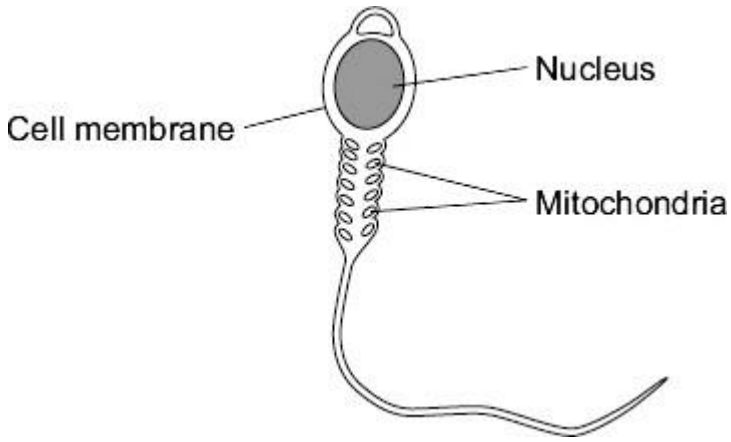
1 Cells in the human body are specialised to carry out their particular function.

(a) The diagram shows a sperm cell.



The sperm cell is adapted for travelling to, then fertilising, an egg.

(i) How do the mitochondria help the sperm to carry out its function?

_____

_____

(1)

(ii) The nucleus of the sperm cell is different from the nucleus of body cells.

Give **one** way in which the nucleus is different.

_____

_____

(1)

(b) Stem cells from human embryos are used to treat some diseases in humans.

Explain why.

