Section A: Multiple Choice

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

Section B: Short Answers

**Question 31. (11 marks)**

a) attenuated whooping cough bacteria (1)

b) artificial active (1)

c) mutation / failure to take the full course of antibiotics / antibiotic dose too low / usage of antibiotics too common / unnecessary antibiotic use /natural selection (Any 1, 1)

d) (Any 4 points, but points must be correctly compared for the mark)

|  |  |
| --- | --- |
| Repeat exposure | Initial exposure |
| Memory cells activated | No memory cells to activate (1) |
| Immune response faster | Immune response slower (1) |
| Immune response lasts longer | Immune response lasts a shorter time (1) |
| Immune response stronger | Immune response weaker (1) |
| Immune response slower to decline | Immune response declines quickly (1) |

e) i) point where restriction enzymes starts to cut the DNA (1)

ii) enzymes that cut DNA in at set point(sequence) (1)

iii) chemical used to help bind two different /recombinant DNA pieces back together (1)

iv) circular pieces of bacterial DNA that can be cut open and recombined with a piece of DNA of interest (1)

**Question 32. (17 marks)**

a) If core body temperature is lower / higher then the rate of survival after the heart attack will be lower / higher / remain the same (Any 1, 1)

b) core body temperature (1)

c) presence of other diseases / age / temperature of the saline / method used to provide the saline to the patient / time between onset of heart attack and provision of saline (Any 2, 2)

d) The group given the current method / provided with the saline at the hospital (Any 1, 1)

Group should be chosen randomly / unbiased way (1)

e) Patients / family of patients should give consent / the treatment should not cause further harm (Any 1, 1)

f) avoids psychological effects of the subjects on their own outcome (1)

avoids bias in the interpretation of the data by the scientist (1)

g) Start with 5 and then subtract one mark for each of the following:

No title, not a line graph, time not on horizontal axis, ruler not used, units not given.

h) only one person was treated at the time elapsed of 1 min / some times had very few patients (Any 1, 1)

i) The sooner cooled saline is injected after a heart attack, the greater the average survival rate (1)

j) increased their sample size / conducted the investigation over a longer period of time (Any 1, 1)

**Question 33. (12 marks)**

a) DNA would have been degraded after such a long time / only small amounts of DNA would have been found (Any 1, 1)

b) (Any 6, 6)

DNA denatured by high heat / temperatures greater than 90oC (1)

DNA is cooled to 50 – 65oC (1)

Primers mark the ends of the target sequence (1)

and anneal to the complementary sequence (1)

Temperature is raised to 72oC (1)

Taq polymerase is added (1)

which replicates each of the DNA strands (1)

This cycle is replicated a number of times to multiply the amount of DNA present (1)

c) i) DNA fingerprinting / gel electrophoresis / southern blotting (Any 1, 1)

ii) Banding patterns would have been similer. Half the bands from the mother and half the bands from the father would have been found in the DNA from the skeleton (1)

d) (Any 3, with at least one from each of the two areas of the body)

Foot - non opposable big toe / transverse arch in the foot / robust calcaneus

Pelvis - short broad pelvis / bowl shaped pelvis / acetabulum sideways facing

**Question 34. (8 marks)**

a) osmoreceptors (1)

b) posterior pituitary (1)

c) in the bloodstream (1)

d) hypothalamus (1)

e) It is negative as the feedback is opposite to the original stimulus (1)

This is the most common form as it results in optimal conditions being maintained (1)

f) urine volume would increase (1)

urine concentration would decrease (1)

**Question 35. (12 marks)**

a) (Any 4, 1 from each box)

|  |  |  |
| --- | --- | --- |
|  | Sensory Neuron | Connector Neuron |
| Structure | Cell body off to one side /  axons and dendrites differ in length /  cell body can be found outside of the CNS (1) | Cell body central /  axons and dendrites similar in length / cell body only found in the CNS (1) |
| Function | Conducts impulses towards the CNS (1) | Conducts impulses between the sensory and motor neurons (1) |

b) i) protection / **insulation** / **increases rate of transmission** of nerve impulses (Any 1, 1)

ii) grey matter of the CNS / brain / spinal cord / named brain structure (Any 1, 1)

iii) (1)

c) i) self evident arrow going correct way (Any 1, 1)

ii) An inability to cause effector to contract (1)

iii) reflex arc would not occur / no stimulation would be received / reflex arc would not be initiated (Any 1, 1)

iv) Nervous – the reflex arc allows extremely rapid responses to prevent harm / damage (1)

