INHERITANCE QUESTIONS 5090 P2

O/N18/22/Q8

(a) Explain what is meant by each of the following terms and describe **one** example of each:

discontinuous variation, ...

.....

.....

.....

.....

.....

continuous variation. .....

.....

.....

.....

.....

.....

[7]

(b) Name the molecule that controls production of proteins in each body cell of a human and describe its importance in inheritance.

.....

.....

.....

.....[3]

[Total: 10]

INHERITANCE QUESTIONS 5090 P2

M/J18/21/Q7

(a) Define the term *allele*.

.....

.....

.....[2]

(b) In mice, the allele for black fur (B) is dominant to the allele for white fur (b).

Two mice with black fur were mated to produce offspring, all of which were black.

One of these black offspring was then mated with a mouse with white fur. Equal numbers of mice with black fur and with white fur were produced.

Complete the genetic diagram to show the pattern of inheritance in each cross.

phenotypes of first parents	black fur	×	black fur
genotypes of first parents	.....	×	.....
gametes	....		
genotypes	.....		.....
phenotype	all have black fur		
phenotypes of second parents	black fur	×	white fur
genotypes of second parents	.....	×	.....
gametes	....		
genotypes	.....		.....
phenotypes	black fur		white fur

[8]

[Total: 10]

INHERITANCE QUESTIONS 5090 P2

M/J18/22/Q7

(a) Describe the cause of each of the following:

Down's syndrome,

.....

.....

.....

.....

sickle cell anaemia.

.....

.....

[3]

(b) (i) Parents, one with blood group B and the other with blood group A, have a child with blood group O.

The parents decide to have another child.

Complete the genetic diagram to show the possible blood groups for the second child of these parents.

genotypes of parents ..... x .....

gametes (.....) (.....) (.....) (.....)

possible genotypes of child ....

possible blood groups of child ....

[4]

(ii) State the probability of each of the following for the second child of these parents:

being the same sex as the first child .....

having the same blood group as the first child ..... [2]

(iii) Name the type of inheritance shown by the alleles that produce the blood group AB.

..... [1]

[Total: 10]

INHERITANCE QUESTIONS 5090 P2

O/N17/22/Q3

An experiment was carried out to investigate the inheritance of flower colour.

In cross 1, a plant with blue flowers (plant **G**) was pollinated by another plant with blue flowers (plant **H**). The resulting seeds were collected and labelled 'batch 1'.

In cross 2, plant **G** was pollinated by a plant with white flowers (plant **J**). The resulting seeds were collected and labelled 'batch 2'.

All the plants were of the same species.

Fifty seeds from each of batch 1 and batch 2 were grown and the number of plants with white flowers was counted.

The results are shown in Table 3.1.

Table 3.1

batch	number of plants with white flowers
1 (from cross 1)	12
2 (from cross 2)	27

(a) Name the dominant phenotype in this experiment .....[1]

The alleles controlling flower colour in this plant are **B** (dominant) and **b** (recessive).

(b) **(i)** State the genotypes of

plant **G** .....

plant **H** .....

plant **J** ..... [3]

(ii) State which of these plants is heterozygous .....[1]

(c) In the box below, draw a genetic diagram for cross 1 (between plants **G** and **H**).

[5]

[Total: 10]

INHERITANCE QUESTIONS 5090 P2

M/J17/21/Q4

Fig. 4.1 shows a Bengal tiger.

Fig. 4.1

Fur colour in the Bengal tiger is controlled by a single gene. The dominant allele of the gene results in orange fur. A single change in this gene produces a recessive allele, which results in white fur in tigers with the homozygous recessive genotype.

(a) (i) Define the term *gene*.

.....

.....

.....

.....[3]

(ii) State the term used to describe a change in a gene.

.....[1]

(b) Using the letters T (orange) and t (white) to represent the alleles that control fur colour, draw a labelled genetic diagram to show how two tigers with orange fur may give rise to offspring with white fur.

[5]

(c) Bengal tigers have dark stripes on their fur.

Suggest why each of the following is true for the pattern of dark stripes:

it is not affected by whether the fur is orange or white

.....

.....

.....

it is unique to each individual

.....

.....

