Markscheme

May 2016

Biology

Standard level

Paper 2

13 pages

Section A

Question			Answers	Notes	Total

1.	**a**		a. nerve cells increase the <u>least</u>
			   OR
			   control cells the <u>most</u> ✓
			
			b. «endodermal and control cells are the same at 48 hours» <u>but</u> the control cells increase exponentially/much more than endodermal cells by 96 hours
			   OR
			   last 48 hours/from 48 hours to 96 hours, constant «small» increase in cell numbers for nerve, <u>but</u> greater/increased change for control and endodermal ✓
			
			c. from 48 to 96 hours much more increase in cell number in control than in endodermal ✓
				Do not accept numbers without distinguishing terms.
				
				Award [1 max] if all three (nerve, endodermal and control cells) not mentioned at some point in the answer as stem requires all three.
					2 max

	b		cell differentiation slows down/retards/decreases population growth **OR** population growth is slower in differentiating/differentiated cell lines ✓	*Accept converse eg: nondifferentiation accelerates growth.*	**1**

	c		a. the percentage of «cells in» G1 in nerve is greater than in control
			   OR
			   the S phase has greater «percentage of cells» in control than in nerve ✓
			
			b. G2 phase is similar in both
			   OR
			   least/lower percentage of cells of the phases in both lines ✓
				Do not accept numbers without distinguishing terms.	**2**

	d		a. more cells in G1 «of cell lines/nerves» with slow population growth ✓ b. more cells in S «of cell line/control» with fast population growth/«significantly» fewer cells in S in both slow growth lines/nerves and endodermal cells ✓ c. G2 seems not to be related with pop growth as it is very similar in the three cell lines ✓	*Accept converse statements.*	**2 max**

Question			Answers	Notes	Total
e			two genetically identical daughter nuclei/cells ***OR*** two identical daughter nuclei ✔		**1**

f			a. cyclin D1 is less in control
			    OR
			    cyclin D2 is not present/very faint in control, but present in large quantity in nerve
			    OR
			    cyclin D3 more in nerve ✔
			
			 b. cyclin D1 is present in both
			    OR
			    cyclin D3 is similar/same in both ✔
				OWTTE	**2**

g			a. cyclin D1 is similar in both nerve and endodermal ***AND*** more than in control so both may be responsible for general/early differentiation ✔
			
			 b. there is much more cyclin D2 in nerve «cell lines» so may be specific for nerve differentiation
			    OR
			    may negatively affect/reduce cell division/growth capacity in nerve ✔
			
			 c. cyclin D2 is most likely what causes differentiation as control group contains none of it ✔
			
			 d. there is slightly more cyclin D3 in endodermal «cell lines» so may be related to endodermal differentiation ✔
			
			 e. limited data to determine roles of cyclins as very complex processes ✔
				Both needed.
				 OWTTE
				
				 OWTTE
				
				 OWTTE
				
				 OWTTE
					3 max

Question			Answers	Notes	Total
2.	a	i	60 kg ✓	*Unit needed.*	1
		ii	coronary heart disease *or* coronary artery disease *or* thrombosis *or* stroke *or* hypertension *or* high blood pressure *or* atheroma *or* fatty deposits in arteries *or* plaque «in arteries» *or* arteriosclerosis *or* atherosclerosis ✓		1
	b		[CH$_2$]$_n$ *or* hydrocarbon chain with single bonds and at least four carbons ✓ COOH head at one end ***AND*** three hydrogens on other end ✓	*The four carbons can include the carboxyl carbon.* *Both needed.*	2

	c		a. hormone produced by <u>adipose</u>/<u>fat cells</u>/<u>adipose tissue</u> ✓
			
			b. acts on/target cells are in the hypothalamus «of the brain» ✓
			
			c. inhibits/reduces appetite
			   OR
			   inhibits hunger
			   OR
			   causes feeling of satiety
			   OR
			   makes you feel full/makes you eat less ✓
			
			d. more leptin with more adipose tissue ✓
			
			e. decreases/reduces food intake
			   OR
			   in humans obese people can have leptin resistance ✓
				Do not accept "pituitary" or "fat".	3 max

Question			Answers	Notes	Total

3.	a	i	a. boiling point of water is greater than methane ✓
			
			b. melting point of water is greater than methane ✓
			
			c. latent heat of vaporization of water is greater than methane
			   OR
			   specific heat capacity of water is greater than methane ✓
					2 max

		ii	a. water is polar
			   OR
			   O atom more negative
			   OR
			   H atoms more positive ✓
			
			b. this causes «strong» hydrogen bonds to form <u>between the molecules</u> ✓
			
			c. which require more/high amount of energy to break ✓
			
			d. which increases the melting/boiling/latent heat properties ✓
					2 max

Question			Answers	Notes	Total
b			a. short wave radiation/UV «shown as» having its origin in the Sun gives off light as short radiation ✓ b. short wave radiation/UV «shown as» passing through the greenhouse gases «some reflected» ✓ c. some short wave radiation/UV is absorbed by the Earth and some is reflected ✓ d. the reflected radiation is long wave radiation «reflected as heat» ✓ e. long wave radiation/IR «shown as» being unable to pass through/being absorbed/reflected by the greenhouse gases ✓	*Award marks for diagrammatic explanations of these marking points.* *Accept UV and IR as long as they are drawn with the correct wavelength.*	**3 max**

Question			Answers	Notes	Total

4.	**a**		a. *I*: <u>nitrogenous</u> base
			    OR
			    adenine
			    OR
			    purine base ✔
			
			b. *II*: deoxyribose ✔
			
			c. *III*: phosphate ✔
					3

	b		a. *A*: gills *or* fins *or* scales *or* no limbs *or* external fertilization ✔ b. *B*: homeothermic *or* endothermic *or* warm-blooded *or* lungs *or* tetrapod *or* <u>four</u> limbs *or* pentadactyl limbs *or* internal fertilization ✔ c. *C*: hair *or* fur *or* mammary glands *or* milk ✔		**3**
	c		eukaryotes ✔		**1**

Section B

Clarity of communication: [1]

The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.

