# Option A

**1a.** *[4 marks]*

Draw a labelled diagram of a reflex arc for a pain withdrawal reflex.

## Markscheme

*Award* ***[1]*** *for any one of the following clearly drawn and correctly labelled.*

a. spinal cord – showing white and grey matter;

b. spinal nerves – showing dorsal and ventral roots;

c. sensory neuron / receptor;

d. motor neuron / effector;

e. relay neuron;

f. arrows showing path from stimulus/receptor to response/effector;

 **1b.** *[3 marks]*

Distinguish between innate behaviour and learned behaviour.

## Markscheme



 **2a.** *[1 mark]*

Identify the type of retinal cells that function best in dim light.

## Markscheme

rods

 **2b.** *[1 mark]*



The image shows the human ear.

Outline the role of the round window in the perception of sound.

## Markscheme

a. allows fluid in the cochlea to move;

b. as oval window moves in, round window moves out / *vice versa*;

 **3a.** *[1 mark]*

State the type of stimulus provided by the sight and smell of the food.

## Markscheme

unconditioned (stimulus)

 **3b.** *[1 mark]*

State the function of the tube.

## Markscheme

to collect the saliva (for measurement of volume)

 **3c.** *[1 mark]*

State **two** effects presynaptic neurons could have on postsynaptic transmission.

## Markscheme

excitation and inhibition

 **4a.** *[1 mark]*

Identify the trial for each flower type that shows the greatest variation.

Paper: Plastic:

## Markscheme

*Paper:* (trial) 1*Plastic:* (trial) 5 *Both required for* ***[1]****.*

 **4b.** *[2 marks]*

Compare the data for plastic and paper flowers.

## Markscheme

a. discovery time in paper flowers always shorter than plastic flowers;b. larger variation in data for plastic flowers;c. decreasing discovery time (over the eight trials) for the paper flowers only;d. no trend in discovery time for plastic flowers;e. from trial four discovery time for paper flowers remains fairly constant/slight variation whereas for plastic flowers discovery time increases;

 **4c.** *[2 marks]*

Outline the evidence from the data that the ability to find nectar using mechanoreceptors is a learned behaviour.

## Markscheme

a. mechanoreceptors are touch receptors;b. discovery time decreases over the eight trials for paper flowers;c. showing evidence of learning;d. plastic flowers discovery times show no evidence of learning;e. paper flowers have a rough surface so mechanoreceptors are more effective / plastic flowers smooth so do not stimulate mechanoreceptors;

 **4d.** *[2 marks]*

Discuss how learning to find nectar using mechanoreceptors could lead to improved chances of survival and reproduction for the tobacco hornworm moth.

## Markscheme

a. improved chances of finding food;b. advantage in dark/conditions when coloured/scented flowers not available;c. not completely dependent on light/chemoreceptors to find food;d. more likely to reproduce and pass gene (for mechanoreceptors) to offspring; advantage over other members of the species through learning;

 **5a.** *[1 mark]*

List two examples of excitatory psychoactive drugs.

## Markscheme

nicotine;cocaine;amphetamines;ecstasy; *Award* ***[1]*** *for any* ***two****. Consider the first two only, if there are more.*

 **5b.** *[2 marks]*

Outline the possible effects of excitatory drugs on mood and behaviour.

## Markscheme

a. increases arousal/alertness;b. feelings of excitement/euphoria;c. aggressive behaviour;d. loss of judgement/self-control;e. social withdrawal/depression/dysfunction;f. loss of appetite;

 **5c.** *[3 marks]*

Discuss the causes of addiction to cocaine.

## Markscheme

a. peer pressure / cultural traditions;b. inherited / genetic predisposition;c. social problems / trauma;d. passed from mother to newborn/when breast feeding;e. many stimulate synapses with dopamine as a transmitter / blocks re-uptake of dopamine;f. pleasurable effects of dopamine/euphoria/regular use may lead to addiction;g. increasingly large/more regular doses needed for effect;

 **6a.** *[4 marks]*

Compare the effects of cocaine and THC.

