**Biology Paper 2 Revision**

Triple Science (HT)

*Answer Booklet*

1. (a)     any **two** from

•        copies of chromosomes made

•        cell divides twice **or** 4 cells formed

•        each gamete / cell now has single set of chromosomes

*allow chromosome number halved /  
cells haploid / cells n*

**2**

(b)     any **two** from

•        sex cells / gametes with different DNA fuse / fertilisation

•        offspring receive genes or chromosomes or alleles from  
both parents / DNA

* homologous chromosomes separate therefore each gamete has different alleles

•        all gametes are genetically different

**2**

(c)     (i)      new form of gene

*allow change in genetic material / DNA / chromosomes / gene*

**1**

(ii)     (no)

         any **two** from

•        some neutral

•        exemplified

*e.g. extra digit*

•        some increase chances of survival / reference to natural  
selection or evolution

•        exemplified

*e.g. example of disease resistance*

**2**

**[7]**

**2.** (a)     phosphate*allow PO43−*

**1**

*do* ***not*** *allow P*

(b)     A / adenine and T / thymine **and** C / cytosine and G / guanine

*do* ***not*** *allow U / uracil*

**1**

(c)     (mutation) changes from C to T DNA code

**or**

there is a change in the three bases / triplet from CAG to TAG

**1**

(mutation) changes the amino acid

**1**

(this could) change the protein

**1**

(so it) forms a different shape / changed active site

*accept different tertiary structure*

**1**

(therefore) the enzyme no longer fits the substrate / carbohydrate

**1**

(d)     mother / woman’s gametes correct: A   a

**1**

father / man’s gametes correct: a   a

**1**

correct derivation of offspring

*ecf*

**1**

identification of child with syndrome H or genotype aa

**1**

0.5

*ecf*

*allow 50% / 1 / 2 / 1 in 2 / 1:1*

**1**

*do* ***not*** *accept 1:2*

**3**.(a)     pupils dilated (at **B**) *allow converse for* ***A***

**1**

in dim light / low light levels

**1**

because circular muscles (in iris) relax

**1**

(and) radial muscles contract

**1**

**(**b)     figure 2 shows myopia where light does not focus on the retina

*allow refraction*

**1**

in figure 3 the lens bends the light so that light focuses on the retina

**1**

**[6]**

**4.**(a)     (i)      cerebral cortex *accept cerebrum / cerebral hemisphere*

**1**

(ii)     MRI (scan)

*allow CAT / CT scan  
do* ***not*** *accept MIR*

**or**

electrode stimulation

*allow electrical stimulation*

**1**

(b)     (i)      sharp point stimulates (pain) receptor (in the skin)

*must be in correct order*

**1**

to send (nerve) impulse

*ignore information and messages*

**1**

via sensory neurone

**1**

to spinal cord

*do* ***not*** *accept spine, ignore CNS*

**1**

crosses synapse

*allow synapse in any correct context*

**1**

to other (relay) neurones / to brain

*do* ***not*** *accept motor neurone*

*allow explanation in a flow diagram*

**1**

(ii)     damage must be between arms and legs / below arms

*accept below the waist*

**1**

since information from nerves in arms still reaches the brain / information from the legs doesn’t reach the brain

**1**

**5.**(a)     (i)      any **two** from:

•        not all eaten

*allow eaten by other animals*

•        used for respiration

*ignore used / lost in heat / movement*

•        lost as CO2 / water / urea

•        lost as faeces **or** not all digested

*if neither mark awarded allow 1 mark for lost as waste*

*ignore references to energy losses*

*do not allow for growth / repair / reproduction*

**2**

(ii)     any **one** from:

•        thrushes eat other things

•        thrush numbers likely to vary (considerably)

*allow it is only an estimate (of population size)* ***or*** *only counted thrushes for 5 hours*

•        thrushes were not present all the time

•        thrushes feed on a much bigger area

**1**

(b)     (i)      any **one** from:

•        there are two dependent variables

•        there is no independent variable

•        to show the association / correlation / pattern (between the two variables)

**1**

(ii)     (snails in woodlands)

more have dark(er) colour(ed shells) **or** fewer have light-coloured shells

*allow converse for grassland, if clear*

**1**

(shells have) no / fewer stripes or have no stripes

*allow converse for grassland, if clear*

**1**

(iii)     less likely to be seen (by predators / birds / thrushes)

*allow camouflaged (from predators / birds / thrushes)*

*allow light coloured shells with stripes would be more visible (to predators / birds / thrushes in woodland (than grassland)).*

**1**

**6.**(a)     an extremophile species

**1**

(b)     (i)      smaller ice area

*allow smaller amount of ice or less ice*

**1**

(so) less habitat

*allow fewer places to live / nest*

**1**

(ii)     **either** increase

as more sea to live in **or** as less competition for food

**or** decrease as less space (ice) to lay eggs  
**or** predators more likely to eat them

*there is no mark for increase / decrease alone. The mark is for an appropriate reason linked to increase / decrease*

*if increase / decrease not ringed the mark may be awarded if it is clear in the explanation which is intended*

**1**

(c)     Living organisms show long-term changes.

