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RIVER VALLEY HIGH SCHOOL YEAR 6 PRELIMINARY EXAMINATION II

CANDIDATE NAME		
CENTRE NUMBER	S CLASS IND	EX //BER
H2 BIOLOGY		9744/01
Paper 1 Multip	ble Choice	22 Sep 2017
		1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number, index number on the Answer Sheet in the spaces provided unless this has been done for you.

name in the spaces at the top of this page.

DO NOT WRITE IN ANY BARCODES.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C**, and **D**.

Choose the one you consider correct and record your choice **in soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.



2	Which	of the following statements regarding stem cells are not correct?
	1	Stem cells are present within various organs of the adult body.
	2	Stem cells can develop into a whole organism when implanted into the womb.
	3	Stem cells can be grown indefinitely in culture under appropriate culture conditions.
	4	Stems cells isolated from a 3-5 day old human embryo can differentiate into only one kind of cells.

Ę	5 Induced pluripotent stem cells have the same developmental potential as embryonic stem cells.
Α	1 and 3 only
в	2 and 4 only
С	2, 3 and 5
D	1, 2 and 3

3	Gran	Graph A shows the transport of molecule X , with the help of carrier proteins, over time.								
3	Gia									
	Number of molecule X in cell									
	A stu Whio resu	udent predicted that the alteration of ch row shows the correct transport It in graph B ?	Time f one variable would result in graph B . process and the alteration in variable that would							
		Transport process	Alteration resulting in graph B							
	Α	A facilitated diffusion increase in environmental temperature to 90 °C								
	В	active transport	increase in concentration of X in cell							
	С	facilitated diffusion	increase in number of carrier proteins							
	D	active transport	increase in availability of ATP							

4	A student pr concentration prior acid hyd	epared three solutions of ns. A sample of each wa drolysis. The results are sl	⁵ sugars, X , Y and Z , and is heated with Benedict's hown below.	d diluted them to varying reagent, with or without				
	Concentration of solution/moldm ⁻³							
0.0001 0.001 0.01								

	X Y Z		no acid	with acid	no acid	with acid	no acid	with acid	
			Blue solution	Blue solution	Green mixture	Green mixture	Orange mixture	Orange mixture	
			Blue solution	Green mixture	Blue solution	Green mixture	Blue mixture	Orange mixture	
			Blue solution	Green mixture	Green mixture	Green mixture	Orange mixture	Orange mixture	
	Base	ed on the	e results, whi	ch of the follo	wing conclus	sions is not c	orrect?		
	Α	Solution Y does not consist of monosaccharides.							
	 B Solution X and solution Y consists of disaccharides only. C Solution X consists of monosaccharides only. 								
	D	Solutio	n Z contains	disaccharide	S.				

5	The	R groups of two amino acids are shown below.								
			Amino acid	R group						
			Serine	-CH ₂ -OH						
			Alanine	-CH₃						
	Whe foun	n placed in aque d?	ous medium, where in	a globular protein will	these amino acids be					
	Α	Both serine and	alanine will be found in	n the interior of the glob	ular protein.					
	в	Both serine and	alanine will be found o	n the exterior of the glo	bular protein.					
	С	Alanine will be found in the interior, and serine on the exterior of the globular protein.								
	D	Alanine will be found on the exterior, and serine in the interior of the globular protein.								

 6 The equations below show the relationship between an enzyme (E) and its substrate (S), product (P) and an inhibitor (I).
 Pathway A: E + S → E + P Pathway B: E + S + I → E + S + I
 In the above reactions, assume that

 increasing the concentration of S increases the activity of the enzyme,

	 at low substrate concentrations the presence of I reduces rate of reaction velocity, and the same maximum rate of reaction can be reached in the presence or absence of I. 					
Whie	ch mechanism is operating in pathway B?					
Α	Positive feedback					
В	Negative feedback					
C Competitive inhibition						
D	Non-competitive inhibition					



ares	Part of the amino acid sequence in β -globin chains of normal and mutant has are shown.							
	Normal hae	emoglobin	thr-pro-glu-glu					

	Mutant ha	emoglobin	thr-pro-val-glu	
Possible mR	NA codons f	or these amino acids	are	
	Glu	tamine (glu)	GAA GAG	
	Thre	eonine (thr)	ACU ACC	
	Pro	line (pro)	CCU CCC	
	Vali	ne (val)	GUA GUG	
Which tRNA in mutant hae	molecule is emoglobin?	not involved in the fo	rmation of this part of a	amino acid sequence
	Α	В	С	D