_____

_____

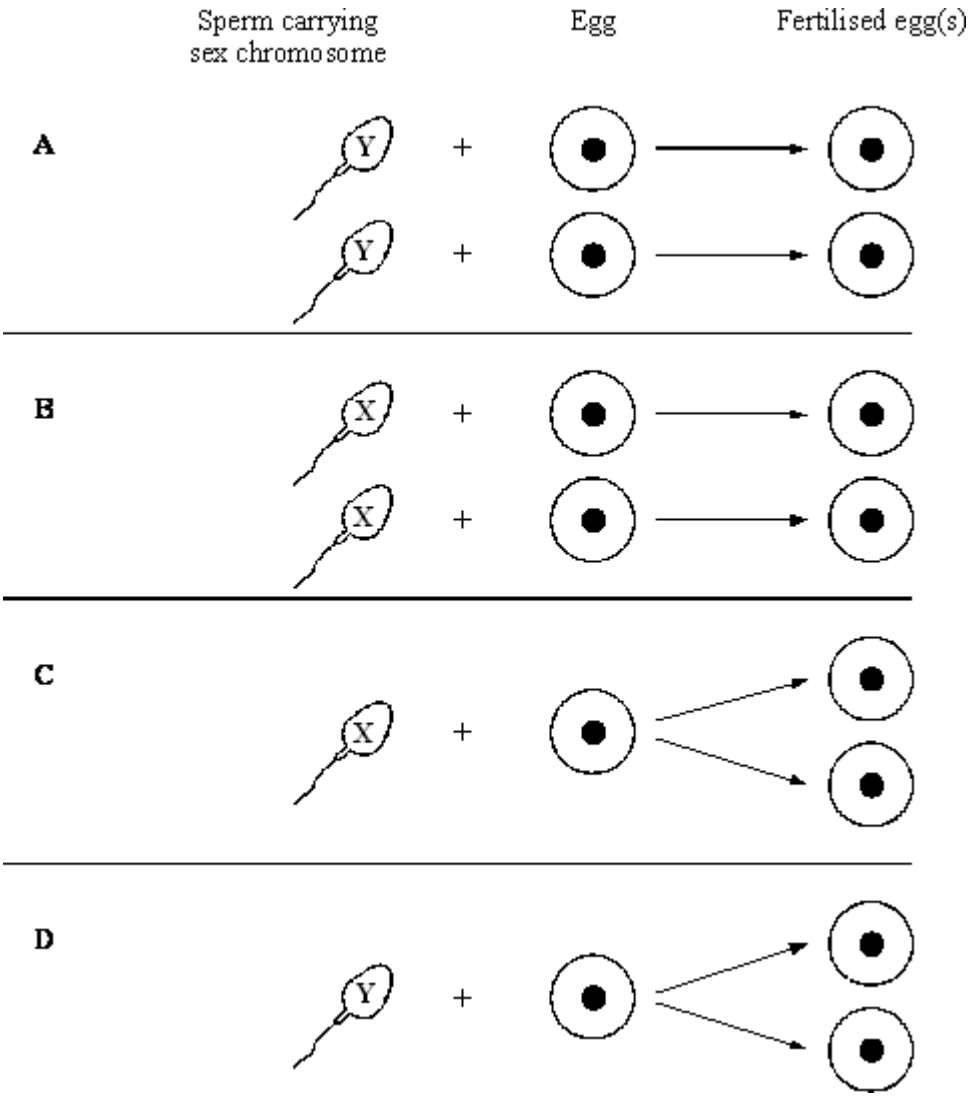
_____

_____

(2)

(Total 4 marks)

2 The diagrams show four ways in which human twins may be formed.



Which diagram, **A**, **B**, **C** or **D**, shows the process which will produce genetically identical twin boys?

_____

Explain the reason for your choice.

_____

_____

_____

_____

_____

_____

(Total 3 marks)

3 (a) Use words from the list to complete the sentences.

alleles **chromosomes** **gametes** **genes** **mutations**

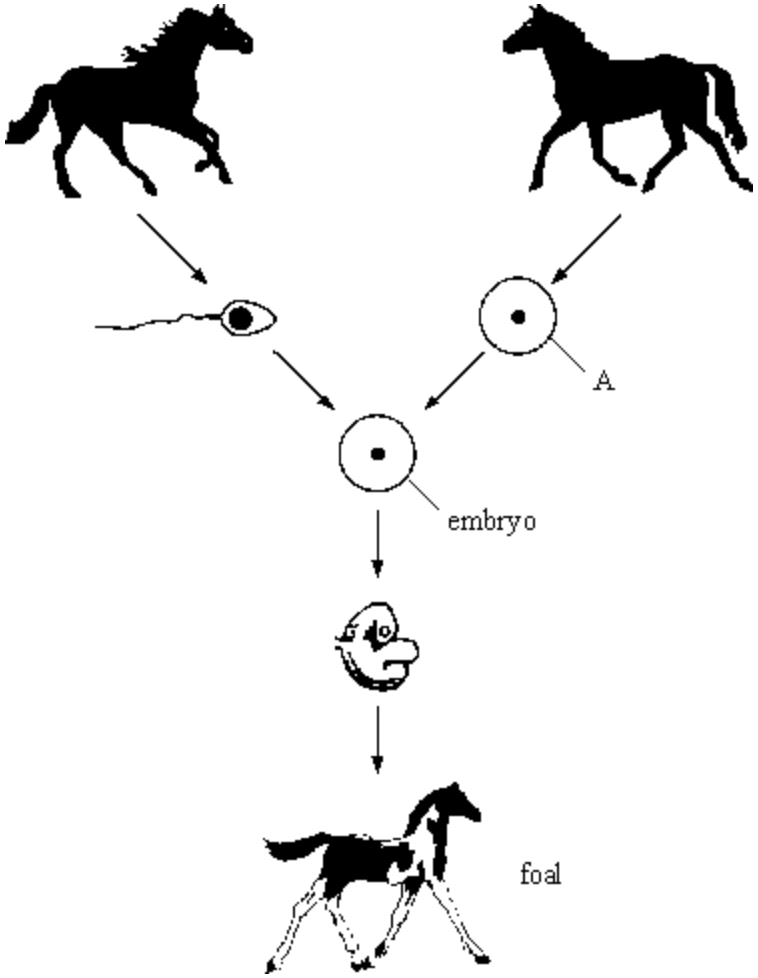
The nucleus of a cell contains thread-like structures called _____.

The characteristics of a person are controlled by _____

which may exist in different forms called_____.

(3)

(b) The drawing shows some of the stages of reproduction in horses.



(i) Name this type of reproduction _____

(1)

(ii) Name the type of cell labelled **A** _____

(1)

(c) When the foal grows up it will look similar to its parents but it will **not** be identical to either parent.

(i) Explain why it will look similar to its parents.

_____

_____

(1)

(ii) Explain why it will **not** be identical to either of its parents.