## Markscheme



*Answers do not need to be in a table format.*

 **6b.** *[2 marks]*

State one other example of an excitatory and an inhibitory psychoactive drug.

Excitatory drug: .....................................................

Inhibitory drug: .....................................................

## Markscheme

a. *excitatory drug*: nicotine / amphetamines/ other drug;b. *inhibitory drug*: benzodiazepines / alcohol / other drug;

 **7a.** *[1 mark]*

State the effect of morphine during pre-competition training for team C.

## Markscheme

increases tolerance to pain (when given in weeks 2 and 3)

 **7b.** *[1 mark]*

Identify which team showed the greatest tolerance to pain on competition day.

## Markscheme

team C

 **7c.** *[2 marks]*

Analyse the effect of the placebo as seen in the data.

## Markscheme

a. placebo has no effect in team B where morphine was not administered previously;b. team B thought they were getting morphine but their performance was the same as team A;c. placebo has a greater effect if morphine has been administered previously as in team C;d. naloxone negates the (expected) effect of placebo (even if morphine administered previously) in team D;e. error bars overlap so results may not be statistically significant/no difference;

 **7d.** *[1 mark]*

Suggest a reason for the reduced pain tolerance in team D during competition.

## Markscheme

naloxone (an endorphin blocking drug) blocks the receptors for endorphins / stops endorphins from acting as pain killers

 **7e.** *[2 marks]*

 Analyse the data collected in the week following competition.

## Markscheme

a. pain tolerance goes down in all groups / all have same level of pain tolerance;b. morphine-like effect/morphine effect is temporary;c. endorphins/naturally produced pain-killers levels/number of receptors for pain-killers decreases;d. decrease in pain tolerance is evidence for motivation/determination during competition and training / lack of motivation when no competition;

 **8a.** *[2 marks]*

State **one** excitatory and **one** inhibitory psychoactive drug.

Excitatory: ............................................................

Inhibitory: ............................................................

## Markscheme

a. *excitatory*: nicotine / cocaine / amphetamines / other drugs;b. *inhibitory*: benzodiazepines / alcohol / THC / other drugs;

 **8b.** *[2 marks]*

Describe, using **one** specific example of an animal, how the process of learning can improve its chances of survival and reproduction.

## Markscheme

a. named animal;b. description of learned action allowing a more flexible response that improves health/survival/reproduction;

*eg:*a. chimpanzees;b. poking sticks in the wood increases chances to get more food/termites/insects;

a. blue jays;b. avoidance of certain bad taste / poisonous insects prevents them from being sick/poisoned;

a. hedgehogs;b. running across roads instead of rolling up when vehicles approach more likely prevents them from being killed;*Accept any other verifiable examples.*

 **9a.** *[1 mark]*

State the relationship between brain volume and hippocampal volume in the non-migratory sparrows.

## Markscheme

as brain volume increases so does hippocampus volume / positive correlation

 **9b.** *[2 marks]*

Compare the hippocampal volume in migratory and non-migratory young and adult sparrows.

## Markscheme

hippocampus volumes are larger in adults than in young birds;

larger range for migratory;

young non-migratory show wider range of hippocampus volumes than young migratory;

some overlap for non-migratory / none for migratory;

 **9c.** *[1 mark]*

Analyse the data in the scattergraph to find which of the four groups of birds has the highest relative hippocampal volume.

## Markscheme

adult migratory (as for any brain volume this group has the largest hippocampal volume) } *(allow mathematical explanation)*

 **9d.** *[1 mark]*

Suggest a reason why this group needs the largest relative hippocampal volume.

## Markscheme

needed for migration / only adults migrate/remember flight paths

*(Do not accept spatial navigation on its own without reference to migration)*

 **9e.** *[2 marks]*

It is possible that non-migratory species possess more advanced cognitive skills other than spatial memory. Use the data to evaluate this hypothesis.

## Markscheme

*Hypothesis supported*:

non-migratory have larger brain volume;

larger brain implies more thinking skills;

hippocampus in non-migratory is approx same size as in migratory;

*Hypothesis not supported*:

only two species/small sample studied so over generalization;

similar hippocampus volume in both migratory and non-migratory birds;

 **10a.** *[3 marks]*

Using the table below, distinguish between *rod cells* and *cone cells*.



