

QUESTIONSHEET 1

- (a) (i) a population of similar organisms that are capable of interbreeding to form fertile offspring;
they are reproductively isolated from other such populations/cannot interbreed with other species to form fertile offspring; **2**
- (ii) an obstacle to interbreeding;
thus limiting gene flow between parts of the gene pool;
thus enabling divergence; **max 2**
- (b) (i) Allopatric: speciation due to populations occupying different geographical areas;
thus there is no gene flow between the populations;
- Sympatric: speciation where the populations occupy the same geographical locality;
but gene flow is restricted between the populations/demes; **4**
- (ii) Prezygotic: prevents fertilisation and the formation of zygotes;
- Any two examples:
geographical isolation/
seasonal/mature at different times/
ecological/live in different habitats but in same region/
behavioural/incompatible mating rituals/incompatibility/cannot fertilise due to physiological incompatibility;;
- Postzygotic: fertilisation can occur but hybrids are either not formed or are sterile; **4**
- TOTAL 12**

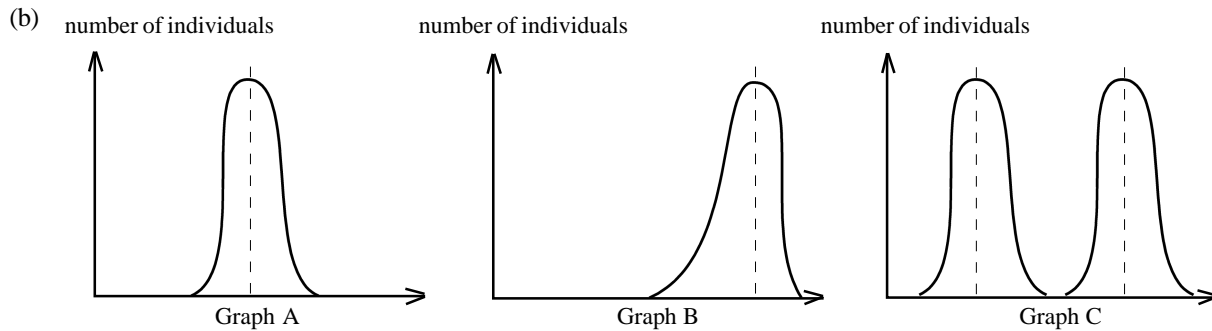
QUESTIONSHEET 2

- (a) prolific breeding/rapid reproduction rate/quick maturing/huge reproductive capacity;
abundant food supply enabling rapid growth/little or no competition for food;
no/few predators to reduce numbers;
could burrow under fences; **max 2**
- (b) no natural resistance/immunity to the virus;
rabbit population was dense/animals lived close together in burrows;
thus supported a huge flea population/fleas could easily jump from rabbit to rabbit;
thus the virus was transmitted very easily from rabbit to rabbit; **max 2**
- (c) a few rabbits developed resistance/immunity to the virus;
possibly as a result of gene mutation;
these rabbits survived and bred;
passing on the resistance/mutant gene to their offspring;
these also developed immunity to the virus (before it caused symptoms/killed them);
thus resistant rabbits were selected and non-resistant rabbits died; **max 4**
- (d) not all rabbits inherit the resistance gene and so some succumb to the virus;
the virus may have mutated changing its infectivity/pathogenicity; **2**
- TOTAL 10**

QUESTIONSHEET 3

(a) A = stabilising; B = directional; C = disruptive;

3



3 correct graphs;;; 3 correct means;;;

6

(c) artificial selection practised by humans;

cattle/sheep/pigs or other example;

improved milk/beef yield/improved wool yield/improved hardiness/improved bacon yield/ any other example;

3

TOTAL 12**QUESTIONSHEET 4**

(a) shape of beak;

1

(b) different diets;

some eat insects some eat seeds/nuts;

beaks become adapted over many generations by variation (mechanisms) and most efficient forms are selected;