.....[3]

[Total: 12]

INHERITANCE QUESTIONS 5090 P2

O/N16/21/Q5

Complete the paragraph below by writing the most appropriate word in each of the spaces.

A ..... includes a long molecule of DNA that is divided into sections called genes. Genes may be copied and passed on to the next generation. Each gene may have two or more alternative forms called ..... . One of these forms may be ..... and the other recessive. A change in the structure of a gene or in the number of chromosomes is called a ..... . Chemicals and ..... may increase the rate at which these changes take place.

[5]

[Total: 5]

INHERITANCE QUESTIONS 5090 P2

M/J16/22/Q9

(a) With reference to the inheritance of blood groups, explain what is meant by each of the following terms:

(I) *dominance*

.....

.....

.....

.....

.....

.....

.....[3]

(II) *codominance.*

.....

.....

.....

.....

.....

.....

.....[3]

(b) Explain the difference between the number of chromosomes in a gamete and in a body cell.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 10]

INHERITANCE QUESTIONS 5090 P2

O/N15/21/Q3

(a) Fig. 3.1 shows the distribution of blood groups in the population of a country.

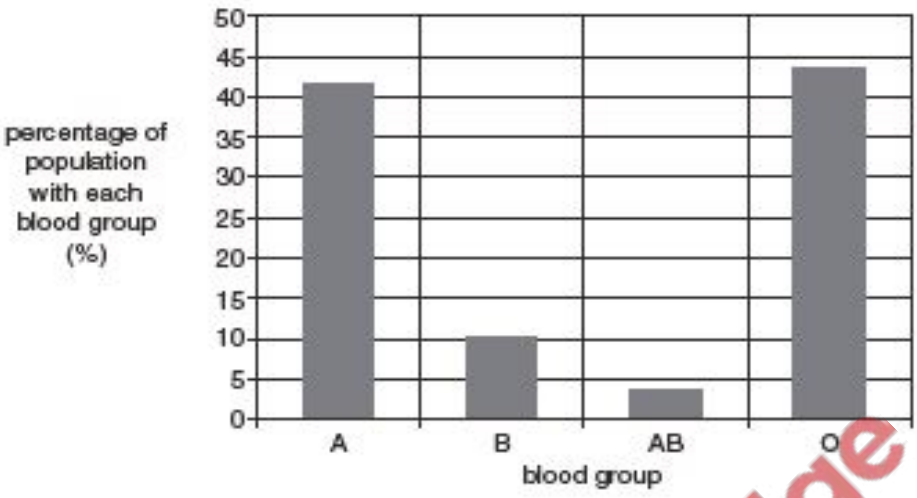

Fig. 3.1

(i) State the type of variation shown in Fig. 3.1.

..... [1]

(ii) Give a reason for your answer to part **(a)(i)**.

.....

..... [1]

(iii) The population of this country is approximately 63 million people. Use the information in Fig. 3.1 to calculate the approximate number of people in the country that have **blood group B**.

Show your working in the space below.

..... [2]

INHERITANCE QUESTIONS 5090 P2

(b) Table 3.1 shows the distribution of blood groups in the populations of four countries.

Table 3.1

country	percentage of population with each blood group (%)			
	A	B	AB	O
S	23	38	10	29
T	42	10	4	44
U	26	18	.....	52
V	36	14	4	46

(I) Calculate the percentage of the population of country **U** that has blood group AB.

Write your answer in the space provided in Table 3.1. [1]

(II) Suggest why the percentage of the population with each blood group varies between the countries listed.

.....

.....

.....

.....

..... [2]

(c) Suggest why it might be necessary to know a person's blood group.

.....

.....

.....

.....

..... [2]

(d) A child's mother has blood group AB and the child's father has blood group O.

Draw a (ring) around each possible genotype and blood group of the child.

genotypes	I^AI^A	I^Ai^o	I^BI^B	I^Bi^o	I^AI^B	i^oi^o
blood groups	A	B	AB	O		

You may use the space below to work out your answer.

[2]

[Total: 11]

INHERITANCE QUESTIONS 5090 P2

M/J15/22/Q4

The dominant allele for the ability to smell the scent of a particular flower is represented by **A**. The recessive allele, which does not allow a person to smell the scent of the flower, is represented by **a**.

