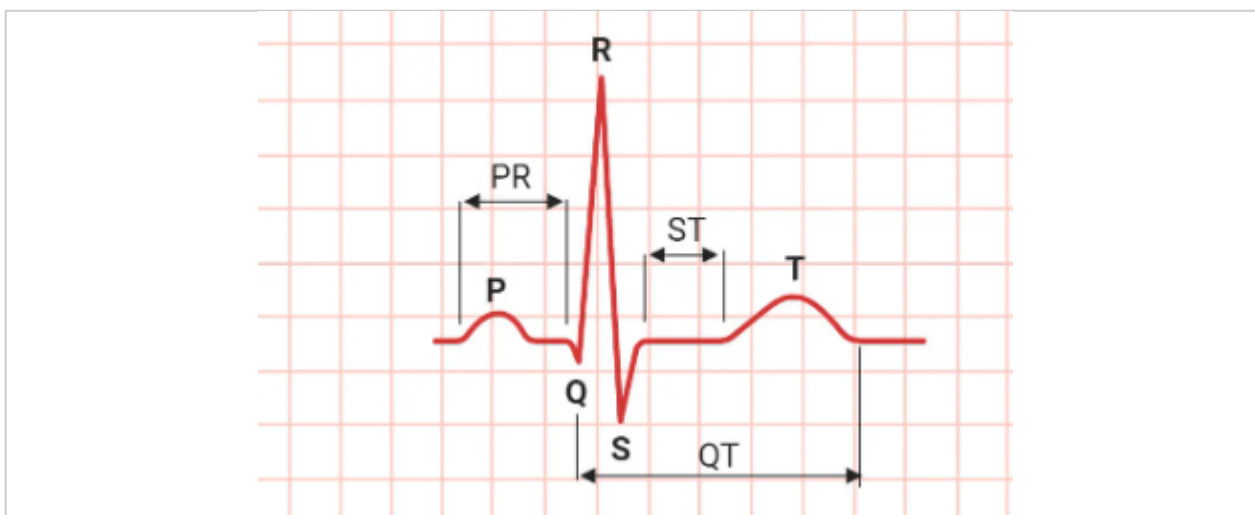
- ☐ By selecting a certain frequency in the reflected signal (frequency gating)
- ☐ By varying the frequency in the transmitted signal
- ☒ By selecting the reflected signal at a certain time after the pulse is sent out (time gating)
- ☐ By varying the total energy in the transmitted signal

32 PET principle

What is the principle of PET (positron emission tomography) scan?

Select one alternative:

- ☐ Gamma rays are emitted directly by a radioisotope injected into the body, and are detected by a ring of detectors around the patient. The concentration of the isotope is mapped by the intensity of radiation in the cross section.
- ☐ Positrons are emitted by a radioisotope injected into the body, and are detected by a ring of detectors around the patient. The concentration of the isotope is mapped by the intensity of radiation in the cross section.
- ☒ Positrons are emitted by a radioisotope injected into the body, travels only a micro distance before being annihilated by collision with an electron. This produces two gamma photons in opposite directions that are detected by a ring of detectors around the patient. The concentration of the isotope is mapped by the intensity of radiation in the cross section.
- ☐ Positive alpha particles are emitted directly by a radioisotope injected into the body, and are detected by a ring of detectors around the patient. The concentration of the isotope is mapped by the intensity of radiation in the cross section.

33 QRS**ECG**

The P-wave in an ecg represents the atrial activation. What does the QRS-complex represent?

Select one alternative:

- ☐ Ventricular depolarization
- ☒ Conduction through the AV-node, and atrial contraction
- ☐ Ventricular repolarization
- ☐ Atrial repolarization

34 Aerobic fitness

Maximum oxygen uptake is a measure of aerobic fitness. What limits the maximal oxygen uptake in healthy individuals?

Select one alternative:

- ☐ The maximal gas diffusion capacity of the alveoli
- ☐ The anaerobic threshold of the muscles
- ☐ The maximal ventilation capacity of the lungs
- ☒ The maximal pumping capacity of the heart

35 Neural adaptation

Training for maximal neural adaptation (recruitment and coordination of motor units).

In training for maximal strength, training neural adaptation is a key component.

How do we train for maximal neural adaptation?

(RM - repetition maximum)

Select one alternative:

- ☐ Eccentric training
- ☒ High intensity (close to 90% of 1RM), few repetitions per series
- ☐ At least 15 repetitions/series
- ☐ Low intensity (30-50% of 1RM), 10-12 reps per series

36 Vascular resistance

Which blood vessels are the primary site of regulation of vascular resistance (regulates central blood pressure)?