Endocrine – hormones can continue to affect their target cells over an extended period of time (1)

**Question 36. (9 marks)**

a) (1 mark each, but points must be correctly compared for the mark)

|  |  |  |
| --- | --- | --- |
|  | B cell | T cell |
| Where they originate | Bone marrow | Bone marrow |
| Where they mature | Bone marrow and spleen | Thymus |
| How they come into contact with an antigen | Helper T cell stimulates them.  Or  Antigen randomly contacts the B cell | Macrophage presents the antigen to T cell |
| Main method of response | Antibodies | Killer T cells |

b) Ensure secondary response is faster (1)

and stronger / longer lasting (Any 1, 1)

c) (Any 3, 1 each)

inhibiting the antigen’s reactions with other cells (1)

binding to viral surfaces to prevent them entering cells (1)

coating bacteria to increase their edibility by phagocytes (1)

causing clumping / agglutination to improve phagocytosis (1)

dissolve organisms (1)

make substances insoluble and therefore more able to be phagocytosed (1)

**Question 37. (10 marks)**

a) i) stimulus – high blood pressure (1)

receptor – pressoreceptors in aortic and carotid bodies (1)

modulator – hypothalamus (1)

effector – smooth muscle of arterioles in skin (1)

response – increased vasodilation (1)

feedback – lowered blood pressure (1)

ii) (Any 3, 1 each)

The hot bath would increase his core body temperature (1)

as he would have gained heat by convection / conduction (1)

Vasodilation would increase blood flow to the skin (1)

iii) efferent / somatic (Any 1, 1)

**Question 38. (8 marks)**

a) If glucose is absorbed more quickly than the other molecules of similar size, then it must be assisted to do so by active transport (1)

Oxygen uptake is greater when glucose is present so cell respiration can then occur to produce energy (1)

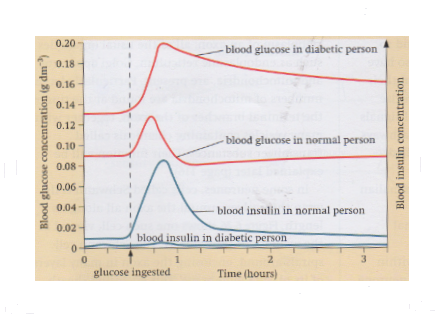
Mitochondria conduct cell respiration that provides energy for processes such as active transport (1)

b) Exercise requires rates of cell respiration to increase (1)

so blood glucose levels will be lower as more glucose is absorbed by cells (1)

c) Starch is a complex molecule that cannot be quickly absorbed (1)

sugar is more quickly absorbed so will be able to increase blood glucose levels more quickly (1)



d) (1)

**Question 39. (13 marks)**

a) DNA determines a person’s potential skin colour (1)

greater / less exposure to the sun will maximize / minimise the person’s actual colour (1)

b) i) The structure of DNA of a gene is not but altered(1 mark) but its expression is(1mark)

ii) Any two of the following. One mark each. Maximum is 2 marks

* *Improved diagnosis of disease*
* *Earlier detection of genetic predispositions to*
* *Rational drug design .*
* *Gene therapy Pharmacogenomics "custom drugs"*
* *study human evolution.*

c) Mutation is a sudden permanent change in the DNA (1)

Any named example (1) eg: sickle cell trait

Indicates how it is beneficial to the organism or species (1) eg: protects against malaria

d) i) The more similar the DNA / amino acid sequence is, the more closely related the species are / the closer the common ancestor (1)

ii) DNA (1)

DNA indicates whether even a single nitrogen base change has occurred (1)

while in comparative proteins, the same amino acid may be produced by a number of different codons (1)

Section C: Extended Answers

**Question 40. (20 marks)**

a) (7 marks)

stimulus – high CO2 / H+  / low pH (Any 1, 1)

receptor – chemoreceptors in medulla / aortic and carotid bodies (1)

modulator – respiratory centre of the medulla (1)

effector – diaphragm (1)

intercostal muscles (1)

response – increased contraction and relaxation of diaphragm and intercostal muscles / increased breathing rate (Any 1, 1)

feedback – decreased CO2 / H+/ increased pH (1)

b) (5 marks)

Oldowan tools(1)

Seen with Homo habilis(1)

Pebble tool worked on only one end(1)

Acheulian tools followed. (1)

Acheulian are hand axes, worked on both ends(1)

c) (8 marks)

Possible reasons for the loss - (Any 3, 1 each)

lack of calcium in diet / lack of weight bearing exercise / rate of bone destruction greater than bone deposition / lack of vitamin D / increased alcohol intake / high rate of smoking / increased caffeine intake / lack of oestrogen.