_____

_____

_____

_____

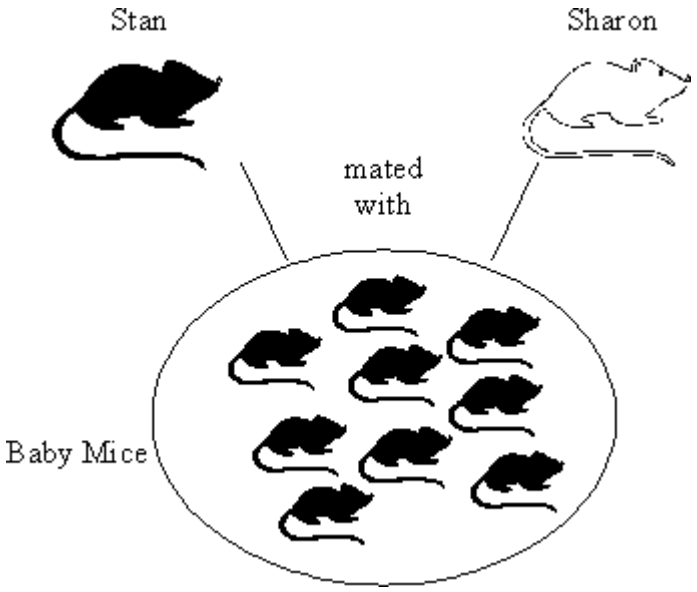
(2)

(Total 8 marks)

4 A student's hobby was breeding pet mice. Three of the pet mice were called Stan, Tom and Sharon. Stan and Tom had black fur. Sharon had white fur.

The colour of the fur is controlled by a single gene which has two alleles B and b.

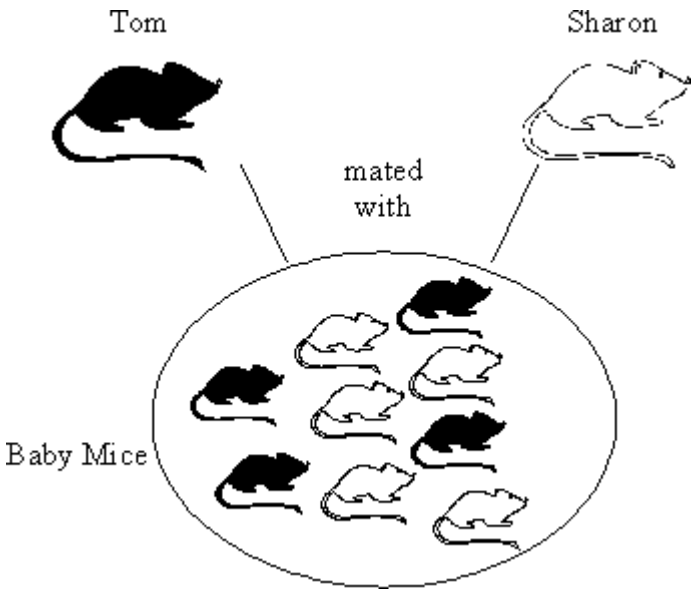
(a) The student first crossed Stan with Sharon. The results are shown on the diagram.



Explain why the baby mice produced by crossing Stan and Sharon all had black fur. You may use a genetic diagram if you wish.

(3)

(b) The student then crossed Tom with Sharon. The results are shown on the diagram.



When Tom was crossed with Sharon, some of the baby mice had black fur and some white.

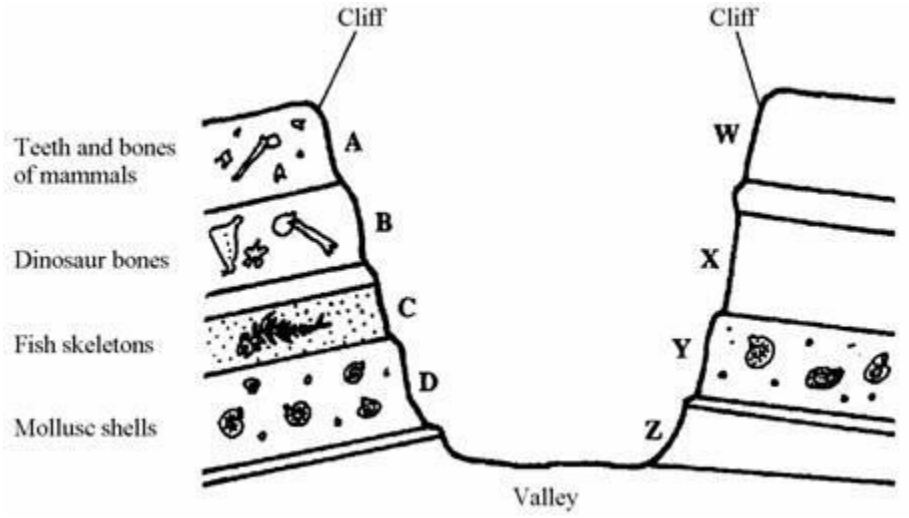
Explain why. You may use a genetic diagram if you wish.