3

(c) ancestors from South American landmass/Ecuador blown by storms/winds;

or carried on driftwood;

2

(d) new variations would arise due to meiosis/fertilisation;

(and) due to continued mutation;

most successful variations would survive better (than less suitable adaptations);

ref to many different niches on the island to which the birds might become adapted;

4

(e) that they are now separate species;

due to reproductive isolation;

2

(f) bill shape/bird song/mating dances or ritual movements;; (any two)

2

TOTAL 14

QUESTIONSHEET 5

- (a) cross pollination can only occur within the gene pool of a species;
cannot bring in new genes because of reproductive isolation between different species; 2
- (b) some alleles express multiple effects in the phenotype;
for example 'mottled colour' in mice and a 'defect in copper absorption' are controlled by the same allele/any other
valid example;
effect of a particular genotype may be modified by different environmental influences; max 2
- (c) even in self fertilisation gametes vary because of meiosis;
variation introduced due to random assortment/chiasmata;
mutation may produce variation; max 2
- (d) DNA replication must be accurate enough to give genetic stability;
but a low level of inaccuracy allows mutation;
and so gives variation allowing evolutionary potential/development; 3
- TOTAL 9**
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QUESTIONSHEET 6

- (i) B; (ii) D; (iii) A; (iv) G; (v) C; (vi) F; (vii) I; (viii) E; (ix) J; (x) H; 10
- TOTAL 10**
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QUESTIONSHEET 7

- (a) (i) the relative proportions of the alleles of a gene present in the population;
can be measured by geneticists and monitored for changes; 2
- (ii) mutation;
migration;
natural selection; 3
- (b) in a large randomly-mating population there is a fixed relationship between gene and genotype frequencies;
in the absence of mutation, migration and natural selection;
these frequencies remain constant from generation to generation; 3
- (c) proportion of non tasters (tt) = $\frac{105}{300} = 0.35$;
since $p + q = 1$, then (tt) which is $q^2 = 0.35$, thus $q = 0.59$;
thus $p = 1 - 0.59 = 0.41$;
thus $2pq (Tt) = 2 \times 0.41 \times 0.59 = 0.48$ or 48%; 4
- TOTAL 12**

QUESTIONSHEET 8

- (a) (i) differential rates of reproduction in nature;
leading to an increase in frequency of some genes/genotypes and a decrease in others; **2**
- (ii) the ability of a species to reproduce new offspring;
far more offspring are generally produced than can survive (due to limitations in environmental provisions or to predation); **2**
- (iii) variations which are inherited from generation to generation;
which if they give advantage will also give survival value; **2**
- (iv) organisms which are capable of interbreeding to form fertile offspring;
not separated from other members of the species by reproductive isolation/breeding barriers; **2**
- (b) far more offspring are produced than can be supported by the environment;
thus there will be a struggle for survival and the best adapted will survive to reproduce more of the same/
the least adapted will die out; **2**
- (c) gene flow might be restricted by organisms being sexually mature at different times;
or by failing to mate by having different mating rituals;
or by a geographical barrier;
or by physiological incompatibility/or by living in different ecological niches/any other valid example; **4**
- TOTAL 14**
-

QUESTIONSHEET 9

- (a) populations/islands X and Y are relatively close/not geographically isolated;
thus birds can still come into contact and breed together;
no chance for any mutations to become genetically isolated/no chance for demes to become established;
so little divergence occurs between X and Y/still reproductively compatible;
population Y probably arose from population X because of prevailing winds;
chromosomes of hybrids will still pair in meiosis (so gametes can form); **max 4**
- (b) populations/islands Y and Z are geographically isolated;
thus will not normally interbreed;
thus mutations/genetic variation in the two populations will occur independently;
thus become isolated by post-zygotic isolation/chromosomes of Y differ from those
of Z/will not pair in meiosis (to form gametes);
Z probably arose from Y as blown by winds rather than originating from X;
not diverged sufficiently to have different courtship rituals/behavioural patterns;
some Y may still be blown to Z allowing occasional interbreeding (although this has now become ineffective); **max 5**
- (b) population/island X is geographically isolated from population Z;
by ocean and island Y;
thus mutations/genetic variation in the two populations has continued independently;
they are now reproductively isolated because their courting/mating behaviours differ;
incompatible mating rituals/courtship dances/plumage colours/breeding times;
this is pre-zygotic isolation;
ref to chromosomes of X will no longer match with those of Z even if they could mate; **max 5**