Question			Answers	Notes	Total
5.	**a**		a. catalyse/speed up «biological» reactions ✔ b. are substrate-specific ✔ c. lower the activation energy «of a chemical reaction»/makes reaction go more easily/increases likelihood of reaction happening ✔ d. substrate collides with/binds to <u>active site</u> ✔ e. enzyme–substrate complex/transition state formed ***OR*** bonds in substrate weakened ✔	*"activation energy" is not in SL but allow marking point if given.* *Do not award mark for stating "lock and key" unless obviously shown in a diagram with enzyme and substrate labelled.*	**4 max**

Question			Answers	Notes	Total
	b		a. key or text giving alleles with upper case for dominant allele and lower case for recessive allele/allele causing disease ✔	*Reject key showing a sex linked gene such as hemophilia.* *Reject if X or Y chromosomes are shown with the alleles.* *Accept Aa or any other upper and lower case letters.*	**4 max**
			b. Punnett grid showing that both parents can pass on either a dominant or a recessive allele in their gamete ✔	*For example row and column headings with A and a.* *This mark can be awarded if X or Y chromosomes are shown but each parent has one recessive and one dominant allele as if for autosomal inheritance.*	
			c. four possible genotypes for child correctly shown on grid ✔	*AA, Aa, aA and aa for example.* *This mark can be awarded if X or Y chromosomes are shown but the genotypes are correct for autosomal inheritance.*	
			d. double/homozygous recessive shown having the disease ✔	*Cannot be awarded with sex linkage.*	
			e. 25 % *or* 0.25 *or* $\frac{1}{4}$ chance of inheriting the disease ✔	*This mark can be awarded if X or Y chromosomes are shown but the ratio is correct for autosomal inheritance.*	

Question	Answers	Notes	Total
c		*Award **[6 max]** if no mention of the role of myelin.*	
	a. neurotransmitter attaches to receptor site, initiating transmission ✔		
	b. nerve impulses are action potentials propagated along the axons of neurons ✔		
	c. resting potential is more negative inside/–70 mV/ more positive outside the membrane **OR** a resting potential has greater concentration of Na ions outside than K ions inside the axon ✔		
	d. «volted gated» channels open and Na ions diffuse in ✔		
	e. causes depolarization of the membrane/–70 mV to +40 mV ✔		**7 max**
	f. local currents affect adjacent channels/cause action potential ✔		
	g. depolarization is followed by repolarization of the neuron ✔		
	h. «voltage gated» channels open and K ions diffuse out/repolarize the membrane ✔		
	i. Na-K pumps restore Na/K balance/resting potential ✔		
	j. myelin around the neuron insulates the axon **OR** speeds the transmission ✔		
	k. myelin permits saltatory conduction **OR** permits jumping from node to node ✔		

*(Plus up to **[1]** for quality)*

	Question		Answers	Notes	Total
6.	**a**		a. <u>cell wall</u> shown with two lines to indicate the thickness ✓ b. <u>plasma</u>/<u>cell membrane</u> shown as a single continuous line ✓ c. <u>nuclear membrane</u>/<u>nucleus</u> shown with double membrane and nuclear pores ✓ d. <u>vacuole</u> «membrane»/<u>tonoplast</u> shown as a single continuous line ✓ e. <u>chloroplast</u>/<u>plastid</u> shown with double or single membrane ✓ f. ribosomes correctly shown ***OR*** RER correctly shown ***OR*** golgi correctly shown ***OR*** mitochondrion shown with double membrane/cristae ✓	*Accept inside of wall labelled "plasma membrane" as if turgid.*	**4 max**

Question			Answers	Notes	Total
b			a. oxygen must be taken up **AND** carbon dioxide must be released ✔	*Both needed.*	
			b. gases pass through a cell membrane by simple diffusion ✔		

			c. require a concentration gradient
			   OR
			   pass from high concentration to low concentration ✔
					3 max

			d. without requiring energy
			   OR
			   passive process ✔		

			e. large SA: vol ratio ✔		

Question			Answers	Notes	Total
c				*Award **[7 max]** if no reference to heritable characteristics or alleles.*	**8 max**
			a. evolution is «cumulative» change in population/species over time **OR** change in allele frequency ✔		
			b. a population has variations amongst the individuals ✔		
			c. due to meiosis **OR** sexual reproduction ✔		
			d. due to mutations ✔		
			e. certain variations give an advantage to some organisms over others in certain environments ✔		
			f. populations/species produce more offspring than the environment can support ✔		
			g. individuals of the species compete for the same resources ✔		
			h. the better-adapted organisms tend to survive and reproduce **OR** less adapted organisms tend to die or reproduce fewer offspring ✔		
			i. individuals «that reproduce» pass on their «heritable» characteristics/alleles/genes to their offspring ✔	*"Traits" is an acceptable alternative to "characteristic".* *Accept "genes".*	
			j. natural selection increases the frequency of «heritable» characteristics/alleles/genes of the better-adapted organisms ✔		
			k. specific example <u>described</u> ✔	*Example must be "described" to award marks.*	

*(Plus up to **[1]** for quality)*