

AQA, OCR, Edexcel

A Level

A Level Biology

**DNA, Translation, Transcription
and Classification Answers**

Name:

M

M

E

Mathsmadeeasy.co.uk

Total Marks:

M1.(a) (i) Repeating units / nucleotides / monomer / molecules;

Allow more than one, but reject two

1

(ii) 1. C = hydrogen bonds;

2. D = deoxyribose;

Ignore sugar

3. E = phosphate;

Ignore phosphorus, Ignore molecule

3

(iii)

Name of base	Percentage
Thymine	34
Cytosine / Guanine	16
Adenine	34
Cytosine / Guanine	16

Spelling must be correct to gain MP1

First mark = names correct

Second mark = % correct, with adenine as 34%

2

(b) (i) 153;

1

(ii) Some regions of the gene are non-coding / introns / start / stop code / triplet / there are two DNA strands;

Allow addition mutation

Ignore unqualified reference to mutation

Accept reference to introns and exons if given together

Ignore 'junk' DNA / multiple repeats

1 [8]

M2.(a) Translation.

1

(b) Transfer RNA / tRNA.

1

(c) TAC;

UAC.

2

(d) Have different R group.

Accept in diagram

1

- (e) 1. Substitution would result in CCA / CCC / CCU;
2. (All) code for same amino acid / proline;
3. Deletion would cause frame shift / change in all following codons / change next codon from UAC to ACC.

3

[8]

- M3.** (a) (i) Phosphate and ribose;
Accept in either order. Both correct for one mark.

For phosphate accept PO_4 / Pi / \textcircled{P} but not P.

Do not accept phosphorus.

Ignore references to pentose / sugar.

1

- (ii) TAGGCA;

1

- (b) (i) Does not contain hydrogen bonds / base pairs / contains codons / does not contain anticodon / straight / not folded / no amino acid binding site / longer;

Assume that "it" refers to mRNA.

Do not accept double stranded.

1

- (ii) (pre-mRNA) contains introns / mRNA contains only exons;

Assume that "it" refers to pre-mRNA.

Accept non-coding as equivalent to intron.

1

- (c) (i)

Part of chromosome	U
Middle	18
End	21

One mark for both figures correct

1

- (ii) 1. Have different (base) sequences / combinations of (bases);
2. (Pre-mRNA) transcribed from different DNA / codes for different proteins;

2

[7]

Visit <http://www.mathsmadeeasy.co.uk/> for more fantastic resources.

- M4.(a)**
1. Helicase;
 2. Breaks hydrogen bonds;
 3. Only one DNA strand acts as template;
 4. RNA nucleotides attracted to exposed bases;
 5. (Attraction) according to base pairing rule;
 6. RNA polymerase joins (RNA) nucleotides together;
 7. Pre-mRNA spliced to remove introns.

6 max

- M5.(a)** (i) (In all organisms / DNA,) the same triplet codes for the same amino acid;

Accept codon / same three bases / nucleotides

Accept plurals if both triplets and amino acids

Reject triplets code for an amino acid

Reject reference to producing amino acid

1

- (ii) 64;

1

- (b) Splicing;

Ignore deletion references

Accept RNA splicing

1

- (c) (i) 1. (Mutation) changes triplets / codons after that point / causes frame shift;

Accept changes splicing site

Ignore changes in sequence of nucleotides / bases

2. Changes amino acid sequence (after this) / codes for different amino acids (after this);

Accept changes primary structure

Reject changes amino acid formed / one amino acid changed

3. Affects hydrogen / ionic / sulfur bond (not peptide bond);

4. Changes tertiary structure of protein (so non-functional);

Neutral 3-D structure

3 max

- (ii) 1. Intron non-coding (DNA) / only exons coding;

*Context is the **intron***

Do not mix and match from alternatives

Neutral references to introns removed during splicing

1.and 2. Ignore ref. to code degenerate and get same / different amino acid in sequence

Visit <http://www.mathsmadeeasy.co.uk/> for more fantastic resources.

2. (So) not translated / no change in mRNA produced / no effect (on protein) / no effect on amino acid sequence;
Accept does not code for amino acids

OR

3. Prevents / changes splicing;
4. (So) faulty mRNA formed;
Accept exons not joined together / introns not removed
5. Get different amino acid sequence;
2 max [8]

- M6.(a)**
1. Chromosome is formed of two chromatids;
 2. (Because) DNA replication (has occurred);
 3. (Sister) chromatids held together by centromere.
3

- (b)
1. Chromosomes in homologous pair;
 2. One of each into daughter cells / haploid number.
2

- (c) Separation of (sister) chromatids / division of centromere.
1

- (d)
1. Independent segregation (of homologous chromosomes);
Accept random assortment
 2. Crossing over / formation of chiasmata.
2 [8]