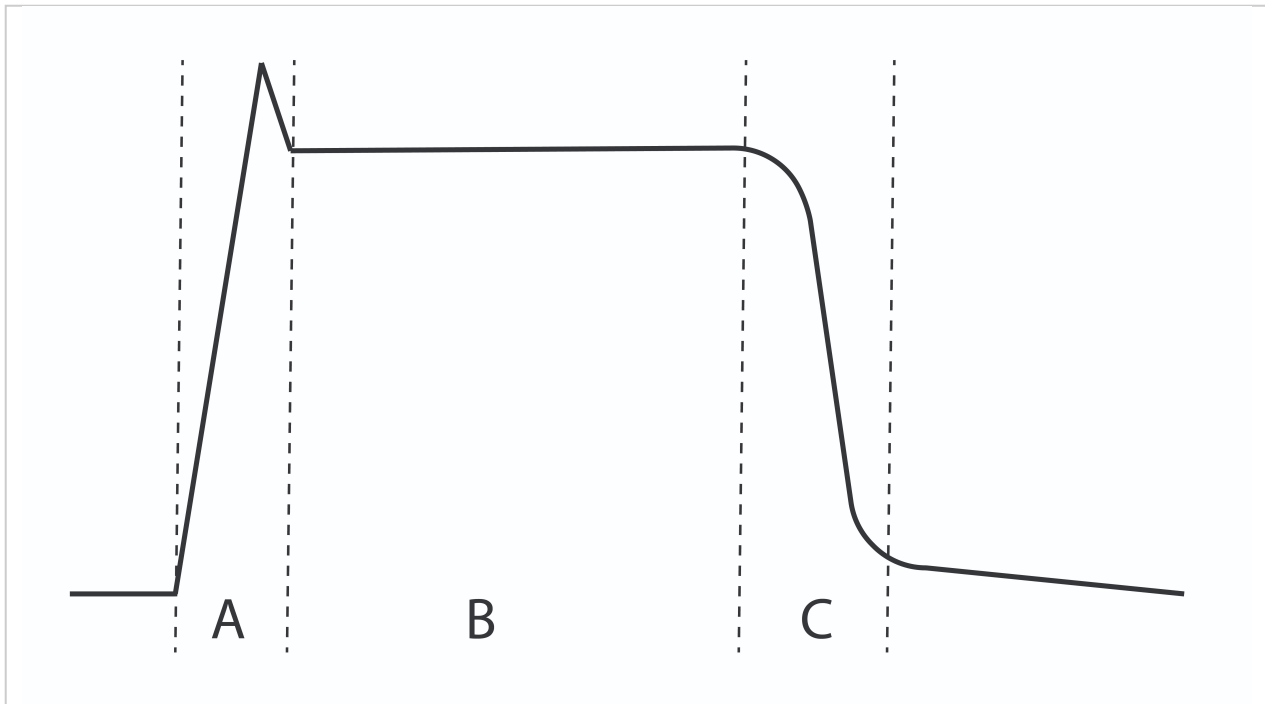
Select one alternative:

☐ Capillaries

☐ Venules

☐ Arteries

☒ Arterioles

37 Action potential and heart cycle

The diagram presents a schematic representation of a cardiac action potential. The cardiac cycle is divided into: systole and diastole. In this particular illustration, which phase(s) (A,B,C) correspond to the systole?

Select one alternative:

☐ A

☒ A+B

☐ B

☐ B+C

38 Heart arrhythmias

Which statements is true when it comes to heart arrhythmias:

Select one alternative:

- ☐ Ventricular fibrillation is not dangerous
- ☐ Tachycardia in the atria are usually more dangerous than in the ventricles
- ☒ Tachycardia in the ventricles can be extremely dangerous
- ☐ In atrial fibrillation there is slow and regular atrial activation

39 The nervous system - Proprioceptors

Proprioception is mediated by proprioceptors located in muscle spindles, Golgi tendon organs and joints. What is the primary function of proprioceptors in the human body?

Select one alternative:

- ☒ To sense the position and movement of the body and its parts
- ☐ To detect changes in temperature
- ☐ To regulate the body's metabolic rate
- ☐ They provide information about the body's internal physiological state

40 Myopia

In a normal eye the lens focuses the light on the retina. Where does the light focus in an eye with myopia and what lens would you use to correct it?

Select one alternative:

- ☐ In myopia, light focuses directly on the retina. No lens is needed for correction.
- ☐ In myopia, light focuses in front of the retina. A concave lens corrects it.
- ☒ In myopia, light focuses in front of the retina. A convex lens is used for correction.
- ☐ In myopia, light focuses behind the retina. A convex lens is used for correction.