Exampro A-level Biology (7401/7402)

Name:

Class:

Genetic diversity MS

Author:

Date:

Time: **101**

Marks: **85**

Comments:

M1.(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]

M2.(a) (i) Centromere;

Accept: if phonetically correct

Reject: centriole

1

(ii) 1. Holds chromatids together;

2. Attaches (chromatids) to spindle;

3. (Allows) chromatids to be separated / move to (opposite) poles / (centromere) divides / splits at metaphase / anaphase;

*3. **Q** Neutral: chromosomes or chromatids split / halved / divided*

3. Reject: reference to homologous chromosomes being separated

Accept 'chromosomes' instead of 'chromatids'

*Ignore incorrect names for **X***

2 max

(iii) (Homologous chromosomes) carry different alleles;

Accept alternative descriptions for 'alleles' eg different forms of a gene / different base sequences

Neutral: reference to maternal and paternal chromosomes

1

(b) (i) (In **Figure 2**)

1. Chromatids have separated (during anaphase);

*1. **Q** Neutral: split / halved / divided*

1. Reject: reference to homologous chromosomes being separated

or

2. Chromatids have not replicated;

1. & 2. Accept 'chromosomes' instead of 'chromatids'

or

3. Chromosomes formed from only one chromatid;

*Accept converse arguments for **Figure 1***

Ignore references to the cell not dividing as in the question stem

Ignore: named phases

1 max

(ii) 1. Three chromosomes;

Ignore shading

2. One from each homologous pair;

Only one mark for three chromosomes shown as pairs of chromatids

2

(iii) Crossing over / alleles exchanged between chromosomes or chromatids / chiasmata formation / genetic recombination;

Accept: description of crossing over eg sections of chromatids break and rejoin

Neutral: random fertilisation

Reject: reference to sister chromatids

***Q** Neutral: genes exchanged*

Neutral: mutation

1

[8]

M3. (a) (meiosis) anaphase I;
chromosomes are moving apart;
chromosomes still double structures;

3

(b) chromosomes in each (homologous) pair twist around each other;
chromatids break and rejoin to chromatid on sister chromosome;
(accept points from a suitable diagram)

2

[5]

M4. (a)

1

(b) bivalent;

1

(c) (i) Ab, aB;

(ii) AB, ab;

2

(d) mutation;
different / new allele formed / genes deleted or duplicated / sequence of genes changed *(reject genetic information)*;
random fusion of gametes / fertilisation;
new combination of alleles;
independent assortment (of chromosomes) *(accept random)*;
shuffling of maternal and paternal chromosomes / new combination of alleles;
(ignore references to stages of meiosis)
any 2 × 2

4 max

[8]

M5. (a) (So results) can be compared / so measurement is the same each time / because eye is not perfectly round / uniform;

Accept eye opens to different amounts

1

(b) (i) 1. Eye (diameter) is smaller and antennae longer;

2. Antennae detecting touch;

3. Data only refers to shrimps / data may not apply to all animals / only in one area;

The principle here is that candidate has recognised that both features confirm suggestion. Exact wording does not matter.

2 max

(ii) 1. Standard deviation gives a measure of spread / variation;

2. More standard deviations overlap, the less likely it is that differences are real / significant / the more likely they are caused by chance;

Do not accept range

Accept converse.

Although we are looking for the idea of significance, we cannot require this term.

2

(c) (i) Qualitative statement about

difference in size /

difference in variation /

overlap in size;

Quantitative statement about

difference in size /

difference in variation /

overlap in size;

Supported by relevant two sets of figures from graph;;

Note simplistic answer involving a quantitative statement gains 1 mark.

More specific answer involving quantitative information gains 2 marks.

2

(ii) (No) for same body length, antenna are longer / antenna are shorter / some with longer body have short antennae / some with shorter body length have longer antennae;

OR

(Yes) positive correlation in open / in cave;

Habitat not critical as a term.