- M7.**
- (a) (i) 22;
1

- (ii)
1. Odd number of chromosomes / 33 chromosomes (in leaf cell);
 2. Chromosomes cannot pair / cannot undergo meiosis / would result in half chromosomes / cannot form haploid cells;
2

- (b) (i) Fast growth / produces crop fast / produces large crop;
Do not insist on relative statement.
Accept similar terms for fast. E.g. "better" growth
Do not accept unqualified references to profit.
1

- (ii) Leaves less likely to break / higher breaking strength;
1

- (c) Low genetic diversity because they are produced by mitosis;

Will all have the same DNA / genes / alleles / will be genetically

Visit <http://www.mathsmadeeasy.co.uk/> for more fantastic resources.

identical / will be clones;

OR

Low genetic diversity because they are not produced by meiosis;

No crossing over / independent segregation / will not be genetically different;

*Independent segregation is the specification term.
Accept other such as random assortment.*

2 [7]

- M8.(a)** (i) 1. Groups within groups;
1. accept idea of larger groups at the top / smaller groups at the bottom
2. No overlap (between groups);
2
- (ii) (Grouped according to) evolutionary links / history / relationships / common ancestry;
Neutral: closely related
Neutral: genetically similar
1
- (b) (i) 1. (Only) one amino acid different / least differences / similar amino acid sequence / similar primary structure;
2. (So) similar DNA sequence / base sequence;
2
- (ii) 1. Compared with humans / not compared with each other;
Accept: degenerate code / more than one triplet (codes) for an amino acid
2. Differences may be at different positions / different amino acids affected / does not show where the differences are (in the sequence);
- 1 max
- (iii) 1. All organisms respire / have cytochrome c;
Accept: converse arguments for haemoglobin
1. Accept 'more' instead of 'all'
1. Accept 'animals' instead of organisms ?
2. (Cytochrome c structure) is more conserved / less varied (between organisms);
2. Neutral: cytochrome c is conserved 1
max [7]

M9. (a) Shape

1. Different penicillin has different shape / structure / enzyme /

active site has specific shape / structure;

Not different

Binding

2. No longer fits / binds to active site / not complementary to active site / does not form E-S complex;

Consequence

3. (Different) penicillin not broken down; 3

- (b) (i) 1. Kills pathogenic / harmful bacteria / pathogens;
2. Disease less likely / improves health / animals healthier / reduces spread of infection;
3. Faster growth / more productive animals / more food converted to meat / greater survival / lower vet's bills / increased yield / less energy (for "fighting infection");

Principles:

Action of antibiotic. Do not accept stops all disease

Action on health

Effect on production

max

2

- (ii) 1. (Adding antibiotics) selects in favour of antibiotic resistance / resistant bacteria more likely to survive;
2. Increase in numbers / higher proportion of resistant bacteria;
- Penalise immune only on the first occasion it occurs in this part of the question.*

2 7]

- M10.(a)** 1. Recognise / identify / attract same species;
- Ignore: references to letting them produce fertile offspring*
2. Stimulates / synchronises mating / production / release of gametes;
3. Recognition / attraction of mate / opposite sex;
- Accept finding a mate*
- Accept: gender*
4. Indication of (sexual) maturity / fertility / receptivity / readiness to mate;
5. Formation of a pair bond / bond between two organisms (to have / raise young).

3 max

- (b) 1. Use a (real) male (with intact wings / no wing removed);

Mark ignoring reference to birds / or other types of animals

Accept: use a real cricket, since only males sing

2. Determine (percentage) response (of females compared with L).

Accept: compare results with L

2

- (c) 1. Lowest / only 30% courtship with no song / K / (or) courtship still occurred when no song played / K;

Note: throughout, for courtship accept response / stimulation / reaction

Neutral: references to methodology

Answer must make clear there is no song / version

K

2. Reduced courtship when no ticks / M / there is some courtship when no ticks / M;

3. Reduced courtship when no chirps / N / there is some courtship when no chirps / N;

Accept: use of figures from the table in an explanation

4. (So) courtship must involve a visual stimulus / other factor involved;

5. Chirps more important as lowest courtship when none / N / ticks less important as similar courtship when changed / M;

Must make comparison to gain mark

6. Data only show presence and absence of chirps / 0 and 7 chirps.

Note: 'courtship still occurred when no sound played so a visual stimulus / other factor / something else (e.g. pheromone?) must be involved'

= 2 marks

4 max

[9]

- M11.(a)** (i) 1. Groups within groups;

*Accept: idea of larger groups at the top **or** smaller groups at the bottom*

2. No overlap (between groups);

2

- (ii) **3;**

1

- (iii) Chordata;

Accept: if phonetically correct eg 'Cordata'