(a) Using these letters, indicate each of the following:

(I) the genotype of a woman who is unable to smell the flower

..... [1]

(II) the possible alleles found in the gametes of a woman who can smell the flower.

..... and ..... [2]

(b) Fig. 4.1 represents some alleles on part of the sex chromosomes of a woman and of a man.

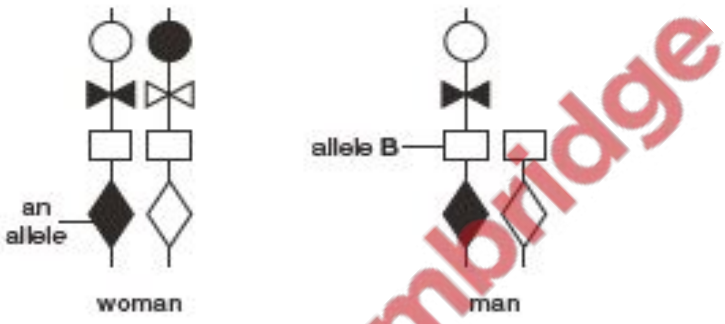

Fig. 4.1

In the space below, draw these alleles as they might appear in a sperm cell that carries the Y chromosome.

[2]

(c) Fig. 4.2 shows how the alleles on one of the chromosomes might appear in a cell taken from somewhere else in the man's body. Allele **B** shows a mutation.

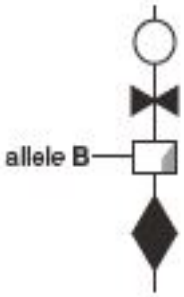

Fig. 4.2

Suggest **two** possible causes of the mutation.

1 .....

2 ..... [2]

(d) Mutated alleles such as that shown in Fig. 4.2 are usually recessive.

Use your knowledge of genetics to explain why society discourages marriage between closely-related people.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 10]

INHERITANCE QUESTIONS 5090 P2

M/J14/21/Q6

(a) Describe the two forms of variation found within a natural population.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(b) Explain how variation is important for the long-term survival of the species.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

INHERITANCE QUESTIONS 5090 P2

M/J14/22/Q2

Two students performed an experiment to illustrate inheritance. They each made a 'spinner' similar to the one shown in Fig. 2.1. A result is recorded when a disc is spun and stops with one side nearest the surface.

Fig. 2.1

(a) Complete Table 2.1, to show the expected results if the two students spin their discs, at the same time, on 80 separate occasions.

Table 2.1

combination of letters on each occasion	number of times each combination of letters is recorded
A and A	20
A and a	
a and a	

[1]

(b) Suggest **two** reasons why the results they obtained may have been different from the expected results.

.....

.....[2]

(c) Suggest the feature or stage in the process of inheritance represented by each of the following:

(i) the students .....

(ii) the spinning of the disc .....

(iii) the letters on the disc .....

[3]

(d) Describe how the students could modify their spinners and use them to illustrate the possible inheritance of blood groups by children of a father who has codominant blood group alleles and a mother who is heterozygous for blood group A.

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 11]

INHERITANCE QUESTIONS 5090 P2

O/N13/22/Q5

Fig. 5.1(a) shows several members of the same species of small mammal. Some of these have white fur and some have black fur. They live in a region with very light-coloured soil.

Fig. 5.1(b) shows the effect of predation by a hawk (a carnivorous bird) after several years.

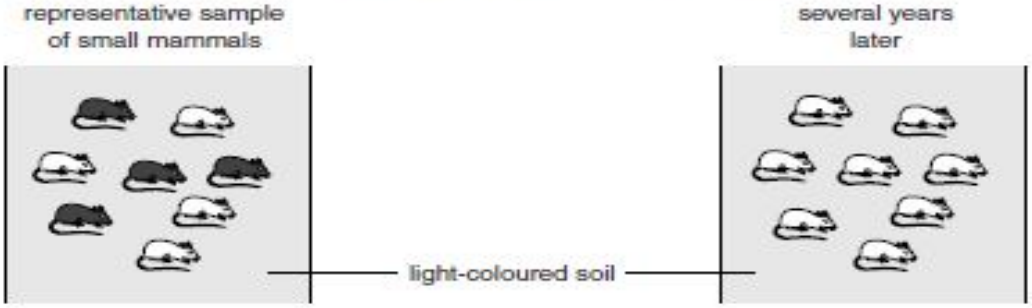

Fig. 5.1(a) **Fig. 5.1(b)**

(a) State the term for groups of animals and plants of different species linked together in a feeding relationship in the same environment.

