Unit 5: Energy, Exercise & Coordination

Question Number	Question			
1.(a)	The table below refers to four functions of the human brain. Complete the table to show which region of the brain is responsible for each function.			
	Correct Answer	Acceptable Answers	Reject	Mark
	Cerebral hemispheres; Hypothalamus; Medulla oblongata	Cerebrum Medulla	Hemispheres Cerebellum	3

Question Number	Question	
1.(b)	Suggest **two** pieces of information this scan could give to a surgeon about this tumour.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **two** marks. 1. Locality 2. Size 3. What brain functions might be affected	2

Question Number	Question	
2.(a)	With reference to the structures of dopamine and L-dopa, suggest why the drug L-dopa is effective in the treatment of Parkinson's disease.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **four** marks. 1. PD results from low levels of dopamine; 2. structure of L-Dopa similar to dopamine / credit details of similarities; 3. therefore can bind to the dopamine receptor {protein/molecule}; 4. initiating action potential; 5. idea that L-Dopa can be converted to dopamine; 6. credit details of mechanism; 7. ref to ability to cross the blood brain barrier; 8. (possibly) due to COOH grouping;	4

Question Number	Question	
2.(b)	Scientists believe that the release of dopamine from the presynaptic membrane is triggered by certain emotional responses. Describe how the release of this neurotransmitter generates an action potential in the postsynaptic neurone.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **five** marks. 1. neurotransmitter diffuses across cleft; 2. binds to receptor {molecules/proteins} on postsynaptic membrane; ligand-gated ion channels; 3. sodium gates open/ increase in permeability to sodium ions; 4. diffusion of sodium ions into postsynaptic neurone; 5. depolarisation of membrane; 6. idea of more (sodium) channels opening; 7. summation of postsynaptic potential to form action potentials;	5

Question Number	Question	
3.(a)	Describe the changes that have occurred in the muscle strength of these weight-lifters over this time period.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **three** marks 1. the % increase is the same for the first 16 years/eq; 2. the % increase is greatest in period 1980-1983/eq; 3. smallest increase in strength during 1984-1987/eq;	2

Question Number	Question	
3.(b)	Suggest possible reasons for the changes that occurred in the muscle strength of weight-lifters during the period 1980-1987.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **three** marks. 1. Use of testosterone/anabolic steroids/eq 2. Idea of higher dose 3. Stronger drugs were taken 4. Use of more effective training routines 5. More suitable lifestyles/eq 6. Idea that strength had reached a maximum / genetic maximum 7. Weight-lifters choosing not to use drugs 8. More effective screening methods	3

Question Number	Question	
3.(c)	Many people feel that the use of performance-enhancing drugs in sport is unethical. State whether you consider the use of performance-enhancing drugs in sport is unethical. Give **two** ethical arguments to support your opinion.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **two** marks. Marks must both be from either agree or disagree Agree: 1. can no longer compare weight-lifters/competition is no longer fair; 2. illegal; 3. uninformed decision taking; 4. possibility of death; 5. health risks; Disagree: 6. individual has right to make own decision re health risks; 7. drug free sport is not fair anyway; 8. due to differences in training resources; 9. pressures from coach / sponsors / public; 10. financial rewards;	2

Question Number	Question	
3.(d)	It is sometimes claimed that outstanding athletes are born and not made. Explain whether you agree with this view.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **three** marks. 1. Phenotype (athleticism) is a result of an interaction between genes/genotype and the environment/eq; 2. Muscle development could be improved by diet/drugs/training (environment)/eq; 3. But the extent of muscle development will also be influenced by the person's genetic makeup/genotype; 4. Ref to (inherited) proportion of fast/slow twitch muscle fibres; 5. Ref to polygeneric inheritance and continuous variation in context	3

Question Number	Question	
4.(a)(i)	Compare the effects of this exercise on the ventilation rate of the two individuals.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **two** marks. 1. Ventilation rates at rest are similar; 2. Ventilation rate of trained individual rises higher than that of the untrained individual during the 5 minute exercise period; 3. After 1 minute ventilation rate of trained individual continues to rise rapidly whereas untrained rises gently/becomes constant;	2