## Markscheme



*Award* ***[1]*** *for each correct row.*

 **10b.** *[3 marks]*

Outline how sound is perceived in the ear.

## Markscheme

sound waves make eardrum/tympanic membrane vibrate;

vibration passes along the bones of middle ear/ossicles/malleus, incus and stapes making oval window vibrate;

vibration passed to fluid in cochlea;

vibration in cochlea stimulate hair cells/mechanoreceptors;

nerve impulse passed to auditory nerve;

 **11a.** *[1 mark]*

Identify which stage of cocaine use shows the least percentage difference between identical twins and non-identical twins.

## Markscheme

occasional

 **11b.** *[3 marks]*

Compare the results for identical twins and non-identical twins.

## Markscheme

both (identical and non-identical twins) show lower percentages going from occasional to abuse to dependence;

at every stage, the percentage is higher for identical twins;

non-identical twins percentage drops to zero for dependence (but identical twins does not);

difference is similar for both groups between abuse and dependence;

sharper decrease between occasional and abuse for non-identical twins than identical twins/*OWTTE*;

*Do not accept answers stating numerical values only*

 **11c.** *[3 marks]*

Analyse the data to find whether it supports the hypothesis that genetic factors cause some people to have a much higher chance of cocaine dependence than others.

## Markscheme

hypothesis supported as identical twins are more likely to behave the same for abuse and dependence than non-identical twins;

identical twins have the same genotype / *OWTTE*;

hypothesis not supported as environment is the major factor for trying cocaine;

not known if similar results may be due to similar environment;

not enough data for valid statistical analysis/*OWTTE*;

 **12a.** *[1 mark]*

State the difference in neuron activity between nights 2 and 7.

## Markscheme

0.8 (*Accept answers from 0.75 to 0.85.*)

 **12b.** *[2 marks]*

Outline the effect of exposure to birdsong on neuron activity.

## Markscheme

a. increases neuron activity;b. increase over three days/increase of about 75 %/of 50–100 %;c. then plateaus/levels off;d. large variation on days 14 and 15;

 **12c.** *[1 mark]*

Suggest **one** reason for the large error bars on days 14 and 15.

## Markscheme

a. small sample so one measure can skew the average / higher average value due to only one measurement;b. different birds respond differently/nothing being learned;c. change in behaviour due to biotic/abiotic changes;

 **12d.** *[2 marks]*

Evaluate the hypothesis that listening to other zebra finches is important to develop singing ability amongst juveniles.

## Markscheme

a. hypothesis seems to be verified since all points after exposure to birdsong are higher;b. learning phase (supported by changes on days 5–7);c. experiment shows only one brain area activity / other factors may also be involved;

 **13a.** *[2 marks]*

Label the following diagram of the eye.



## Markscheme

I irisII vitreous humourIII choroidIV fovea (*do not accept yellow spot*) *Award* ***[1]*** *for every two correct answers.*

 **13b.** *[2 marks]*

Outline the diversity of stimuli that can be detected by human chemoreceptors.

## Markscheme

a. (dissolved) chemicals detected by taste buds (in the tongue and mouth);b. (airborne) chemicals detected by (olfactory) receptors;c. chemicals/ions/pH in blood (for example CO/glucose) detected by chemoreceptors (in carotid artery/medulla oblongata);d. neuroreceptors detect neurotransmitters;

 **14.** *[3 marks]*

The diagram below shows a synapse where the neurotransmitter is dopamine and some of the processes that take place during nerve transmission.

Explain the effect of cocaine on neurotransmission at a synapse.



## Markscheme

a. dopamine initiates depolarization of post-synaptic membrane;b. cocaine binds to (transporter) carrier proteins/proteins in pre-synaptic membrane;c. cocaine blocks reabsorption (of dopamine);d. cocaine causes dopamine build up in synaptic cleft/space;e. so stimulus continues/cocaine is excitatory;

 **15a.** *[1 mark]*

Label structures I and II

I. .............................................................

II. .............................................................

## Markscheme

I: pinna;II: ear drum / tympanic membrane; (*both needed*)

 **15b.** *[1 mark]*

Outline how sounds are perceived in the cochlea, including the name of the cell type involved.