**1**

**7.**(a)     gets more light (near surface)

*allow warmer (near surface)*

*allow bladders contain (more) carbon dioxide*

**1**

(so) photosynthesises more

**1**

(because) bladders aid floating (when tide is in)

**or**

(so) more biomass / glucose / starch produced

*ref to ‘more’ needed only once, eg gets more light for photosynthesis gains* ***two*** *marks*

*if ‘more’ not given do not award mark on the first occasion*

**1**

(b)     lets angler fish see / attract its prey / mates **or** see predators as it is dark (at 1000m)

**Or** lets angler fish see / attract prey to get food

**Or** lets angler fish see / attract mates to reproduce

**Or** lets angler fish see predators to avoid being eaten

*must be in a correct pair to gain* ***two*** *marks*

**2**

**8** (a)     grown down *allow longer*

**1**

towards gravity / gravitropism *allow geotropism*

**1**

(b)     grow up

**1**

towards the light *allow phototropism*

**1**

(c)     3

**1**

(d)     repeat the experiment

**1**

(e)     seeds germinate sooner so growing season is longer

**1**

**9** (a)     (i)      fewer cows

any **one** from:

•        less methane *do****not****allow CH4*

•        less CO2 in the atmosphere because of less deforestation **or** less plants consumed.

*allow less CO2released into the atmosphere because less fuel used e.g. to heat cowsheds****or****to transport meat*

*do****not****allow CO2*

**1**

(ii)     any **two** from:

•        could be mass produced to feed an increasing population

•        disease free meat

•        no / low fat

•        no harm to animals or less intensive farming

*allow (may be) suitable for vegetarians*

•        antibiotic free meat

•        more land available for farming crops

*allow no energy loss along a food chain*

**2**

(b)     fungus / Fusarium

**1**

with glucose (syrup)

**1**

in aerobic conditions **or** in presence of oxygen *ignore air*

**1**

mycoprotein is harvested / purified

*allow ammonia added (as source of nitrogen)*

*ignore stirring / mixing and temperature*

**1**

**[8]**

10. (a)     any **two** from:

•        (volume of) peat compost has been steady and then declined **or** volume of peat compost has declined since 2005

*allow 2007 instead of 2005*

•        (volume of) peat-free compost has increased (since 1999)

•        (volume of) peat is higher than peat-free until 2005, then peat-free compost is higher (than peat)

*allow 2007*

•        total volume of peat and peat-free compost has increased.

**2**

(b)     increases carbon dioxide (in the atmosphere) *ignore methane*

**1**

(c)     any **one** from:

•        reduces biodiversity

•        destruction of habitats

•        disruption of food chains.

**1**

**[4]**

(d)    (i)      range of different species

*accept idea of variety of organisms or plants or animals*

**1**

(ii)     any **two** from:

•        organisms may produce substances useful to humans

*do****not****accept if food is only example*

•        duty to preserve for future generations

•        effect on other organisms, eg food chain effects

*ignore effect on human food supply*

•        loss of environmental indicators

**2**

**[5]**

11(a)     5

**1**

(b)    any **one** from:

*allow in either section*

•     more light

*allow more sun / sunnier*

•     warm(er) / hot

•     more water / lot of rain

**1**

increased / more photosynthesis

*allow in either section or more biomass / carbohydrate / named (made) allow enzymes / metabolism faster*

*do****not****allow food*

***NB****for****2****marks this must be linked to heat*

*to gain****2****marks more / increased must be mentioned at least once*

**1**

(c)     less pollution / named pollutant eg carbon dioxide / ‘fumes’ / emissions

*allow examples of effect of less pollution*

*eg less global warming / less acid rain*

*allow any relevant environmental effect*

*eg imported diseases*

**1**

less fuel used / less transport / named transport

*ignore ‘less distance’ / importing*

*allow ‘less distance travelled’ / ‘less travel’*

*allow smaller carbon footprint once only for either mark*

**1**

**[5]**

**Q12.**

(a)     less sweating so less water loss

**1**

(as) no / little water available in desert

**1**

(b)     (fat store) can be metabolised / respired to water

**1**

(little urine…) conserve water

**1**

(hard mouth) not damaged by spines on plants / on food

**or**

not damaged by hard / dry food

**1**

(c)     dromedary / *C.dromedarius*

**and** bactrian / *C. bactrianus*

*no mark for the names, but must be identified*

**because**

same genus

*ignore ‘both are Camelus’*

**1**

(d)     any **two** from:

•   the fossil record

•   oldest fossils in N. America

**or**

•   newer fossils in S. America / in Asia / in Africa

*allow numbers for ages (45 Mya* ***and*** *3 Mya / 6 Mya)*

•   chemical / DNA analysis of living species

*allow radioactive dating of fossils*

**2**

(e)     isolation of separate camel populations by sea

**or**

by mountains

**1**

habitat variation / described between populations

*allow examples – biotic (e.g. food / predators) or abiotic*

**1**

genetic variation / mutation in each population

**1**

45 million years is sufficient time to accumulate enough mutations

**1**

natural selection

**or**

better adapted survive to reproduce

**1**

pass on favourable allele(s)

*allow gene(s)*

**1**

**[14]**

**Q13.**

(a)     white blood cells have the same DNA / genes / chromosomes

**or**

have the gene for GH

*allow have all the genes*

*allow all body cells (except RBCs) have all of the genes*

**1**

(b)     enzyme has specifically-shaped active site

**1**

the 2 antibiotic resistance genes have different (sequence of) bases

**1**

only Tetracycline-resistance gene fits (active site of) enzyme

**or**

only Tetracycline-resistance gene is complementary to (active site of) enzyme

**1**

(c)

|  |  |
| --- | --- |
| **Ampicillin** | **Tetracycline** |
| ✔ |  |
|  |  |
| ✔ | ✔ |

***1*** *mark for each correct row*

*if no other mark, allow* ***1*** *mark for one correct column*

**1**

**1**

**1**

(d)     clone produced by asexual reproduction

*allow by ‘mitosis’*

**1**

all DNA / all genes are copied

*allow GH gene copied*

*allow plasmid copied*

**1**

every cell receives a copy

**or**

receives every gene

**or**

receives GH gene

**or**

receives plasmid

**or**

genetically-identical cells

**1**

**Q14.**

(a)     pupils dilated (at **B**)

*allow converse for* ***A***

**1**

in dim light / low light levels

**1**

because circular muscles (in iris) relax

**1**

(and) radial muscles contract

**1**

(b)     figure 2 shows myopia where light does not focus on the retina

*allow refraction*

**1**

in figure 3 the lens bends the light so that light focuses on the retina

**1**

**[6]**

**Q15.**

(a)     any **three** from:

•   a (chemical) messenger

**or**

an organic substance

*allow correct named example – e.g. protein / modified amino acid / catecholamine / steroid*

•   made by the endocrine system / an endocrine gland / endocrine organ

*allow made by / released from a (ductless) gland*

•   affects (a) specific / target organ(s) / tissue(s)

•   released into the blood

*allow carried by the blood*

**3**

(b)     insulin **and** glucagon

*both required for* ***1*** *mark correct spelling only for glucagon*

**1**

(c)     **Level 2 (3-4 marks):**

Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

**Level 1 (1-2 marks):**

Relevant points (reasons / causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.

No relevant content (0 marks)

**Indicative content**

•   (0−0.5 h: ) glucose from meal enters blood

**or**

increase in blood glucose (to 6.5 mmol / dm3)

•   glucose detected by pancreas

•   pancreas secretes insulin

•   (insulin causes) glucose to move (out of blood) into cells / liver

•   liver converts glucose to glycogen

•   causing a fall in blood glucose (after 0.5h)

•   low blood glucose (< 5.0 mmol / dm3) detected by pancreas

•   pancreas releases glucagon

•   liver converts glycogen to glucose (which enters blood)

•   blood glucose rises (after 1 h **or** to 5.2 mmol / dm 3 (at 1.5 h))

16. Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also apply a ‘best-fit’ approach to the marking.

**0 marks**

No relevant content.

**Level 1 (1 – 2 marks)**

There is a description of thermoregulation **or** at least one correct mechanism (skin, sweat glands or muscles) but roles may be confused.

**Level 2 (3 – 4 marks)**

There is a description of thermoregulation **or** some correct mechanisms (sweating, shivering, blood flow in the skin).

**Level 3 (5 – 6 marks)**

There is a clear description of thermoregulation by TC or skin **and** some correct control mechanisms.

