**Edwest Examination, 2015**

**HUMAN BIOLOGICAL**

**SCIENCES**

**STAGE 3**

**SOLUTIONS**

1. C
2. D
3. A
4. B
5. A
6. B
7. B
8. C
9. B
10. C
11. A
12. B
13. C
14. A
15. B
16. C
17. A
18. A
19. C
20. D
21. D
22. C
23. D
24. D
25. C
26. D
27. C
28. C
29. D
30. B

31.

(a)

|  |  |  |
| --- | --- | --- |
| **Amino Acid** | **DNA triplet** | **mRNA codon** |
| Serine | TCT  (1) | AGA  (1) |

(b) isolate gene for Factor VIII on human chromosome (1)

restriction enzyme cuts out gene (1)

isolate plasmid in bacterial cell (1)

cut open plasmid using same restriction enzyme (1)

‘glue’ gene for Factor VIII into plasmid using DNA ligase (1)

join sticky ends (1)

clone/ multiply for adequate quantities (1)

**Any five = 5 marks**

(c)

|  |  |
| --- | --- |
|  | **Function** |
| **Promoter Gene** | **Section of DNA that facilitates transcription/ initiates transcription**  **(1)** |
| **Structural Gene** | **Section of DNA that codes for a particular protein**  **(1)** |

(d) Age of the cell/ time of day/ signals from other cells/ environment

**(Any two = 2 marks)**

32.

1. Type 2 diabetes (1)
2. Blood glucose falls (1)

Stimulates alpha cells in pancreas (1)

Glucagon secreted (1)

Stimulates breakdown of glycogen in the liver/ glycogenesis (1)

Stimulates production of glucose from fats and amino acids/ glyconeogenesis (1)

Blood glucose level rises (1)

Negative feedback (1)

**Any five = 5 marks**

1. cortisol stimulates glycogenolysis/ breakdown of glycogen to glucose in the liver (1)

cortisol stimulates gluconeogenesis/ increasing the rate which amino acids are removed from cells (and transported to the liver) to be converted to glucose (1)

33.

(a)

|  |  |  |
| --- | --- | --- |
|  | Endocrine | Nervous |
| Speed | Rapid  (1) | Slower  (1) |
| Duration | Long lasting  (1) | Short duration  (1) |

(b) Amine attach to receptor on membrane 🡪 steroid pass directly across membrane

Amine require secondary messenger to bring about changes in the cell 🡪 steroid directly bring about changes within the cell

Amines alter cytoplasm activities such as ribosome activity 🡪 steroids alter gene expression

**Any two = 2 marks**

34.

1. Height of foam (1)
2. pH of buffer solution (1)
3. volume of catalase/ volume of hydrogen peroxide/ concentration of catalase/ concentration of hydrogen peroxide/ number of drops of detergent/ time (2) **Any two = 2 marks**
4. **Graph**

Line graph (1)

Axis labelled correctly (1)

Neat and accurate plotting (1)

Appropriate scale (1)

35.

1. A= cerebellum
2. Regulate heart rate, regulate breathing, regulate diameter of blood vessels (any two) (2)
3. Pin in foot is stimulus (1)

Sensory neuron/ afferent pathway (1)

Interneuron in spinal cord (1)

Motor neuron/ efferent pathway (1)

Response by effector= moving foot from danger (1)

**Any three = 3 marks**

1. brain receives sensory input after danger has passed (1)

fast response (1) less chance/ protection from of greater injury (1)

**Any two = 2 marks**

(e) sensory neuron pathway/ pain receptors blocked (1), motor neuron unaffected (1) therefore movement still possible (1)

36.

1. resting potential -70mv (1)

cell more positive on outside and negative on inside (1)

threshold reached -55mv (1)

sodium channels open (1)

sodium diffuses into nerve cell (1)

charges reversed (1)

sodium channels close (1)

**Any five = 5 marks**

1. myelinated- action potential ‘jumps’ from one Node of Ranvier to the next (1), increase in speed/ fast (1)

unmyelinated- action potential travels the entire length of cell (1) decrease in speed/ slow (1)

37.

1. ball and socket joint (1)

limitations- ligaments, tendons, muscles and adjoining bones

**Any two = 2 marks**

1. avascular/ no direct blood supply (1)

slow diffusion of oxygen and nutrients for repair (1)

38.

1. 64
2. osteoporosis
3. changes to calcium intake in the diet/ increase vit D production through diet or sunlight exposure/ increase weight bearing exercise/ stop smoking (**Any two = 2 marks)**

|  |  |  |
| --- | --- | --- |
|  | **Structure** | **Function** |
| **A** | Canaliculi  (1) | Deliver nutrients and remove waste to and from osteocytes  (1) |
| **B** | Haversian canal  (1) | Surround/ contain blood vessels and nerve cells  (1) |

39.

1. first exposure to antigen immune system slow to respond (1)

level of specific antibody increases slowly (1)

illness occurs (1)

slow decrease (1)

memory cells remain (1)

second/ subsequent exposure (1)

rapid production of specific antibody (1)

no noticeable effects/ illness (1)

**Any six = 6 marks**

1. Active natural (1)

40.

1. DNA heated to 96 degrees and strands separate (1) Denaturation (1)

Temperature lowered (1)

Primer added, joins to the template strands (1)

Taq polymerase (1)

Annealing (1)

Amount of DNA doubles (1)

Elongation/ extension (1)

**Any six = 6 marks**

1. genetic testing/ forensics e.g. crime scenes/ paternity testing/ evolutionary relationships **Any two = 2 marks**

|  |  |  |
| --- | --- | --- |
| Biotechnological Technique | Function | Use |
| DNA Sequencing | Used to determine the order to bases on a DNA molecule  (1) | Identification of genetic mutation/ parental identification  (any 1) |
| DNA Profiling | Identification of a specific persons DNA sequence/ fingerprint  (1) | Forensics/ locating genetic disease (any reasonable)  (1) |

41.