Question Number	Question	
4.(a)(ii)	Suggest what other information would be needed to allow a valid comparison to be made of the effect of a training programme on ventilation rate.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **three** marks 1. gender; 2. age; 3. level of rest; 4. drugs; 5. were the exercises the same; 6. repeat the study with these two individuals; 7. repeat the study with more individuals; 8. allow other valid factors;	3

Question Number	Question	
4.(b)(i)	Nerve impulses from the aortic body would not reach the respiratory centre.	
	Correct Answer	Mark
	☒ **B**	1

Question Number	Question	
4.(b)(ii)	Nerve impulses from the respiratory centre would not reach the diaphragm.	
	Correct Answer	Mark
	☒ **D**	1

Question Number	Question	
4.(b)(iii)	Nerve impulses from the respiratory centre would not reach the stretch receptors.	
	Correct Answer	Mark
	☒ **A**	1

Question Number	Question	
4.(b)(iv)	Nerve impulses from the carotid body would not reach the respiratory centre.	
	Correct Answer	Mark
	☒ **C**	1

Question Number	Question	
5.(a)	Describe the electrical activity that occurs in the heart during one complete heart beat.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **four** marks. 1. wave of excitation sent from SAN; 2. spreads over atria walls; 3. delayed at atrioventricular septum; 4. wave of excitation sent from AVN; 5. passes along bundles of His/purkine fibres; 6. spreading over walls of ventricles;	4

Question Number	Question	
5.(b)	Calculate the heart rate of the individual with a normal heart beat, using the information in the ECG. Show your working.	
	Answer	Mark
	Duration of 1 beat **OR** 60 / duration; Correct answer, 50 Beats min^{-1} / bpm;	2

Question Number	Question	
5.(c)	Compare the ECG of the normal individual with that of the individual with tachycardia.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **two** marks. 1. Interval between QRS phases longer (in normal rhythm); 2. Credit correctly manipulated figures; 3. Lower voltage during QRS phase in normal rhythm;	2

Question Number	Question	
5.(d)	Suggest what effect tachycardia would have on cardiac output. Explain your answer.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of three marks. 1. Cardiac output could decrease if there was insufficient time to fill the ventricles (between contractions); 2. Cardiac output could increase if ventricles fill sufficiently; 3. The change in cardiac output will depend on whether the decrease in stroke volume is compensated by the increase in heart rate/eq;	3

Question Number	Question	
6.(a)(i)	Put a cross in the box next to the arrow that correctly shows the direction of impulse travel in cell **A**.	
	Correct answer	Mark
	⟵ ☒	1

Question Number	Question	
6.(a)(ii)	Identify the type of neurone for cell **A** and cell **B** by putting a cross in the correct box in the table below.	
	Correct answer	Mark
		2

	Relay neurone	**Motor neurone**	**Sensory neurone**
Cell **A**		☒	
Cell **B**	☒		

1 mark for each row. Do not award the mark if there is more than one cross in the row.

Question Number	Question			
6.(b)(i)	Complete the equation below to show the chemical changes in rhodopsin in the presence of light.			
	Correct answer	Acceptable answers	Reject	Mark
	Retinal	Transretinal Retinine	Cis retinal retinol	1

Question Number	Question	
6.(b)(ii)	Describe the movement of sodium ions across the rod cell membrane, in the presence of opsin.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **three** marks. 1. opsin binding to membrane/eq 2. cation channels closed 3. sodium ions cannot enter cell by diffusion 4. active pumping 5. of sodium ions is unaffected 6. net loss of sodium ions	3

Question Number	Question			
6.(b)(iii)	State the term that describes the electrochemical state of a rod cell in light.			
	Correct answer	Acceptable answers	Reject	Mark
	hyperpolarised	hyperpolarisation	Bleached depolarised	1

Question Number	Question	
7.(a)	Describe the effect of repeated touching on the time taken for the gill to be exposed again.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **three** marks. 1. Recovery time falls steeply initially 2. Stays low 3. Fluctuations 4. ref to reinforcement 5. credit appropriate manipulation of data ref to anomalous point 3	3

Question Number	Question			
7.(b)	Name the type of learning shown by a sea slug in this investigation.			
	Correct answer	Acceptable answers	Reject	Mark
	habituation			1