**examples of biology points made in the response:**

*full marks may be awarded for detailed description of what happens if the core temperature is either too high or too low*

•        temperature receptors in TC

•        the TC detects (core) body / blood temperature

•        temperature receptors in the skin send impulses to the TC, giving information about skin temperature

•        if the core body temperature is too high: blood vessels / arterioles supplying the skin capillaries dilate / vasodilation

***do not*** *accept refs to veins instead of arterioles or answers that imply blood vessels have moved up / down through the skin.*

•        so that more blood flows (through the skin) and more heat is lost

•        sweat glands release more sweat to cool the body

•        by evaporation

•        if the core body temperature is too low: blood vessels supplying the skin capillaries constrict

•        to reduce the flow of blood (through the skin) and less heat is lost

*allow idea of blood diverted to vital organs in extreme cold*

•        muscles may shiver to release (heat) energy

•        from respiration, some of which is lost as heat

**[6]**

17 (a)     if too high insulin released from pancreas

**1**

so glucose is moved into cells

*allow glucose is stored*

**1**

if too low, glucagon is released (from pancreas)

**1**

causes glycogen to be converted to glucose and released into the blood

**1**

(b)     type 1 not enough / no insulin produced

**1**

whereas type 2 cells do not respond to insulin

**1**

type 1 is treated with injections of insulin

**1**

whereas type 2 is treated with diet and exercise

**or**

loss of weight

**or**

drugs

**1**

(c)     (3.45 × 106) + (5.49 × 105) = 3.999 × 106

**or**

3 450 000 + 549 000 = 3 999 000

*allow 3.999 × 106* ***or*** *3 999 000 with no working shown for* ***1*** *mark*

**1**

****

**or**

****

= 6.15

*allow 6.15 with no working shown for* ***2*** *marks*

*allow for* ***1*** *mark for a calculation using either:*

**

***or***

******

***or***

******

***or***

******

**1**

6.2

*allow 6.2 with no working shown for* ***3*** *marks*

**1**

*allow ecf from second step correctly rounded for* ***1*** *mark*

(d)     could be other reasons for glucose in urine

**or**

blood test gives current / immediate result, urine levels might be several hours old

**or**

not always glucose in urine

**1**

(e)     results not affected by glucose from food

**or**

8 hours is sufficient time for insulin to have acted on any glucose from food eaten

**or**

so that there is a low starting point to show the effect

**1**

(f)     (patient **A**)

*no mark for identifying* ***A***

glucose level much higher (than **B**)

**1**

and remains high / does not fall

**1**

**18.**

(a)     (molecules are) (too) large

**1**

cannot pass through (filtration) membrane / (holes in) filter

allow ‘is not filtered out of the blood’

**1**

(b)     glucose is reabsorbed

*ignore ‘is absorbed’ unless qualified by ‘into blood’*

**1**

all of it

**1**

(c)     (molecules / ions) small so pass through filter

**or**

not all is reabsorbed

*allow the body needs to maintain the right balance of ions and urea in the blood*

*ignore ‘are filtered’ unqualified*

**1**

more water reabsorbed on a hot day

**1**

due to more water lost in sweat

*‘more’ needed at least once to gain both marks*

**1**

(d)     **Level 3 (5-6 marks):**

A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

**Level 2 (3-4 marks):**

A judgement, supported by some relevant reasons is given.

**Level 1 (1-2 marks):**

Relevant points are made. If there is a judgement, this is asserted, but not logically linked to the points made.

No relevant content (0 marks)

**Indicative content**

**pro transplant:**

•   (dialysis requires repeated treatments to prevent) build-up of toxins

**or**

to prevent raised blood pressure between sessions

•   inconvenience of dialysis, e.g. long sessions of immobility **or** repeated hospital visits

•   (dialysis requires restricted diet) to prevent build-up of urea / ions

•   there is a greater risk of infection with dialysis e.g. repeated puncturing of skin **or** use of non-sterile equipment allows entry of microorganisms

•   there is a risk of blood clots with dialysis

•   dialysis more expensive in the long term / 2+ years

**or**

examples given e.g. 2 yrs dialysis = £60 000 compared with 2 yrs after transplant

= (£51 000 + £5 000) = £56 000

•   transplant is a long term treatment **or** may remain healthy for many years

**con transplant:**

•   shortage of kidney donors leading to long waiting time

•   requires death of another person **or** live donation leaving a person with just one kidney

•   exploitation of poor people for donor kidneys (paying for organs)

•   need to match tissue type

•   rejection – role of wbcs / lymphocytes

•   need immunosuppressant drugs – susceptibility to infection

•   dangers of surgery – physical damage / infection / brain damage from anaesthetic

•   high initial cost – limited funding (either personal or NHS / CCG)