.....[1]

(b) Explain what has happened to the small mammal population in the time between Fig. 5.1(a) and Fig. 5.1(b).

.....

.....

.....

.....[3]

(c) A change in agricultural practice caused the soil to become slightly darker.

(I) Suggest **two** genetic changes that might occur in this population of small mammals.

1 .....

2 .....[2]

(II) Explain how these genetic changes might help these small mammals to survive such an environmental change.

.....

.....[2]

[Total: 8]

INHERITANCE QUESTIONS 5090 P2

O/N12/22/Q2

Species **D** lives in a forest. Fig. 2.1 shows what can happen, over the same period of time, if some members of species **D** migrate from the forest to a desert region.

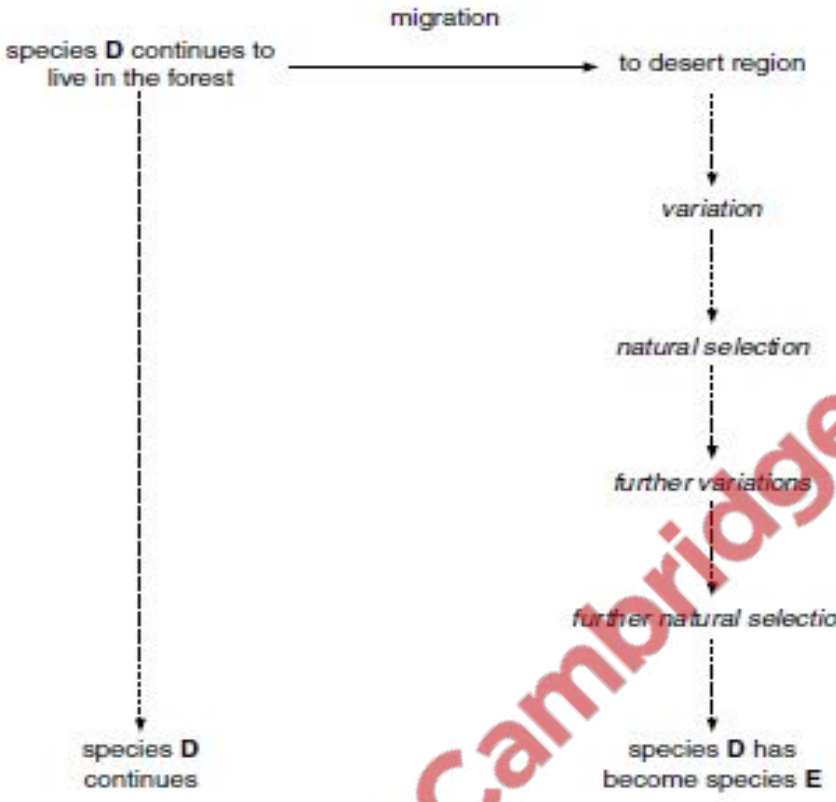

Fig. 2.1

(a) Name the **two** main causes of variation in organisms.

1. .....

2. ..... [2]

(b) Name the process involving variation and natural selection that has led to the development of species **E**.

..... [1]

INHERITANCE QUESTIONS 5090 P2

Mark Scheme (2018-2012) Both variants

O/N18/22/Q8

8(a) (discontinuous)

idea of few + phenotypes / categories AW OR no intermediates ;

inherited / passed to next generation ;

genes / genetic / genotype / alleles ;

correct example (e.g. blood group, eye colour, sex, ear lobes, tongue roll) ;

bar chart / bar graph ;

(continuous)

idea of many

+ phenotypes / categories AW OR intermediates / range ;

genes / genetic / genotype / alleles

+ environment ;

any named environmental factor (e.g. diet / sunlight exposure) ;

correct example (e.g. skin colour / hair colour / height / weight) ;

normal distribution ;