## Markscheme

cilia/hair/hair bundles of hair cells vibrate with (cochlear) liquid/fluid movement

 **15c.** *[2 marks]*

Identify a function of the parts of the brain by using numerals II to V to complete the chart. Hypothalamus has been completed for you.



## Markscheme



*Award* ***[1]*** *for any* ***two*** *correct responses.*

 **15d.** *[2 marks]*

Discuss how the pupil reflex can be used as a test for brain death.

## Markscheme

a. pupil reflex is controlled by autonomic nervous system/brain/midbrain; (*do not accept medulla*)b. light shone into the eye would normally cause pupil contraction;c. no pupil reflex indicates that synapses are not functioning;d. can indicate brain death but not necessarily / *OWTTE*;

 **16a.** *[3 marks]*

Explain how sound is perceived by the ear.

## Markscheme

sound (waves) vibrate eardrum/tympanic membrane;movement is magnified by ossicles/middle ear bones;oval window vibrates / fluid in cochlea moves and moves hairs in cochlea;different frequencies detected by different parts of cochlea membrane and hair cells;these are connected to the auditory nerve;

 **16b.** *[1 mark]*

Hearing is a result of the stimulation of mechanoreceptors. List **three** other main types of receptors.

1. ..................................................................

2. ..................................................................

3. ..................................................................

## Markscheme

chemoreceptors / photoreceptors / thermoreceptors / baroreceptors *Award* ***[1]*** *for three correct receptors*.

 **17a.** *[1 mark]*

Distinguish between innate behaviour and learned behaviour.

## Markscheme

innate behaviour develops independently of the environmental context, whereaslearned behaviour develops as a result of experience*To award* ***[1]****, answers need to address both innate and learned behaviour.Do not accept “instinct” as a description of innate behaviour.*

 **17b.** *[2 marks]*

Outline Pavlov’s experiments into conditioning of dogs.

## Markscheme

conditioned stimulus of sound/ringing bell / other stimulus used by Pavlov;replaces unconditioned stimulus of sight/smell of food;both result in conditioned response/production of saliva;

 **18a.** *[1 mark]*

Define the term *reflex*.

## Markscheme

rapid and unconscious/automatic response (to a stimulus)

 **18b.** *[3 marks]*

Draw a labelled diagram of a reflex arc for a pain withdrawal reflex.

## Markscheme

*Example of diagram.*



sensory neuron shown connecting site of stimulus/receptor to relay neuron; relay neuron shown in grey matter, connecting sensory neuron to motor neuron; motor neuron shown connecting relay neuron to effector/muscle / cell body of motor neuron shown in grey matter; cell body of sensory neuron shown outside spinal cord/in dorsal root; spinal cord shown with grey and white matter;

 **18c.** *[2 marks]*

Outline Pavlov’s experiments into conditioning in dogs.

## Markscheme

unconditioned stimulus is smell/sight of food and unconditioned response is salivation;conditioned stimulus is sound of a bell and conditioned response is salivation at sound of bell;bell/other stimulus is repeatedly applied just before food;after several repeats the response can be seen without the food/when only the bell is rung/other stimulus;

 **19.** *[3 marks]*

Explain the effects of psychoactive drugs on synaptic transmission.

## Markscheme

psychoactive drugs may increase or decrease transmission (to the post-synaptic membrane);may increase the release/delay the breakdown/interfere with storage/uptake/reabsorption of neurotransmitters;may mimic the action of neurotransmitters;inhibitory drugs may reduce the effect of excitatory neurotransmitters / increase the effect/release of inhibitory neurotransmitters;inhibitory drugs can hyperpolarize the post-synaptic neuron;

 **20a.** *[1 mark]*

Define the term *stimulus*.

## Markscheme

stimulus is a change in the (internal/external) environment that can be detected

 **20b.** *[1 mark]*

Outline the functions of the following parts of the brain.