9	Tay-Sachs compound	diseas s, which i	e is cha results in c	aracterised deterioratio	d by ab on of cogn	normal a iitive and r	ccumulati notor abili	on of lij ties.	oid-related	
	It is caused by an autosomal recessive mutation in the allele coding for hexosaminidase A (HEXA), an enzyme that regulates the metabolism of phospholipids.									
	The base triplets in part of the coding DNA sequences for a normal HEXA allele and a mutant Tay-Sachs allele, as well as their corresponding amino acids are shown.									
	Normal HEXA alleleCGTATATCCTATGCCCCTGAC									
		Arg	lle	Ser	Tyr	Gly	Pro	Asp		
	Tay- Sachs allele	CGT	ΑΤΑ	тст	ATC	СТА	TGC	CCC	TGA	
		Arg	lle	Ser	lle	Leu	Cys	Pro	Thr	
	Which combination correctly describes the nature of mutation that results in the Tay Sachs allele?								the Tay-	

		Changes to nucleotide sequences	Alteration of reading frame	Length of polypeptide
	Α	Deletion of 2 bases	Yes	Shorter
	в	Insertion of 2 bases	Yes	Longer
	С	Substitution of 4 bases	No	Unchanged
	D	Insertion of 4 bases	Yes	Longer

10	Whie	Which row correctly identifies the characteristics of the human genome?						
	Promoter Histone proteins bound to DNA Centromeres sequence Repeated sequence							
	Α	Multiple	Always	Position varies for every chromosome	Absent			
	в	One	Always	Position varies for every bivalent	Present			
	С	Multiple	Sometimes	Position varies for every bivalent	Present			
	D	One	Sometimes	Position varies for every chromosome	Absent			

11 The globin gene family in humans consists of α , β and γ genes. These genes code for the globin chains that make up haemoglobin and are expressed at different levels during different developmental stages.

The graph shows the expression of the various globin chains during the prenatal (fetal) and postnatal (after birth) periods.



12	Sev betv ana	Seven skeletons were found in an unidentified grave. To establish the relationship between these seven individuals, DNA were isolated from these skeletons and then analysed using gel electrophoresis.							
	The	e results obt	ained from t	he skeleton	s, three child	dren and fou	ur adults, are	e shown bel	ow.
		Child 1	Child 2	Child 3	Adult 1	Adult 2	Adult 3	Adult 4	
			\equiv						
		\equiv		_		_			
		—		_	=		—	_	
								—	
				_					
	Other analysis showed that all three children have the same parents. Which two adults may be the parents of these children?						ults		
	A Adults 1 and 2								
	В	Adults 1 a	and 3						
	С	Adults 2 a	and 3						
	D	Adults 2 a	and 4						



А	В	С	D
	XX		

14	The sam	diagram depicts the behaviour of chromosomes at various stages of meiosis of the e cell.
		There is a second a second
		Bill stime bad
		NINT & STATE
	Whi	ch of the following shows the correct order of the stages?
	Α	$ \rightarrow \vee \rightarrow \rightarrow \vee \rightarrow \vee \rightarrow $
	в	$ \rightarrow \rightarrow \vee \rightarrow \rightarrow \vee \rightarrow \vee$
	С	$ \rightarrow \rightarrow \rightarrow \vee \rightarrow \vee \rightarrow \vee$
	D	$ \rightarrow \rightarrow \vee \rightarrow \rightarrow \vee \rightarrow \vee$

15	Which of the following are necessary for tumourgenesis to occur?					
	1	Gain of function mutation to proto-oncogenes				
	2 Loss of function mutation of tumour suppressor genes					
	3 Inactivation of telomerase enzymes preventing cell apoptosis					
	4 Production of chemical factors that induce angiogenesis					
	Α	1 only				
	В	1 and 2 only				

с	1, 2 and 3 only
D	All of the above

16	The	diagram shows the structure of an influenza virus.		
		P Q R R S S S S S S S S S S S S S S S S S		
	Whi	ch of the following statements concerning the lettered components are correct?		
	-	Mutations that disrupt the function of R will result in the inability of the virus to initiate infection in the host cell.		
		P and Q are unlikely targets for vaccination because they undergo mutation constantly.		
	3	New influenza viruses acquire S from host cell during budding.		
	4 The host cell enzymes are not required to form the complementary RNA from T .			
	Α	1 and 2 only		
	в	3 and 4 only		
	С	1, 2 and 3		
	D	2, 3 and 4		

17	Which	Which statements about viruses are true?			
	1	They encode genes for synthesising their own ATP.			
	2	They are single-cell organisms.			
	3	They can have genomes made of DNA.			
	4	They package ribosomes into their virion.			