(3)
(Total 6 marks)

5 The drawing shows some of the fossils found in the layers of rock in two cliffs.

The two cliffs are on opposite sides of a large valley.

Geologists think that the valley has been carved out by rivers, and that the order of rock layers has not changed.



(a) (i) Which of the rock layers, **A**, **B**, **C** or **D**, is the oldest? _____

(1)

(ii) Give the letters of **two** layers of rock on opposite sides of the valley that are the same age.

_____ and _____

(1)

(b) How do fossils provide evidence for the theory of evolution?

_____

_____

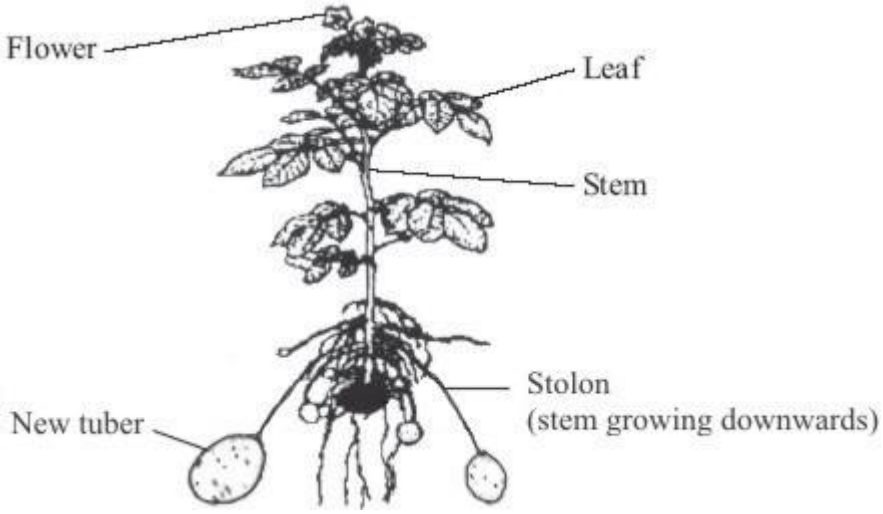
_____

_____

(2)

(Total 4 marks)

6 The drawing shows a potato plant producing new tubers (potatoes). Buds on the stem of the parent plant produce stolons. The new tubers are formed at the ends of the stolons (stems that grow downwards).



(a) Explain why the new tubers are genetically identical to each other.

_____

_____

_____

_____

(2)

(b) Some of the tubers are used to produce potato plants. These new potato plants will not all grow to the same height.

Give **one** reason why.

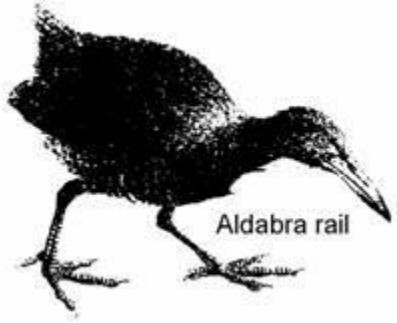
_____

_____

(1)

(Total 3 marks)

7 Flightless birds called Rails once inhabited 20 islands in the Pacific Ocean. During the last two centuries they have disappeared from 15 of these islands. The Aldabra Rail, shown below, is one of the few survivors. The island which it lives on is very remote.



Suggest **three** reasons why Rails have disappeared from 15 of the 20 islands they once inhabited.

1. _____

_____

2. _____

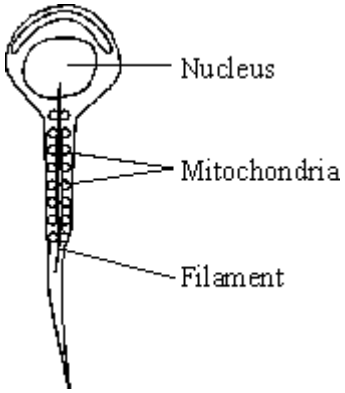
_____

3. _____

_____

(Total 3 marks)

8 The diagram shows a human sperm. Inside the tail of the sperm is a filament mechanism that causes the side to side movement of the tail, which moves the sperm.