Medulla oblongata:

## Markscheme

*medulla oblongata*: controls autonomic functions of the body such as heart rate/blood pressure/ventilation/swallowing/vomiting/digestion/cranial reflexes

 **20c.** *[1 mark]*

Outline the functions of the following parts of the brain.

Hypothalamus:

## Markscheme

*hypothalamus*: links nervous and endocrine systems/produces hormones secreted by posterior pituitary/controls hormonal secretion by pituitary/maintains homeostasis such as control of body temperature/hunger/thirst/fatigue/circadian cycles

 **20d.** *[3 marks]*

Explain the effects of psychoactive drugs on synaptic transmission.

## Markscheme

psychoactive drugs may increase or decrease transmission (to the post-synaptic membrane);may increase the release/delay the breakdown/interfere with storage/uptake/reabsorption of neurotransmitters;may mimic the action of neurotransmitters;inhibitory drugs may reduce the effect of excitatory neurotransmitters/increase the effect/release of inhibitory neurotransmitters;inhibitory drugs can hyperpolarize the post-synaptic neuron;

 **20e.** *[2 marks]*

Outline how endorphins act as painkillers.

## Markscheme

endorphins released by pituitary gland (during stress, injury or exercise);endorphins block transmission of impulses at synapses involved in pain perception;bind to receptors in the membrane neurons (involved in) sending pain signal;block release of neurotransmitters;

 **21a.** *[2 marks]*

Identify the parts of the brain indicated on the diagram below.



## Markscheme

I. cerebral hemisphere / cerebrum;II. hypothalamus;III. cerebellum;IV. medulla oblongata; *Award [1] for any two of the above.*

 **21b.** *[3 marks]*

Outline the unconscious control of the heart rate.

## Markscheme

heart can contract without nervous stimulation/myogenic contractions;SA node is pacemaker/generates heart beat/initiates each cardiac cycle;epinephrine/adrenalin speeds up the heart rate;autonomic/sympathetic and parasympathetic nervous system control;sympathetic speeds up heart rate;parasympathetic/vagus nerve slows heart rate (back to normal/resting rate);

 **21c.** *[3 marks]*

Describe different aspects of the processing of visual stimuli.

## Markscheme

edge enhancement is greater perception at edges of light/dark areas;caused by processing in two types of ganglion cell in retina;

contralateral is processing left field of view in right side of brain / *vice versa*;cross over between left and right sides in the optic chiasma;

convergence is combining impulses from groups of (rod/cone) cells;done by bipolar cells in retina;

 **22.** *[6 marks]*

Discuss the causes of addiction, including genetic predisposition, social factors and dopamine secretion.

## Markscheme

 *social and genetic: [3 max]*

*genetic:*

a. genetic link found for (cocaine) addiction;

b. difficult to prove / multifactorial;

*social:*

c. alcohol/other drug problems among family members;

d. poor school performance;

e. poverty / family conflicts / chaos / stress;

f. having friends who drink/use other drugs;

g. not fitting in socially / being excluded because of race/ability/ethnicity/gender/age/sexual orientation / other factors;

*dopamine and addiction: [3 max]*

h. substances with addictive potential stimulate the release of dopamine;

i. dopamine is a chemical in the brain that is associated with reward and pleasure;

j. substance use brings a flood of dopamine, which alters the chemistry of the brain;

 **23a.** *[1 mark]*

List **two** dietary sources of vitamin D.

## Markscheme

*e.g.* cod liver oil / fish liver oil / oily fish (accept correctly named example) / egg yolk / fortified cereal / ONE named dairy product (*i.e.* milk/cheese/ yoghurt)*Allow any* ***two*** *sources for the mark. Reject fish alone.*

 **23b.** *[1 mark]*

State an example of these receptors in humans.

## Markscheme

hair cells of cochlea

 **23c.** *[3 marks]*

Discuss exposure to sunlight as a source of vitamin D.

## Markscheme

UV light/sunlight on skin causes chemical production of vitamin D;UV too low in winter in high latitudes;vitamin D stored in liver so can make enough to last several months/through winter;UV light can damage skin and cause skin cancer so exposure needs to be limited;use of sun-block will inhibit vitamin D production;covering skin with clothing prevents UV reaching skin; *Accept reference to cultural/religious customs*

 **24a.** *[3 marks]*

Distinguish, using examples, between innate behaviour and learned behaviour.