8(b) DNA / deoxyribonucleic acid ;

chromosomes / genes / alleles ;

copied / replicated ;

passed to next generation / from parents ;

gametes / egg / sperm

M/J18/22/Q7

7(a) form / version ;
gene ;
reference to codes for / specifies production of + protein ;
reference to dominant / codominant / recessive ;
2
7(b) BB ; x Bb ;
B + B + B + b ;
BB + Bb ;
Bb (black) ; x bb (white) ;
B + b + b + b ;
Bb + bb ;

INHERITANCE QUESTIONS 5090 P2

M/J18/22/Q7

7(a) **1** inherited / genetic **AW ;**
(Down's syndrome)
2 mutation **+** chromosome **;**
3 reference to chromosome 21 **;**
4 one extra **or** 3 instead of 2 **or** 47 not 46 **or** 24 not 23 in **+** gamete/egg/sperm **;**
(sickle cell anaemia)
5 mutation **+** gene **;**
6 homozygous recessive / two recessive alleles **;**
3
7(b)(i) **1** I^BI^O **+** I^AI^O **or** BO **+** AO **;**
2 I^B **+** I^O **+** I^A **+** I^O **or** B **+** O **+** A **+** O
or gametes correct for stated parent genotypes **;**
3 I^AI^B **+** I^BI^O **+** I^AI^O **+** I^OI^O **or** AB **+** BO **+** AO **+** OO
or possible genotypes of child correct for stated gametes **;**
4 AB **+** B **+** A **+** O
or possible blood groups of child correct for stated genotypes **;**
4 Allow any order within each marking point
7(b)(ii) *(same sex)*
50% / half / ½ / 0.5 / 2 in 4 / 1 in 2 / 1:1 **;**
(same blood group)
25% / quarter / ¼ / 0.25 / 1 in 4 / 1:3 **;**
2
7(b)(iii) codominance / codominant **;**

O/N17/22/Q3

3(a) blue **;**
3(b)(i) (**G**) Bb / heterozygous **;**
(**H**) Bb / heterozygous **;**
(**J**) bb / homozygous **+** recessive **;**
3(b)(ii) **G + H ;**
3(c) **1** parent genotypes / gametes correct from **G and H** in **(b)(i) ;**
2 offspring genotypes correct for parent genotypes / gametes **;**
3 offspring phenotypes correct for stated genotypes **;**
4 genotype / phenotype ratio correct **;**
5 correct use of the terms gamete **+** genotype / phenotype **;**

M/J17/21/Q4

4(a)(i) section of / made of / piece of **+** DNA / chromosome **;**
controls production of one protein **;**
may be copied **;**
unit of inheritance / passed on to next generation **;**

4(a)(ii) mutation ;
4(b) Tt + Tt ;
t + t ;
tt ;
tt offspring clearly indicated as white ;
3 · labels on genetic diagram correct ;
A parent / offspring / gamete / genotype / phenotype
4(c) *(unaffected by fur colour)*
(controlled by) different gene(s) ;
(unique to each individual)
alleles ;
(as a result of) mutation(s) ;
meiosis AW ;
different combinations (of alleles) ;
reference to some may be homozygous / heterozygous ;
reference to codominance ;

O/N16/21/Q5

5 chromosome ;
allele(s) ;
dominant ;
mutation ;
radiation / named radiation / radioactivity ;

M/J16/22/Q9

9 (a) (i) 1. allele(s) ;
2. responsible for a character(istic) / trait ;
3. only one needs to be present / reference to heterozygote AW ;
4. for the character to appear / be expressed (in phenotype) AW ;
5. e.g. $I^A I^O$ + group A / $I^B I^O$ + group B / $I^A I^B$ + dominant to I^O ;
A A, B, O instead of I^A, I^B, I^O
[max 3]
(ii) 1. two alleles ;
2. neither being recessive / (equally) dominant ;
3. both have an effect / are expressed / phenotype intermediate ;

4. reference to heterozygote AW ;
5. I
A
I
B
/ AB ;
[max 3]

(b) 1. number of chromosomes in a gamete is half those in a somatic or body cell ORA / one versus two sets of chromosomes ;
2. correct use of the terms haploid + diploid ;
3. 46 v. 23 ;
4. gametes / haploid cells are the result of meiosis / reduction division ;
5. somatic / body cells occur in / produced by mitosis ;
6. (diploid) number restored + at fertilisation ;
7. each parent has equal share in genotype of offspring AW ;
A sex cell = gamete / one named gamete
[max 4]