(a) Describe the function of the mitochondria and suggest a reason why they are arranged around the filament near the tail of the sperm.

_____

_____

_____

_____

(3)

(b) Explain the significance of the nucleus in determining the characteristics of the offspring.

_____

_____

_____

(2)

(Total 5 marks)

9 (a) (i) Some diseases can be tackled by using antibiotics and vaccination.
Explain fully why antibiotics cannot be used to cure viral diseases.

_____

_____

_____

_____

(2)

(ii) A recent study found that babies in 90 % of hospitals are infected with the MRSA bacterium.

Explain how the MRSA bacterium has developed resistance to antibiotics.

_____

_____

_____

_____

(2)

(b) A person can be immunised against a disease by injecting them with an inactive form of a pathogen.

Explain how this makes the person immune to the disease.

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

10 Doctors give antibiotics to patients to kill bacteria in their bodies.

Explain how the overuse of antibiotics has led to the evolution of antibiotic-resistant bacteria.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

_____

_____

_____

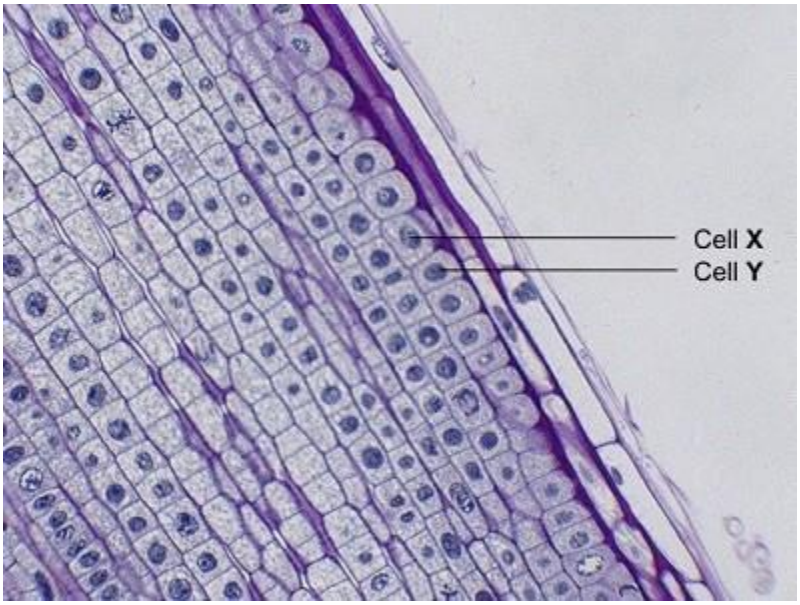
_____

_____

_____

(Total 3 marks)

11 The photograph shows some cells in the root of an onion plant.



By UAF Center for Distance Education [CC BY 2.0], via Flickr

(a) Cells **X** and **Y** have just been produced by cell division.

(i) Name the type of cell division that produced cells **X** and **Y**.

_____

(1)

(ii) What happens to the genetic material before the cell divides?

_____

(1)

(b) A gardener wanted to produce a new variety of onion.

Explain why sexual reproduction could produce a new variety of onion.

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

12 Cystic fibrosis is an inherited disorder that can seriously affect health.

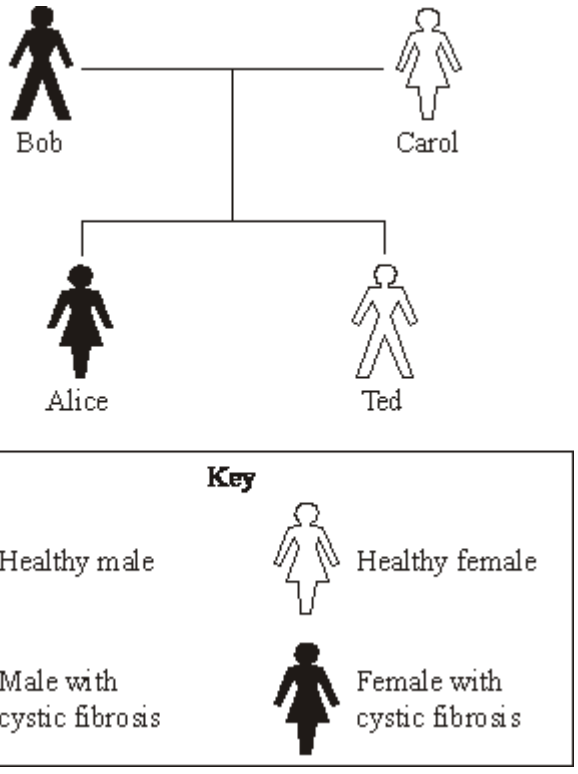
(a) Which **one** of these is affected by cystic fibrosis?