	5	5 They can have a single-stranded or double-stranded RNA genomes.
	6	They can have a membrane-like envelope.
	Α	5 and 6 only
	в	3, 5 and 6
	С	1, 3, 5 and 6
	D	All of the above

18	Whic	Which of the following statements about the <i>lac</i> operon are correct?				
	1	<i>lac Z</i> , <i>lac</i> Y and <i>lac</i> A are structural genes that will be expressed when the operator is switched on.				
	2	2 In the absence of alloactose, the repressor protein will be unable to bind to the operator.				
	3 When glucose and lactose are available and the repressor becomes inactivallolactose binds to it.					
	4	lac Y codes for a protein that increases uptake of lactose from environment.				
	5	6 Catabolite activator protein binds to promoter to increase rate of transcription.				
	Α	1 and 2				
	в	1 and 3				
	С	1, 2 and 5				
	D	3, 4 and 5				

19	A black-haired female rabbit was crossed with a white-haired male rabbit. Eight offspring were born. Two were white-haired males, two were white-haired females and all the others were black-haired females. What can be deduced about the inheritance of hair colour in rabbits?				
	A Hair colour is sex-linked in rabbits.				
	в	The allele for black hair is dominant to the allele for white hair.			
	C The allele for white hair is dominant to the allele for black hair.				
	D The results of this cross are inconclusive.				

20	Two genes, Q and R, affect the size of the petals and the pigmentation of a flower.
	Gene Q has two alleles, Q^L and Q^A . The genotype Q^LQ^L produces large petals, Q^LQ^A

	produces small petals, and in Q ^A Q ^A , petals are absent.			
Gene R has two alleles. R produces a red pigment and is dominant over the allel produces no pigment.				
	A plant that is heterozygous at both gene loci was selfed. How many different phenotypes will be observed in the next generation?			
	Α	4		
	в	6		
	С	9		
	D	12		

21	The a su isoto were	common isotope of oxygen is ¹⁶ O. Air containing ¹⁶ O ₂ and ¹⁸ O ₂ was bubbled through uspension of algae for a limited period. After this, the concentration of these two opes of oxygen in the water was monitored for the next 50 minutes whilst the algae e subjected to periods of dark and light. The results are shown in the diagram.					
		concentration of oxygen isotope in the water $dark$ ight dark 0^{-1} $0^$					
	Wha	vnat is the best explanation for these results?					
	Α	Both isotopes of oxygen are used by the algae in the dark in respiration, but in the light oxygen is produced from water in photorespiration.					
	В	The algae can distinguish chemically between the two isotopes.					
	С	The algae produce oxygen from the water used in photosynthesis, but only in the light.					
	D	The two isotopes have different rates of diffusion.					

22 After vigorous exercise, changes occur in the muscle tissue. Compared with 'at rest' conditions, what will the changes be?

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		ATP	lactate	pН
	Α	decreased	increased	decreased
	в	increased	increased	increased
	С	decreased	decreased	increased
	D	increased	decreased	decreased

23	The trans corre	The hormone insulin binds to the tyrosine kinase receptors and initiates various signal transduction pathways to generate cellular responses. Which of the following shows the correct sequence of events, following the binding of insulin to the receptor?			
	1 phosphorylation of tyrosine residues				
	2	2 signal amplification			
	3	3 dimerisation of tyrosine kinase receptor			
	4	signal transduction			
	5	5 activation of transcription factors			
	B $3 \rightarrow 4 \rightarrow 1 \rightarrow 2 \rightarrow 5$				
	$C 1 \rightarrow 3 \rightarrow 5 \rightarrow 4 \rightarrow 2$				
	D $3 \rightarrow 1 \rightarrow 4 \rightarrow 2 \rightarrow 5$				