## Markscheme

learned behaviour occurs as a result of experience (while innate is independent of environment);innate behaviour is controlled by genes/inherited (while learned is not inherited);correct example of both;

 **24b.** *[2 marks]*

Using **two** examples, discuss how the process of learning can improve survival.

## Markscheme

name of animal, how they learn and advantages for survival;name of another animal, how they learn and advantages for survival; *e.g.* grizzly bears by operant conditioning/practise how to catch salmon providing needed food supply;goslings learn who their mother is/imprinting, avoid predators by staying near mother;

 **25a.** *[2 marks]*

The diagram below represents the human eye. State the names of structures I, II, III and IV.



I. ..................................................................

II. ..................................................................

III. ..................................................................

IV. ..................................................................

## Markscheme

I. cornea;II. lens;III. vitreous humour;IV. choroid; (*Accept sclera as line is on the border between these two*)*Two correct for* ***[1]*** *and four correct for* ***[2]****.*

 **25b.** *[2 marks]*

Outline the evidence provided by DNA for the common ancestry of living organisms.

## Markscheme

all living organisms use DNA as genetic/hereditary material;genetic code is (almost) universal;idea that mutations accumulate gradually in DNA;

 **25c.** *[2 marks]*

The cladogram below shows the classification of species A to D. Deduce how similar species A is to species B, C and D.



## Markscheme

A is most similar to B;A is equally similar to C and D;A is least similar to both C and D;

 **25d.** *[2 marks]*

Suggest **two** reasons for using cladograms for the classification of organisms.

## Markscheme

methods used to prepare cladograms use a different approach from traditional classification/taxonomy;show ancestral relationships;reflect how recently two groups shared a common ancestry;cladograms are (objective/accurate because they are usually) based on molecular differences;they should be considered as a good complement to traditional classification;

 **26.** *[6 marks]*

Discuss the concept of brain death and the use of the pupil reflex in testing for brain death.

## Markscheme

whole brain death is brain stem and cerebrum;

failure of pupil to respond to light indicates brain stem death;

without brain stem function, life cannot continue;

cerebrum involves higher order brain function;

non-functioning cerebrum with functioning brain stem is vegetative state;

some would argue this is the death of the person;

though brain stem function alone may be able to maintain homeostasis;

 **27a.** *[4 marks]*

Outline the use of **two named** *ex situ* conservation measures.

## Markscheme

name;use;

*example 1*:*name*: zoos;captive breeding of animals / permits assisted reproductive methods / use of modern technology;*example 2*:*name*: botanic gardens;allows for protected growth of plants / protected from extreme climatic conditions / provision of all necessary conditions;*Award* ***[1]*** *for name and* ***[1]*** *for its use.Accept other suitable examples.*

 **27b.** *[4 marks]*

Outline **two** factors that affect the incidence of coronary heart disease.

## Markscheme

*Award* ***[1]*** *for a factor and* ***[1]*** *for its effect.*

*Accept any two of the following factors with its associated effect:*e.g.: genetic predisposition / age / being male / obesity / eating too much saturated fat and cholesterol / lack of exercise / smoking / diabetes (melitus) / hypertension / stress.*Accept converse statements of factors decreasing risk.*

e.g. *factor*: genetic predisposition; *effect*: some synthesise more cholesterol/LDL than others;e.g. *factor*: being male; *effect*: women before menopause appear to be protected by higher blood estrogen levels which men do not have;e.g. *factor*: obesity; *effect*: excess weight raises blood pressure/blood cholesterol/triglyceride levels / lowers HDL/good cholesterol levels;

 **27c.** *[5 marks]*

Discuss how brain lesions and fMRI (functional magnetic resonance imaging) scanning can be used in the identification of the brain part involved in specific functions of animals.