Draw a ring around your answer.

blood **cell membranes** **kidneys** **nervous system**

(1)

(b) The diagram shows the inheritance of cystic fibrosis in a family. The allele that produces cystic fibrosis is recessive.



(i) Explain why Alice inherited cystic fibrosis.

_____

_____

_____

_____

(2)

(ii) Explain why Ted did **not** inherit cystic fibrosis.

_____

_____

_____

_____

(2)

(c) Bob and Carol know that there is a risk that their next baby will have cystic fibrosis.

Embryos can be screened for the allele that produces cystic fibrosis.

Many people support the screening of embryos, but others do not.

(i) Suggest **one** reason why many people support the screening of embryos for the cystic fibrosis allele.

_____

_____

_____

(1)

(ii) Suggest **one** reason why many people are against the screening of embryos for the cystic fibrosis allele.

_____

_____

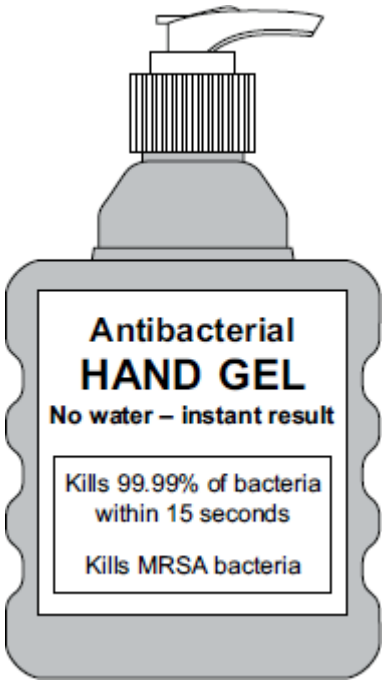
_____

(1)

(Total 7 marks)

13 MRSA strains of bacteria are causing problems in many hospitals.

(a) The diagram shows a hand-gel dispenser.



Hand-gel dispensers are now placed at the entrance of most hospital wards.

Explain why.

_____

_____

_____

_____

(2)

(b) Explain, as fully as you can, how MRSA strains of bacteria became difficult to treat.

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

Mark schemes

1 (a) (i) release energy

allow provide / supply / give energy
*do **not** accept produce / create / generate / make energy*
*do **not** allow release energy for respiration*

1

(ii) contain half the (number of) chromosomes **or** contains one set of chromosomes **or** contains 23 chromosomes

allow genetic information / DNA / genes / alleles instead of chromosomes
accept haploid

1

(b) any two from:

- (stem cells) are unspecialised / undifferentiated
  *allow description **eg** 'no particular job'*
- are able to become differentiated
  or can form other types of cell / tissue / organ
- stem cells can / able to divide / multiply

2

[4]

2 D

idea that twins have come from one (fertilised) egg
idea that Y sperm / Y chromosome produces boys

each for 1 mark
*allow 1 mark if candidate selects **A and** states that Y sperm / Y chromosome produce boys (reject Y gene unqualified) OR allow 1 mark if candidate selects **C and** states that twins must have come from one (fertilised) egg*

[3]

3 (a) chromosomes
genes (*reject* alleles)
alleles

for 1 mark each

3

(b) (i) sexual / sex

for one mark

1

(ii) egg / gamete / sex cell / ovum (*reject* ovule)

for one mark

1

(c) (i) information / genes / DNA passed from parents (*reject* chromosomes)

for one mark

1

(ii) genes / genetic information / chromosomes from <u>two</u> parents
alleles may be different
environmental effect / named may have been mutation

any two for 1 mark each

2

[8]

4 (a) Stan BB
Sharon bb
all offspring Bb

3

(b) Tom Bb
black offspring Bb
white offspring bb

3

[6]

5 (a) (i) D

for 1 mark

1

(ii) D Y (*both*) or C X (*both*) or B W (*both*)

for 1 mark

1

(b) *N.B. answers must relate to fossils <u>providing evidence</u>*
show types of animals / plants that <u>no longer exist</u> / named ref eg dinosaur
show <u>changes</u> in types *(of animals / plants)*
similar fossils found in rocks of similar age
reference to sequence of change
or example
e.g. horse / limb

any two for 1 mark each

2

[4]