24	During pregnancy, glucose is transferred from the bloodstream of the mother to the bloodstream of the foetus through the placenta.						
	In an experiment conducted with co	In an experiment conducted on a pregnant female subject, experiments X and Y were conducted with control periods of no treatment before them.					
	Measurements of blood glucose levels in both mother and foetus were made. Also, the glucose transfer rates from mother to placenta, and from placenta to foetus were monitored. The experimental data is shown in the table below.						
	Experiment	Glucose concentration / mg cm ⁻³ Glucose transfer rate / mg min ⁻¹					
		Maternal blood Foetal blood		From mother to placenta	From placenta to foetus		
	Control period	54	15	38	9		
	After X 54 9		9	38	16		
	Control period	52	14	39	8		

After Y		211	30		58	34
Which of the follo		wing is likely to de	scribe expe	riment	al steps X and Y ?	
x					Y	
Α	Glucagon injection given to foetus			Insulin injection given to mother		
в	Insulin injection given to foetus			Glucagon injection given to foetus		
С	Insulin i	Insulin injection given to mother			lucagon injection	given to foetus
D	Insulin	injection given to f	oetus	G	lucose injection g	iven to mother



26 The formation of the Isthmus of Panama around 3 million years ago (*Mya*) led to the separation of the Pacific and Atlantic oceans. Pistol shrimps of the *Alpheus* genus can be found in both oceans, surrounding the Isthmus. *Alpheus nuttingi* resides in the Atlantic ocean and *Alpheus millsae* resides in the Pacific ocean.

	Atlantic Ocean
	Isthmus of Panama Pacific Ocean
Des gene inter	bite being physically separated, <i>A. nuttingi</i> and <i>A. millsae</i> are morphologically and etically very similar. The two species have also been shown to be capable of breeding in captivity. Which of the following statements are likely to be true?
-	A. nuttingi and A. millsae are derived from a common ancestral species.
2	2 The formation of the Isthmus resulted in geographical isolation of the two species 3 <i>Mya</i> .
3	<i>A. nuttingi</i> and <i>A. millsae</i> are two separate species because they are geographically isolated.
2	Similar environmental conditions around the Isthmus exerted similar selection pressures, leading to convergent evolution between <i>A. nuttingi</i> and <i>A. millsae</i> .
Α	1 only
в	1 and 3
С	2 and 3
D	3 and 4

27	Myxor 14 da numbe	Myxomatosis is a viral disease of rabbits. It spreads rapidly and most rabbits die within 14 days of being infected. Myxomatosis has been deliberately used to reduce the number of rabbits in countries where they are a significant crop pest.		
	The ir myxor to 50%	nitial release of the virus caused populations to fall by over 90%. Resistance to natosis increased in the 70 years following initial release, so at the present time up 6 of infected rabbits are able to survive.		
	Which myxor	of the following statements could explain the increasing frequency of resistance to natosis in the years following release of the virus?		
	1	In populations with high incidences of myxomatosis, mutations leading to resistance are more likely to occur.		
	2	Infected rabbits die quickly, hence the alleles that code for myxomatosis are eliminated from the population.		
	3	The initial release of the virus led to a bottleneck event, greatly altering the frequency of alleles in rabbit populations.		
	4	During disease outbreaks there is greater food availability for the surviving		

		rabbits, increasing the probability that they survive.		
	Α	4 only		
	в	1 and 2 only		
	С	2 and 4 only		
	D	2, 3 and 4 only		

28	Whic	Which statements correctly describe lymphocytes?			
	1	1 Each B lymphocyte has the ability to make several types of antibody molecules.			
	2 Some B lymphocytes and T lymphocytes become memory cells.				
	3 Plasma cells secrete antibodies into the blood plasma.				
	4	4 Some T lymphocytes stimulate macrophages to kill infected cells.			
	Α	A 1, 2, 3 and 4			
	B 1, 2 and 3 only				
	C 2, 3 and 4 only				
	D 1 and 4 only				



	adults will have been vaccinated as children.		
	Α	1, 2 and 3	
	в	1 and 2 only	
	С	1 and 3 only	
	D	2 and 3 only	



	D	Earlier melting of snow allows vegetation cover to increase faster, reducing loss of heat from the surface of the Earth.
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