TOTAL 14

QUESTIONSHEET 10

- (a) (i) (from the distribution map it is clear that) the populations are isolated on different islands/groups of islands;
 even though they are not separated by huge distances/may not like flying over water/psychological barrier to crossing water;
 gene mutations/genetic variation may cause different plumage patterns/colours;
 which are selected for/of survival/camouflage value on different islands;
 since interbreeding is restricted these variations can become established;
 but if they do interbreed chromosomes can still pair in meiosis so gametes can be made (by offspring)/not reproductively isolated;
 also courtship rituals are still compatible/not behaviourally isolated; **max 5**
- (ii) continued restriction on interbreeding/isolation;
 continued mutation/genetic variation;
 this must be selected for and become established;
 until behavioural/mating rituals become incompatible/behavioural isolation;
 and chromosomes become so different that meiosis cannot occur in any hybrids;
 since pairing/synapsis of chromosomes cannot occur; **max 4**
- (a) prezygotic isolation operates before fertilisation occurs/prevents fertilisation;
 for example, geographic/behavioural/ecological/seasonal/incompatible gametes;
 postzygotic isolation operates after fertilisation;
 for example, hybrid sterility/hybrid inviability or premature death; **4**

TOTAL 13**QUESTIONSHEET 11**

gene;
 sympatric;
 allopatric;
 geographical;
 pre-zygotic;
 seasonal;
 ecological;
 post-zygotic;
 inviable; sterile; (these two points can be given either way round)

TOTAL 10

QUESTIONSHEET 12

- (a) ref to use of warfarin as rat poison/its action as an anticoagulant resulting in bleeding;
interferes with action of vitamin K;
mutation of normal gene to mutant gene which gave warfarin resistance;
the mutant resistant gene acted as a dominant;
thus both homozygotes and heterozygotes could survive exposure to warfarin;
allowed rapid spread of the resistant strain of rats/alleles (throughout Britain); **max 4**
- (b) original population of moths were white with black specks;
camouflaged against predation (by birds) on bark of silver birch trees;
silver birch bark became darker during the industrial revolution due to pollutants/soot;
occasional black mutants appeared in the population/ref gene mutation to give melanic form;
these were better camouflaged (on the polluted bark) than the normal/white forms;
thus the white forms were predated on and the black forms survived to breed;
thus the black/melanic forms were selected for (and the population of moths became melanic); **max 4**
- (c) influenza virus has a very high mutation rate;
due to base changes in its RNA/in one or more of its 8 genes/pieces of RNA;
these change the nature of the surface antigens/neuramidase/haemagglutinin;
(every few months) small genetic changes occur causing small antigenic changes/antigenic **drift**/producing new **strains** of influenza;
(every few years) much larger genetic changes occur causing major antigenic change/antigenic **shift**/producing new **species/**
subtypes of influenza;
ref antigenic drift produces epidemics/antigenic shift produces pandemics;
antibodies against one strain of influenza are unlikely to protect against new strains/species of influenza; **max 4**
- (d) only hard parts/bones/exoskeletons/plant cell walls stand a chance of fossilisation;
most dead organisms just rot away/decay/may be eaten;
conditions for fossilisation are relatively rare;
body needs to be buried in anaerobic conditions to prevent decay;
suitable example/peat/ river mud/silt/sand;
and where petrification/impregnation with inorganic salts can occur;
most fossils are still buried/hidden in rocks/sections of the fossil record may be destroyed by earthquakes/weathering; **max 4**

TOTAL 16