Effect of this loss - (Any 2, 1 each)

increased risk of fractures / stooping / hunched position / pain on movement / reduction in height / loss of bone density.

Treatment for this loss - (Any 3, 1 each)

calcium supplements / vitamin D supplements / increased weight bearing exercise / hormone replacement therapy / increase dairy intake / stop smoking / reduce alcohol consumption / decrease caffeine intake.

**Question 41. (20 marks)**

a) (7 marks)

Structure of the cell membrane – (Any 4, 1 each)

Molecules that make up the membrane are continually moving (1)

Membrane is made up of a number of different molecules (1)

Made up of a phospholipid bilayer (1)

with an outward facing hydrophilic head (1)

and an inner facing hydrophobic fatty acid tail (1)

Cholesterol embedded in the membrane makes it stronger / less fluid (1)

Function in active transport – (Any 3, 1 each)

Active transport requires the use of carrier proteins in the cell membrane (1)

which move molecules from areas of low to high concentration / against a diffusion gradient (1)

Carrier proteins are specific to one substance (1)

So when they are saturated they can’t work any faster (1)

b) (6 marks)

(Any 6, 1 mark each)

The hypothalamus releases releasing / inhibiting factors which are hormones (1)

which move through the local bloodstream to the anterior pituitary (1)

and causes the release of hormones from the anterior pituitary (1)

The hypothalamus produces ADH / oxytocin / hormones (1)

that move down its axons (1)

and are stored in axon terminals in the posterior pituitary (1)

Nerve impulses from the hypothalamus cause the release of these hormones (1)

c) (7 marks)

(Any 7, 1 each)

There is a more positive environment outside / more negative environment inside the cell membrane (1)

which produces a potential difference across the cell membrane when it is at rest (1)

There is a tendency for K+ to move out of the cell (1)

On stimulation the cell membrane becomes more permeable to Na+ (1)

So Na+ moves into the cell (1)

and the cell membrane becomes depolarised (1)

As a result the inside of the cell becomes positively charged very quickly (1)

Then K+ moves out of the cell (1)

and the cell membrane is repolarised / an action potential occurs (1)

This change in potential occurs along the membrane in one direction (1)

**Question 42. (20 marks)**

a) (7 marks)

Cause – (1)

lack of dopamine

Symptoms – (Any 2, 1 each)

shaking / shuffling gait / inability to control fine motor coordination / lack of balance / expressionless / fixed gaze

Reasons for treatment using stem cells – (Any 4, 1 each)

Stem cells can be placed into the brain in those regions affected by the lack of dopamine (1)

Stem cells will replace the cells no longer able to produce dopamine / damaged cells (1)

causing the production of dopamine (1)

and thus reducing the symptoms of the disease (1)

b) (7 marks)

(Any 7, 1 each)

Tay Sachs is an autosomal recessive condition (1)

which originated from a mutation (1)

People can carry the disease without themselves being affected / heterozygotes are unaffected (1)

and have a 25% chance of producing an affected child if their partner is also a carrier (1)

When migrating / moving away from the original population (1)

the new population being established is small in size (1)

and as Ashkenazi Jews only marry within their own religion (1)

the chances of producing an affected child / incidence of expressing two recessive alleles is much higher (1)

and because carriers may be provided with immunity against tuberculosis (1)

the frequency of the mutated allele remains high (1)

c) (6 marks)

How the process works – (Any 2, 1 each)

Groundwater contains fluoride ions (1)

Bone absorbs fluoride from the water in the surrounding soil (1)

The more fluoride the sample has, the older it is (1)

What information it provides – (Any 1, 1)

The relative age of the fossil (1)

Whether two samples at the same site are of the same age (1)

Limitations – (Any 3, 1 each)

Can only be used on bone / teeth / antler (1)

Can only be used on samples from the same site (1)

Fluoride levels can vary in the soil even in the one place over time (1)

Not all objects absorb fluoride ions at the same rate (1)