**[13]**

**Q19.**

(a)     Too much thyroxine is released into the blood

**1**

which raises BMR

**1**

causing increase in formation of glycogen / lipids / proteins

**or**

increase in rate of respiration

**or**

increase in breakdown of excess proteins

**1**

(b)     FSH causes eggs to mature and stimulate ovaries to produce oestrogen

**1**

LH stimulates the egg to be released

**1**

(c)     (missing a dose causes a) dip / drop in progesterone levels

**1**

(therefore) FSH is not inhibited anymore

**1**

(therefore) LH is not inhibited anymore

**1**

(and consequently) an egg is matured and released

*allow (and consequently) an egg is available to be fertilised*

**1**

**20.**

(a)     any **two** from:

•        drop the ruler from the same height each time

•        let the ruler drop without using any force

•        same type / weight of ruler

•        thumb should be same distance from the ruler each time at the start

•        use the same hand to catch the ruler each time

•        carry out the experiment with the lower arm resting in the same way on the table

*allow description of holding bottom edge of ruler opposite the catcher’s thumb*

**2**

(b)     117

**1**

(c)    

**1**

0.1539

*allow 01539 with no working shown for* ***2*** *marks*

**1**

0.154

*allow 0.154 with no working shown for* ***3*** *marks*

**1**

*allow ecf as appropriate*

(d)     no indication beforehand when the colour will change

**or**

you might be able to tell when the person is about to drop the ruler

**1**

measurement of time is more precise (than reading from a ruler)

**or**

resolution (of computer timer) is higher

**1**

(e)     cerebral cortex

*allow cerebrum*

**1**

*ignore identified lobes*

(f)     cerebellum

**1**

**[10]**

**21.**

(a)     measure the length / area of the field

**1**

(b)     use (a) random number(s) (generator)

**or**

use coordinates method explained

**1**

(c)     compare their results with another student’s results

**1**

place more quadrats

**1**

(d)     0.25 × 5 = 1.25

**1**

500 / 1.25 = 400

**1**

(40 × 400 =) 16 000

*allow 16 000 with no working shown for* ***3*** *marks*

**1**

(e)     11

**1**

(f)     (quadrat) 5

*both quadrat number and correct reason must be given for* ***1*** *mark*

**1**

very few or only 2 growing (here)

**[9]**

**22.**

(a)     (i)      gravitropism / geotropism

*not ‘…trophism’*

*ignore ‘positive’ or ‘negative’*

**1**

(ii)     any **two** from:

•        anchorage

•        takes in water

•        takes in ions / minerals / salts / correct named example

*allow nutrients*

*do not accept food*

**2**

(iii)    auxin

**1**

(b)     Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response.  
Examiners should also refer to the information on page 5, and apply a best-fit approach to the marking.

**0 marks**No relevant content.

**Level 1 (1 – 2 marks)**There is a basic description of a simple method involving seedlings and light.

**Level 2 (3 – 4 marks)**There is a description of a method involving seedlings in 1-sided light, and a control, with a correct observation.

**Level 3 (5 – 6 marks)**There is a description of a method involving groups of seedlings in 1-sided light, and in control conditions. It includes some correct measurements or observations.

**examples of Biology points made in the response:**

•        use of scissors to cut tips from some shoots / cut hole in box

•        use of forceps for handling seedlings

•        use of ruler to measure lengths of shoots at start and at end

•        other factors controlled – eg temperature / water

•        use of lamp + box re. one-sided lighting

•        repetitions – each treatment ≥ 3 times

•        control in total darkness / all-round light

•        time taken = several hours to a few days

•        sample results: tip exposed to 1-sided light→bend to light, tip removed→vertical, control→vertical

**6**

**[10]**

**23.**

(a)     any **two** from:

•        (microorganisms) produce enzyme / amylase / carbohydrase

•        to break down / digest starch / carbohydrate (in potato)

•        into sugars / glucose

•        which diffuse back into microorganism

*accept decomposer / fungus / bacterium / cell*

**2**

(b)     (i)      (microorganisms)

*(accept bacteria / fungi / decomposers)*

digest the potato (starch)

*allow breakdown / feed on / consume / decompose*

*do* ***not*** *accept eat*

**1**

use starch / glucose / carbohydrate for respiration

**1**

which releases carbon dioxide / CO2 (into the atmosphere)

**1**

(ii)     up to 40 °C the potato took less time to decay / the rate is faster

*ignore yes / no*

*answers must be comparative*

**1**

but at 50 °C it took longer / the rate is slower

**or**

at 50 °C / a high(er) temperature the enzymes have denatured

*accept at a higher temperature / above 40 °C*

**1**