(a) **Any two lines = 4 marks**

|  |  |
| --- | --- |
| **Adaptation**  **(1 each)** | **Advantage**  **(1 each)** |
| **Pelvis** | **Becomes shallow and broad** |
| **Legs** | **Legs are longer than arms to allow for low centre of gravity** |
| **Foot** | **Longitudinal and transverse arch in biped as opposed to only a transverse arch** |

1. decreased reliance on the sense of smell (1)

increased importance of stereoscopic vision (1)

olfactory centre of the brain decreases in size/ vision centre of the brain increases in size (1)

42.

(a)

|  |  |  |
| --- | --- | --- |
| **Dating Technique** | **Relative or Absolute** | **Description** |
| **Carbon-14** | Absolute  (1) | Measures the rate of decay of the carbon-14 isotope to calculate the age of a sample.  (2) |
| **Fluorine Dating** | Relative  (1) | Determines the relative age of a fossil based on the amounts of fluoride in a fossil.  (2) |

(b) at fertilisation the mitochondria in a sperm cell are destroyed (1) therefore the mitochondrial DNA that is inherited comes from the mother (1)

SECTION 3

43.

(a)

**Physiological**-

thermoreceptors/ hypothalamus detect a decrease in body temperature stimulus) (1)

constriction of blood vessels in the skin (1)

vasoconstriction (1)

less heat lost through radiation (1)

shivering (1)

increase muscle tone increases heat production (1)

stimulation of adrenal medulla (1)

secretes adrenaline (1)

increases metabolic rate (1)

APG secretes thyroid-stimulating hormone (1)

causes thyroid to secrete increased thyroxine (1)

increases metabolic rate (1)

increased metabolic rate = increased heat production by the body (1)

**Behavioural**-

Conscious behaviour such as putting on more clothes/ sheltering from cold (anything reasonable) (1)

Reduce the surface area of the body/ curl up into a ball (1)

**Any twelve = 12 marks**

(b)

DNA strand separate to expose the required code for hormone (1)

RNA nucleotides are joined to the complementary nucleotide on the template strand (1)

Adenine pairs with uracil (1)

RNA polymerase creates the strand of mRNA (1)

mRNA leaves the nucleus through a nuclear pore (1)

mRNA attaches to ribosome (1)

ribosome moves along mRNA reading the code for the hormone (1)

Each codon/ triplet of mRNA has corresponding tRNA anticodon (1)

tRNA brings the correct amino acid (1)

amino acids bond together to create protein (1)

**Any eight = 8 marks**

44.

(a)

Conscious though- cerebrum (1)

Nerve impulses travel to skeletal muscles/ upper motor neuron & lower motor neuron (1)

Stimulate neuromuscular junctions (1)

Release of acetylcholine (1)

Diffuse across synapse (1)

Bind to motor end plate (1)

Cause muscle contraction (1)

Antagonistic muscles relax (1)

Bones as attachment point for muscle/ framework (1)

Bones form joints where movement occurs (1)

Inner ear provides cerebellum information about balance and movement (1)

Cerebellum coordinates which muscles contract (1)

Cerebellum coordinates the strength required for muscle contraction (1)

Cerebellum controls smooth, coordinated action (1)

Stretch receptors send info to cerebrum (1)

Conscious awareness of movement and coordination (1)

**Any thirteen = 13 marks**

(b)

Action potential reaches muscle fibre (1)

Calcium and ATP required (1)

Thin actin slide over (1)

Thick myosin (1)

Cross bridge formation (1)

Z lines closer (1)

Sarcomere shortened (1)

Muscle fibre/ muscle shortens due to overlapping (1)

Power stroke (1)

Myofilaments (actin/ myosin) same length (1)

ATP required (1)

**Any seven = 7 marks**

45.

(a)

Isolating mechanisms prevent gene flow between populations/ are barriers to gene exchange between breeding populations/ spilt a gene pool (1)

Example of isolating mechanism (geographic/ reproductive) (1)

Mutations occur randomly (1)

Gene/ chromosome mutations (1)

Mutations increase/ decrease survival/ provide a survival advantage or not (1)

Populations now exposed to different conditions/habitat/environment (1)

Natural selection acts differently on/there are different selection pressures on each population/groups (1)

Surviving/best suited/fittest individuals are able to breed/pass on favourable genes/alleles/characteristics/mutations (1)

Favourable genotype = favourable phenotype (1)

Over long periods/after a long time/after many generations (1)

New species formed/speciation has occurred (1)

New species are unable to interbreed/breed together to produce fertile young (1)

**Any ten = 10 marks**

(b)

(i) tools

begin with using pebble tools e.g. choppers/ scrapers (1)

making and using simple tools e.g. flaked tools/ cutters (1)

stone/ bone tools (1)

complex stone tools with many flakes (1)

purpose built tools (1)

stone hand axes (1)

**Any five = 5 marks**

(ii) cultural trends

increase in communication e.g. signals, simple speech to more complex language (1)

move from solitary to loosely organised groups to living in organised groups (1)

sleeping in trees to building shelters (1)

scavenger to hunter (1)

no cooperative hunting 🡪 cooperative hunting (1)

use of fire (1)

division of labour (1)

**Any five = 5 marks**