O/N15/21/Q3

3 (a) (i) discontinuous ; [1]

(ii) no intermediate values / distinct / separate categories ; [1]

(iii) (63 / 100) × 10 ;

6.3 million / 6 300 000 / 6.3 × 106 ;

[2]

award 2 marks for correct

answer alone

(b) (i) 4 (%) ; [1]

(ii) ref. alleles / genes ;

each person has two (for blood group) ;

different (allele / gene) frequency in different populations ;

ref. inbreeding (of separate groups) AW ;

[max. 2]

A example of inbreeding e.g.

geographical isolation / culture

(c) blood transfusion / tissue (A blood donor) / organ transplant ;

clotting with ref. to blood / prevent rejection ;

to check paternity ;

[max. 2]

A if ref. is to donor or recipient

A ORA

(d) IAIo + IBIo ;

A + B ;

[2]

M/J15/22/Q4

4 (a) (i)	aa ;		[1]
(ii)	a/A ; A ;		[2]
(b)	chromosome with 2 alleles drawn ; the same two alleles as in Fig. 4.1 ;		[2]
(c)	radiation or type named ; chemicals or mutagenic chemical named ;	Ig ref. to inheritance e.g. uv, gamma, alpha e.g. mustard gas, benzene, tar, etc.	[2]

(d)
1. parents with normal
phenotype / appear normal / do not
have mutational condition ;
2. heterozygotes / carriers of
recessive allele ;
3. greater chance (correctly
qualified) ;
4. children + inheriting 2 recessive
alleles / being homozygous ;
5. suffering from mutational
condition ;

M/J14/21/Q6

6 (a) continuous variation ;
gradual change / range ;
between extremes ;
genes + environment ;
discontinuous variation ;
few and distinct differences ;
controlled by genes alone ;
any correct example of one or the other correctly linked ;

(b) some variations are advantageous ;
competition ;
in the organism's habitat / environment ;
organism survives / differential survival / ORA ;
breeds / reproduces ;
passes on the advantage / beneficial gene / allele ;
over many generations / ref. time ;
continuous adaptation to the changing environment ;
evolution / natural selection / AW ;
changes that result from the environment not so important ;

M/J14/22/Q2

2 (a)

combination of letters on each occasion	number of times each combination of letters is recorded
A and A	20
A and a	40
a and a	20

[1]
(b) expected are theoretical or statistical / spinning is random or
due to chance ;

disc poorly made / toothpick doesn't pass through middle / AW;
error in counting ;
[2]
Ig wind / force of spin
A 'it' is random
(c) (i)
(ii)
(iii)
parents (cells) / genotypes / gonads or both named ;
meiosis / reduction division / gamete (formation) / fertilisation ;
genes / alleles / chromosomes / gametes ;
[3]
R genotype

(d) Correct alleles, A, B and O (with or without I) ;
one disc with A and B and one disc with A and O ;
each disc with correct numbers of alleles, i.e. 3 for discs given in question ;
representing father and mother ;
spin several / many times ;
results recorded / counted ;

O/N13/22/Q5

5 (a) biotechnology / fermentation / culturing; 1
(b) to control / lower / the temperature; 1 A maintain
(c) enzymes;
prevention of denaturation / destruction / prevents death of fungus / microorganism / bacterium;
optimum / best / better / + for growth / reproduction;
high(er) yield; 2
(d) any ref. sterile;
(H) for introduction of microorganism or named;
and food / nutrients / culture medium;
e.g. amino acids / protein / carbohydrates or named;
(J) for introduction of air / oxygen;
bubbles / large surface area (as O_2 passes through grille) / sparger;
for respiration;

O/N12/22/Q2
2 (a) genes / mutation / named common mutagen;
environment / habitat / named environmental factor; [2]
(b) evolution / speciation; [1]
(c) different/changed environment;
mutation(s);
variations + advantageous AW / better adapted;
survive;
reproduce / passed on;
cumulative effect / over many generations;
leading to change in phenotype / appearance / or e.g.; [Max 4]
(d) difference in genes/DNA;
difference in chromosomes;
ref to problems with fertilisation;
no sexual attraction / incompatible;
geographical separation; [Max 2]