6 (a) grow from parents,
by vegetative reproduction/asexual reproduction/
no sexual reproduction

for 1 mark each

2

(b) e.g. different environmental conditions/named condition

for 1 mark

1

[3]

7 3 of e.g.
new predators
new diseases
new competitors
environmental changes (initiated by Man)

each for 1 mark

[3]

8 (a) **award one mark for each key idea**

energy released **or** energy transferred **or** respiration

*allow provides **or** gives*

*do **not** allow produces **or** makes*

3

near to the site of movement **or**
energy available quickly **or** more
energy

accept allows more mitochondria to fit in

(mitochondria) packed (around
filament) **or** efficient arrangement **or**
spiral arrangement

(b) contains chromosomes **or** genes **or**
DNA

***not** genetic material*

1

(which) contribute half (the genes) to
the fetus **or** offspring

*23 chromosomes **or** half the genes*
***or** reference to X,Y chromosome determining sex (if the notion of halfness is there)*
nucleus contains half genes for the offspring = 2 marks

1

[5]

9 (a) (i) viruses live inside cells

1

viruses inaccessible to antibiotic

allow drug / antibiotic (if used) would (have to) kill cell

1

(ii) mutation

ignore mutation caused by antibiotic

1

natural selection **or** no longer recognised by antibiotics

accept description of natural selection

1

(b) (stimulate) antibody production

ignore antitoxin

1

(by) white cells

1

<u>rapidly</u> produce antibody on re-infection

ignore antibodies remain in blood

1

[7]

10 **Quality of written communication**

*for correct use of at least **two** scientific terms eg mutation, resistant (**not** just 'antibiotic-resistant', **not** 'immune') / selection / natural selection / survival / reproduction / gene / allele / DNA*

1

any **two** from:

mutation occurs in bacteria or change in DNA / gene occurs

cancel if mutation 'caused by' antibiotic

(when antibiotic used) only resistant bacteria survive **or** non-resistant bacteria are killed **or** reference to 'natural selection'

resistant bacteria pass on the gene / allele

allow pass on the mutation
*do **not** accept just 'pass on resistance'*

2

[3]

11 (a) (i) mitosis

correct spelling only

1

(ii) replicates / doubles / is copied / duplicates

accept cloned
ignore multiplied / reproduced

1

(b) fertilisation occurs / fusion (of gametes)

accept converse for asexual, eg none in asexual / just division in asexual

1

so leading to mixing of genetic information / genes / DNA / chromosomes

genes / DNA / chromosomes / genetic information comes from 1 parent in asexual
ignore characteristics

1

<u>one</u> copy (of each allele / gene / chromosome) from each parent
or
gametes produced by meiosis
or
meiosis causes variation

meiosis must be spelt correctly

1

[5]

12 (a) cell membranes

1

(b) (i) two recessive / cystic fibrosis / faulty / diseased / the allele(s) / genes
two can be implied by second marking point
ignore chromosomes

1

from Bob **and** Carol / both parents / the parents
*if no other marks awarded 'Carol is a carrier' gains **1** mark*

1

(ii) (inherited) dominant / normal allele / gene

1

from Carol / mother
ignore references to recessive allele / gene from father / Bob
*if no other marks awarded he has <u>just</u> / <u>only</u> one recessive allele gains **1** mark*

1

(c) (i) reduce number of people with cystic fibrosis (in population)

or

reduce health-care costs

or

expensive to have baby with cystic fibrosis
accept to allow decision / emotional argument qualified eg allows abortion
or
allows people to make choices about termination
or
help to prepare financially / emotionally etc

1

(ii) any **one** from:

- possible damage / risk to embryo / fetus / baby
  allow possible harm / risk to mother
- screening / it is expensive
- (may) have to make ethical / moral / religious decisions
  ignore not natural / playing God / unethical / immoral / religious unqualified
- right to life

1

[7]

13 (a) kills / destroys bacteria / MRSA
*do **not** allow germs*

1

prevents / reduces transfer
allow stops MRSA entering ward

1

(b) mutation
*do **not** accept antibiotics causes mutation*

1

(causes) resistance
allow not effective
ignore immunity

1

to antibiotics

1

[5]