Must refer to idea of same habitat

Accept description

1

(d) More alleles of each gene / shrimps in open have all the alleles;

Candidates are required to use the information from the table. Must therefore refer to alleles.

1

(e) 1. A small number of shrimps were / went into the cave;

2. All / high proportion of shrimps had allele L;

3. Cave population descended from these / these reproduce;

3

(f) (i) 1. Cross shrimps from two sites / watch courtship;

2. Breed young together / observe mating;

3. Allow 1 mark for any method of improving quality of results e.g. carry out reciprocal crosses / large number of crosses / isolate beforehand;

Other valid equivalent suggestions should be accepted.

(ii) If same species the shrimps would breed, producing fertile young / courtship species specific;

Accept any form of evidence – mating / laying eggs / giving birth to young.

3

[15]

M6. (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 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]

M7. (a) (i) Continuous variation – range of values / not discrete categories / many categories / no gaps;

1

(ii) Crossing over / chiasmata;
Random segregation / independent assortment;
In meiosis I and meiosis II;

max 2

(b) Range influenced by single 'outlier' (*accept anomaly*) / converse for S.D.;

S.D. shows dispersion / spread about mean / range only shows highest and lowest values / extremes;
Or
S.D. allows statistical use;
Tests whether or not differences are significant;

max 2

[4]

M8. (a) 1. Chromosomes shorten / thicken / condense;
2. Chromosomes associate in homologous / (described) pairs / formation of bivalents / tetrads;
3. Crossing-over / chiasma formation;
4. Join to spindle (fibres) / moved by spindle;(*)
5. (At) equator / middle of cell;(*)
6. (join via) centromere / kinetochore;(*)
7. (Homologous) chromosomes move to opposite poles / chromosomes separate / move apart; (*ALLOW* 'are pulled apart')
8. (Pairs of) chromatids separated in 2nd division;

(*) OR " independent assortment"
unqualified = 1 mark

max 6

(b) 1. Crossing-over; [*IGNORE* any wrong ref. to timing]
2. Independent / random assortment / orientation / segregation of (homologous) chromosomes in meiosis I;
3. Independent / random assortment / orientation / segregation of chromatids in meiosis II;

\+ Any **three** from:
4. Different adaptations / some better adapted;
5. Some survive / example described;
6. To reproduce;
7. Pass on gene / allele;
8. Allows for changing environment / different environment / example described;

max 5

(c) (i) 21;

1

(ii) 1. *T. aestivum* has 2 copies of each type of chromosome / is diploid;
2. *T. aestivum's* chromosomes can form bivalents / can assort in meiosis / can produce haploid gametes;
3. *T. aestivum's* gametes receive a copy of every chromosome / receive all the genetic information;

ACCEPT converse argument for hybrid plants

3

[15]

M9.(a) 1. Reduction in ATP production by aerobic respiration;

2. Less force generated because fewer actin and myosin interactions in muscle;

3. Fatigue caused by lactate from anaerobic respiration;

3

(b) Couple **A**,

1. Mutation in mitochondrial DNA / DNA of mitochondrion affected;

2. All children got affected mitochondria from mother;

3. (Probably mutation) during formation of mother's ovary / eggs;

Couple **B**,

4. Mutation in nuclear gene / DNA in nucleus affected;

5. Parents heterozygous;

6. Expect 1 in 4 homozygous affected;

4 max

(c) 1. Change to tRNA leads to wrong amino acid being incorporated into protein;

2. Tertiary structure (of protein) changed;

3. Protein required for oxidative phosphorylation / the Krebs cycle, so less / no ATP made;

3

(d) 1. Mitochondria / aerobic respiration not producing much / any ATP;

2. (With MD) increased use of ATP supplied by increase in anaerobic respiration;

3. More lactate produced and leaves muscle by (facilitated) diffusion;

3

(e) 1. Enough DNA using PCR;

2. Compare DNA sequence with ‘normal’ DNA;

2

[15]