## Markscheme

lesions (from accidents/birth) indicate effect of loss of area;*e.g.* split brain patients/severed corpus callosum led to understanding different functional roles of left and right hemispheres / other valid examples;many actions of the body involve different areas of the brain;damage may be to several/many parts so results unclear;difficult to interpret due to complexity of reactions;fMRI gives a more specific knowledge of stimulated area/activation;*e.g.* used to study/diagnose ADHD/dyslexia/recovery from strokes/music comprehension / other valid examples;non-invasive / no damage to brain;can study healthy subjects;involves blood flow/supply/oxygenation;not neuronal connections (so requires interpretation);good spatial but poor temporal resolution;problem of statistical interpretations of model; *Award* ***[4 max]*** *if either brain lesions or fMRI alone are discussed.*

 **27d.** *[5 marks]*

Explain the liver damage caused by excessive alcohol consumption.

## Markscheme

can cause inflammation/fatty liver/cirrhosis of the liver from alcohol abuse;usually from prolonged/excessive drinking / *OWTTE*;products of alcohol metabolism toxic to cells / alcohol consumption reduces antioxidant activity;replacement of healthy liver cells with fibrous/scar tissue;blocks blood flow through liver / loss of functional liver cells / blocks normal metabolic carbohydrates/fats/proteins;decreased ability to remove toxins (through bile)/bacteria / production of bile and blood proteins;nutritional deprivation / susceptible to infection/hepatic viruses;

 **28.** *[6 marks]*

Explain how the structures of the human ear allow for sound perception.

## Markscheme

eardrum/tympanic membrane vibrates with sound (waves);movements of eardrum/tympanic membrane amplified by bones of middle ear/stapes;bones are malleus/hammer, incus/anvil, stapes/stirrup;movement transmitted to oval window;creates pressure waves in the liquid within cochlea;waves travel up to/dissipate at round window;hairs in cochlea vibrate according to movement (of liquid/waves);different frequencies detected by different hair cells (on different parts of membrane);movement of hairs cause action potential/depolarization/hyperpolarization of hair cells;cause nerve impulses to be transmitted through auditory nerve;

 **29.** *[6 marks]*

Discuss the evolution of altruistic behaviour using **one** non-human example.

## Markscheme

organism expends time/energy in caring for other (unrelated) members of the same species;put themselves at risk or disadvantage for the good of other members of the species / actions that increase another individual’s number of offspring at cost to one’s own reproduction;

valid example; (*e.g. primates / vampire bats / male turkeys or other birds such as Florida jays / mole rats*)*Do not accept parental care.*

description of altruistic behaviour of the example given;might expect natural selection to be against behaviour that reduces chances of survival and reproduction;close kin share alleles;(adaptive significance is to) increase frequency of alleles shared in common;(provides genetic advantages in kin by) promoting survival and reproduction within species;altruistic behaviour towards non-relatives may allow selection of alleles responsible for the behaviour to be perpetuated;some argue no true altruism as organism benefits either directly or indirectly in the future; *Award* ***[5 max]*** *if no valid non-human example given.*

 **30.** *[2 marks]*

Explain the effects of cocaine in terms of action at synapses in the brain.

## Markscheme

cocaine affects synapses using dopamine as neurotransmitter;cocaine attaches to dopamine receptors on presynaptic membrane;blocks dopamine transporters/prevents re-uptake / causes dopamine to persist in the synaptic cleft;amplifies synaptic transmission / is an excitatory psychoactive drug / causes constant stimulation of postsynaptic neuron;dopamine builds up in the synapse contributing to euphoria/pleasurable effects;

 **31.** *[6 marks]*

Discuss the concept of brain death and how it can be diagnosed.

## Markscheme

it is a legal/medical definition of death;some cases of coma are irreversible / some cases of coma may recover;damage in the medulla (oblongata) is generally permanent;doctors have to diagnose damage to decide treatment;use tests of brain stem function to decide whether to preserve patient’s life / without brain stem function life cannot continue;test pupil reflex / shine light into eye;if pupils do not constrict with light this suggests brain death;more than one test used to diagnose brain death;no response to pain or cranial reflexes;legal/ethical definition needed for organ donation / long term use of life-support machines may be inappropriate / bioethical considerations;

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