Question Number	Question	
7.(c)	Explain how this learned response may be of benefit to the sea slug in its natural environment.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **four** marks. 1. Ignore unimportant stimuli 2. More receptive to important stimuli 3. Less time wasted with gill covered 4. More time for oxygen uptake 5. Can remain active when being touched 6. Such as by wave action	4

Question Number	Question	
8.(a)	Describe, using specific examples, the evidence that the Black Death was caused by a virus.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **three** marks. 1. Increased frequency of mutant CCR5 allele; 2. Pattern of disease similar to flu; 3. Symptoms eg bleeding consistent with known effect of virus; 4. Incubation period matches known viruses; 5. Contagion matches known viruses; 6. Other valid point;	3

Question Number	Question	
8.(b)	Suggest reasons why it is likely that a vaccine for bird flu can be produced fairly easily, whereas no effective vaccine for malaria has yet been produced.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **two** marks. 1. Methods for flu vaccine production already exist; 2. Harmless version of virus can be produced; 3. Can't use whole *Plasmodium* since too complex; 4. Antigens continually changing / mutations; 5. Several stages to life cycle;	2

Question Number	Question	
8.(c)	Explain how small samples of DNA from a burial site can be amplified and how such samples might be used to find the identity of an unknown virus.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **four** marks. 1. Polymerase chain reaction / PCR; 2. Replication of DNA; 3. Many copies of same sequence of bases / nucleotides; 4. DNA / base sequence of unknown matched to sequence of known virus; 5. Ref. to gene probe;	4

Question Number	Question	
8.(d)	Describe the risks of using genetically modified organisms.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **two** marks. 1. unforeseen consequences; 2. danger of transmission of genetic material; 3. release of resistance markers/eq;	2

Question Number	Question	
8.(e)(i)	Explain how a hybrid virus could be particularly dangerous to humans.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **two** marks 1. have genes for replicating in human cells; 2. can infect human cells; 3. and genes for damaging humans / haemagglutinin; 4. passed directly from human to human / more easily passed from human to human;	2

Question Number	Question	
8.(e)(ii)	Explain how a hybrid virus could be useful in producing a vaccine.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **two** marks. 1. have H5N1 surface genes (producing antigens for immune system to recognise); 2. antigens stimulate immune system/eq; 3. but less dangerous human flu genes;	2

Question Number	Question	
8.(f)	Explain what is meant by a 'breathtaking selection pressure', and how this might have led to very high frequency of the mutant form of CCR5.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **three** marks. 1. Likelihood of surviving <u>much</u> greater with mutation / converse/eq; 2. To reach reproductive age; 3. Mutant allele much more likely to be passed to offspring; 4. Higher proportion of offspring have mutated allele; 5. In future generations;	3

Question Number	Question	
8.(g)	The South African government decided not to allow the use of ARV drugs for the treatment of HIV infected people. Suggest possible reasons for their decision.	
	Answer	Mark
	Award one mark for each of the following points in context to a maximum of **five** marks. 1. High cost; 2. Drug companies profiteering; 3. Campaign for generic, cheap drugs; 4. Not necessarily best treatment; 5. Other methods such as diet control may be effective; 6. Traditional methods may be effective; 7. Drugs may be unsafe; 8. Patients receiving drugs fall ill; 9. AIDS not caused by HIV alone; 10. Other factors affecting immune system important; 11. AVRs may cause AIDS; 12. People taking drugs get AIDS;	5

Question Number	Question	
8.(h)	Use information from the two studies of HIV infection in South Africa to describe the current pattern of infection. You should include reference to changes in infection rates between 2000 and 2005 and the effect of gender. Suggest reasons for the trends you observe, including reasons for the different findings of the two studies for infection of women with HIV in 2005.	
	Answer	Mark
	Award one mark for each valid points in context to a maximum of **seven** marks. Possible points include: 1. Infection rate stable under 24; 2. Fewer infected from birth due to drugs; 3. Better education; 4. Still rising over 24; 5. Sexually active; 6. Must be unprotected sex if pregnant; 7. Lower over 35; 8. Higher death rate of infected individuals; 9. Fewer males infected under 35; 10. Young males less likely to take the test; 11. DOH study shows higher infection rate; 12. Not all of National study having unprotected sex; 13. Those at risk might be more likely to refuse test; 14. Under 20 group includes children in National study;	7