1

- (b) (i) 1. (To provide) genetic variation;
Genetic variation must be directly stated and not implied
2. (Allows) different combinations of maternal and paternal chromosomes / alleles;
Accept: any allele of one gene can combine with any allele of another gene
- 2
- (ii) 1. (Zedonk has) 47 / odd / uneven number of chromosomes;
Accept: diploid number would be odd
Reject: if wrong number of chromosomes is given
2. Chromosomes cannot pair / are not homologous / chromosome number cannot be halved / meiosis cannot occur / sex cells / haploid cells are not produced;
Accept: cannot have half a chromosome
Q *Reject: meiosis cannot occur **in** sex cells*
- 2 [8]

M12.(a) (Different) form / type / version of a gene / different base sequence of a gene; 1

(b) Two / sister chromatids joined by a centromere;

Due to DNA replication; 2

(c) (i) Crossing over; 1

Exchange (of alleles) between chromatids / chromosomes;
Negate first marking point for answers which refer to independent segregation.

Chiasma / chiasmata = first marking point

1

(ii) Is infrequent / rare;
References to it being 'random', 'occurs by chance' or 'doesn't always occur' should not be credited without a clear idea that it is rare or infrequent.

1

(d) (i) Three chromosomes shown; 1

One from each homologous pair;
For first mark point allow drawings showing three chromosomes as single or double structures.

1

(ii) 8; 1
[9]

M13.(a) (i) Reliable / representative / for statistical tests;

Accept: identify anomalies

Neutral: accurate / valid / bias

1

(ii) 1. Find coordinates (on a grid) / split area into squares / number the sites;

1. Ignore references to tape measures, metre rulers etc

2. Method of generating / finding random numbers eg calculator / computer / random number generator / random numbers table;

2. Accept: numbers out of a hat / use of dice

2

(iii) 1. Breeding (of lizards);

Neutral: weather / climate / hurricanes / hibernation / migration / emigration / immigration

2. Food source / prey;

3. Predator;

4. Variation in malarial infection;

5. Temperature variation;

6. Availability of water eg drought / 'rainy season'

2 max

(b) 1. Number in sample varies;

2. Allow a (valid) comparison;

2

(c) 1. (Overall) positive correlation (for either / both species);

Neutral: only one study / no repeats

2. Reference to (site) 5 / 300 metres;

3. Limited results for *A. watsi* / small sample / number / percentage infected for *A. watsi*.

2 max

(d) (i) 1. Fewer *A. watsi* infected / more *A. gingivinus* infected;

2. Higher number of *A. watsi* present when higher percentage / number of *A. gingivinus* infected / no *A. watsi*

present when *A.gingivinus* has zero infection;

2

- (ii) 1. Reduced immunity / increased susceptibility to disease;
1. Accept: idea that energy / resources are used to combat malaria
2. Reduced oxygen transport / uptake / respiration / reduced activity / movement;
2
- (iii) 1. There is a probability of less than 1% / 0.01;
1. Reject: probability is / equal to 1% / 0.01;
1. Reject 0.01% / 5% / 0.05 / 0.05%
2. That result(s) / correlation / it is due to chance;
2. Allow correct interpretation using above (incorrect) figures eg there is a probability of less than 5% that the results are due to chance =1 mark

OR

3. There is a probability of more than 99% / 0.99;
4. That result(s) / correlation / it is not due to chance;
Note: there is a probability of more than 5% that the results are due to chance =0 marks
3. Reject: probability is / equal to 99% / 0.99;
3. Reject 0.99% / 95% / 0.95 / 0.95%
4. Allow correct interpretation of above figures ie 0.99% / 95% / 0.95 / 0.95% but reject if less than
2 [15]

- M14.** (a) Most closely (related) to chimpanzee / most recent common ancestor;

1

Least (related) to dogfish / least recent common ancestor;

Allow 'chicken is second' to chimpanzee as equivalent to second mark point.

Allow answers which compare similarity in DNA / genetic material.

Marks should not be awarded for answers which only compare amino acid sequences without any indication of relationships.

Allow 'monkey' for chimpanzee and 'fish' for dogfish

1

- (b) Is present in all eukaryotes;

1

- (c) Reference to base triplet / triplet code / more bases than amino acids / longer base sequence than amino acid sequence;

Introns / non-coding DNA; / same amino acid may be coded for / DNA code is degenerate;

Reject different amino acids are formed / produced.

Ignore reference to codon.

