Answers to examination-style questions

Answers				Marks	Examiner's tips
1	**a)**	**i)**	1 and 2 share neurone but 2 and 3 have separate neurones (to brain)	1	Ignore wrong names of neurones.
		ii)	1 unit is sub-threshold / 3 units are above threshold / give sufficient depolarisation; (1 unit) no impulses / no action potential / in (sensory) neurone / does not stimulate (sensory) neurone / 3 units → impulses; (spatial) summation / sufficient neurotransmitter released / from 3 receptors / insufficient N-T from one;	3	Reject 'temporal'.
	b)		impulses along separate neurone from each receptor cell / each receptor cell connects to separate neurone	1	
2	**a)**	**i)**	label myelin sheath on neurone	1	
		ii)	no salutatory conduction / description / all sections depolarise; slower transmission / reduced frequency / arrival of impulses to muscle;	2	
	b)		entry of calcium ions (presynaptic membrane); vesicles fuse with membrane / exocytosis / release TS; neurotransmitter diffuses; binds to receptors, postsynaptic / membrane / muscle membrane; depolarisation / sodium ions enter; release of calcium ions (from within the muscle); removes tropomyosin / bind to troponin; exposing binding sites on the actin; cross bridge formation / myosin binds; myosin head moves / pull the actin along; rachet mechanism / description / detach and reattach; ATPase activated;	7 max.	
	c)	**i)**	1.3 μm, maximum overlap / muscle (fully) contracted / actin sites all occupied / no further cross bridge formation		

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	ii)	actin and myosin, no overlap / completely separated; no cross bridge formation; the muscle cannot contract;		
	iii)	muscle is contracting; because binding sites available / interactions can occur;	2	
3 **a)**		thermoreceptors in skin; impulses via nerves / neurones to or from; hypothalamus; heat gain / temperature centre (in hypothalamus); contraction / constriction of arterioles; diversion through shunt vessels;	4 max.	Accept receptors in hypothalamus if after reference to cooled blood. Do not accept capillaries or just vaso-constriction.
b)	**i)**	reduced evaporation of sweat; due to reduced gradient / saturation / high water content of air; less heat loss by (latent) heat of evaporation;	2 max.	
	ii)	skin vessels open / vasodilatation; blood diverted from muscles / limited volume of blood;	2	(Movement dq.)
4 **a)**		387	1	
b)	**i)**	**CCAG**	1	
	ii)	5	1	
c)		high-energy radiation / X-rays / ultraviolet light / gamma rays; high energy particles / alpha particles / beta particles; named chemical mutagens e.g. benzene / caffeine / pesticide / mustard gas / tobacco tar / free radicals; length of time of exposure (to a mutagen); dosage (of mutagen);	2 max.	Two named examples = 2 marks.
d)	**i)**	UAC UUA UGG	1	
	ii)	addition and deletion (of bases / nucleotides); thymine added; adenine deleted;	3	Addition of thymine and deletion of adenine = 3 marks. Allow addition of adenine (RNA) and deletion of uracil (RNA) = 2 marks.

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5	**a)**	three bases / codon code for one amino acid; look up genetic code using table / find mRNA / DNA codons; synthesise DNA with correct base sequence;	2 max.	
	b)	**i)** means of getting new DNA into cell / host / gene carrier	1	
		ii) codes for characteristic that is easy to detect / gives valid example; allows identification of modified cells / cells that have taken up the gene / DNA / vector / plasmid with the gene;	2	
	c)	to ensure that the (antibacterial) protein is produced; to show that the (antibacterial) protein is effective; to check that no by-products / toxins produced / to ensure people do not become allergic/ no side effects / safe;	2 max.	
	d)	to prevent cross-breeding / pollination with other rice crops / plants; prevent new gene transferring to other plants; example of disadvantage, e.g. consumer opposition;	2 max.	
	e)	DNA splits / separates / hydrogen bonds break; make mRNA / using RNA nucleotides; via RNA polymerase; complementary pairing / eq.; introns / non-coding DNA removed; mRNA joins to ribosome; tRNA carries to a specific amino acid; codon–anticodon relationship / explained; peptide bonds form between amino acids;	6 max.	Max. 4 points on 1–5.
6	**a)**	**i)** A-band	1	The length of the A-band / dark band remains the same as it is determined by the length of the myosin filaments which do not change.
		ii) H-zone and I-band	1	

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b)		actin filaments slide in between myosin; actin filaments entering H-zone reduces its width / Z lines are pulled closer;	2	As the actin filaments are pulled in between the myosin filaments the width of the H-zone and I-band decreases.
c)	**i)**	low high; low high; high low; (*1 mark per row*)	3	Slow fibres are adapted to aerobic respiration and therefore have a high number of mitochondria in which the Krebs cycle occurs.
	ii)	overall rate of contraction limited by rate of ATP hydrolysis; ATPase hydrolyses ATP; ATP hydrolysis provides energy for *any **two** from*: myosin–actin interaction; myosin head movement / actin movement relative to myosin; to 're-cock' myosin head;	4 max.	Candidates may misinterpret this question and write all they know about muscle contraction. The question is about the rate of reaction of ATPase, so all points on the mark scheme are related to the role of this enzyme in muscle contraction.
	iii)	lactate is a product of anaerobic respiration; fast fibres have higher activity of glycolytic enzymes / have lower activity of Krebs cycle enzymes / have fewer mitochondria;	2	Fast fibres have a high concentration of enzymes involved in anaerobic respiration so produce more lactate than slow fibres.
7 **a)**		identify those at risk of developing cancer; so as to avoid relevant environmental factors; enable early diagnosis; identify risk in families;	2 max.	

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b) *Mutation of suppressor gene – up to 4 marks* mutation is a change in DNA; base sequence altered / example given; suppressor gene produces wrong instruction / has different code; therefore different amino sequence; different protein structure / non-functional protein; *Malignant tumour – up to 4 marks* cell division by mitosis; tumour cells growth abnormal / continuous / uncontrolled; tumour cells spread / invade other tissues / form secondary tumours / metastasis; via blood / lymph system;	8 max.	