2

[5]

M15. (a) 1. Occurs in an unchanging environment;

1

+

2. Selection against extremes / selection for the mean / mean / median / mode unaltered

3. Range / S.D is reduced

4. Increasing proportion of populations becomes well adapted to environment; 4

(b) 1. All plants are acyanogenic below -4°C and (most) cyanogenic above $+10^{\circ}\text{C}$;

2. Cyanogenic plants' cells freeze below -4° ;

3. Releasing cyanide (into their own tissues) / damaging / killing plants / disrupting metabolism;

4. Selective advantage not to produce cyanide at -4°C ;

5. Slugs present at higher temperatures / not usually present / inactive at lower temperatures and cyanide production kills / deters slugs; 5 [10]

M16. (a) Recognition of same species;

Stimulates release of gametes;

Recognition of mate / opposite gender;

Indication of sexual maturity / fertility;

2 max

(b) (i) Internal fertilisation / fertilisation occurs in pouch / limited area;

Q The term fertilisation is not required in the answer but must be implied.

1

(ii) Protection from predators (developing in pouch);

1

(c) (i) Less stress caused to seahorse / quicker / more accurate method / body is curved / head is linear;

Q Do not accept "easier" unless qualified.

1

(ii) Head length proportional to body length / or described;

1

(d) Positive correlation between head / body lengths of male and female / female and male with similar head / body lengths pair together;

1

Visit <http://www.mathsmadeeasy.co.uk/> for more fantastic resources.

(e) Use line of best fit;

And extrapolate / extend line as required;

2

(f) (Compare) DNA;

Sequence of bases / nucleotides;

Compare same / named protein;

Sequence of amino acids / primary structure;

Immunological evidence – not a mark

Inject (seahorse) protein / serum into animal;

(Obtain) antibodies / serum;

Add protein / serum / plasma from other (seahorse) species;

Amount of precipitate indicates relationship;

Q *The marks awarded for reference to DNA and sequence of bases / nucleotides must be in a different context to DNA hybridisation.*

6 max

[15]

M17.(a) 1. Females are (generally) longer / larger / bigger / up to 115(mm) / males are (generally) shorter / smaller / up to 100(mm);

Ignore: tall

Accept: females have a larger / 90 modal / peak / most common value and males have a smaller / 80 modal / peak / most common value

Accept mean length of females greater / mean length of males shorter

Reject: use of mean in relation to 80 mm or 90 mm

Reject: Most of the females are 90 mm long / most of the males are 80 mm long

2. Females show a greater range / variation / males show a narrower range / variation.

Accept: correct use of figures from the graph: the range of males is 50 to 100 and of females is 50 to 115 / the spread is 50 for males and 65 for females

2

(b) (i) **2.6 to 2.7 = 2 marks;**
Incorrect answer but evidence of a numerator of **24180 OR**
156 × 155 or denominator of **9014 = 1 mark;**

2

(ii) (Fewer plant species) – no mark

1. (So) few(er) habitats / niches;

Ignore habitat size

Q Neutral: fewer homes

2. (So) lower diversity of insects / fewer insect species / fewer insect types;

Q Neutral: fewer insects

Accept less variety of insects

3. (So) fewer food sources / less variety of food.

Q Neutral: less food

Ignore references to pesticides, farmers' actions, competition between lizards and evolution

3 [7]

M18. (a) (i) EITHER: Correct answer: 3.45 / 3.44 / 3.4 = 2 marks

OR: Understanding of $\sum n(n-1)$ / use of

$$134 / (2 + 90 + 12 + 30)$$

+ wrong answer

= 1 mark

max 2

- (ii) Takes account of number of individuals / abundance / population size (as well as number of species);

1

- (b) The species at A / *F. spiralis* loses less water / loses water less rapidly / loses less mass;

The species at A / *F. spiralis* better adapted to / can survive where exposed for longer / to drier conditions;

The species at A / *F. spiralis* avoids competition For named aspect – e.g. light / substratum / space / CO₂;

ACCEPT converse argument re. F. serratus

3 [6]

M19.(a) Species richness measures only number of (different) species / does not measure number of individuals. 1

- (b) Trees vary in height. 1

- (c) 1. Index for canopy is 3.73;
2. Index for understorey is 3.30;
3. Index in canopy is 1.13 times bigger;

If either or both indices incorrect, allow correct calculation from student's values.

3

- (d) 1. For *Zaretis itys*, difference in distribution is probably due to chance / probability of being due to chance is more than 5%;
2. For all species other than *Zaretis itys*, difference in distribution is (highly) unlikely to be due to chance;

Visit <http://www.mathsmadeeasy.co.uk/> for more fantastic resources.

3. Because $P < 0.001$ which is highly significant / is much lower than 5%.3 [8]

- M20.**(a) PKNJ. 1
- (b) *Lutra lutra*. 1
- (c) Bone / skin / preserved remains / museums. 1
- (d) 1. (Hunting) reduced population size(s), so (much) only few alleles left;
Accept bottleneck
2. Otters today from one / few surviving population(s);
Accept founder effect
3. Inbreeding.
Allow any two 2 max
- (e) 1. Population might have been very small / genetic bottleneck;
2. Population might have started with small number of individuals / by one pregnant female / founder effect;
3. Inbreeding.
Allow any two 2 max

[7]