Topic Test: OxfordAQA International GCSE Biology 9201

Inheritance

Name: _____

Class: _____

Date: _____

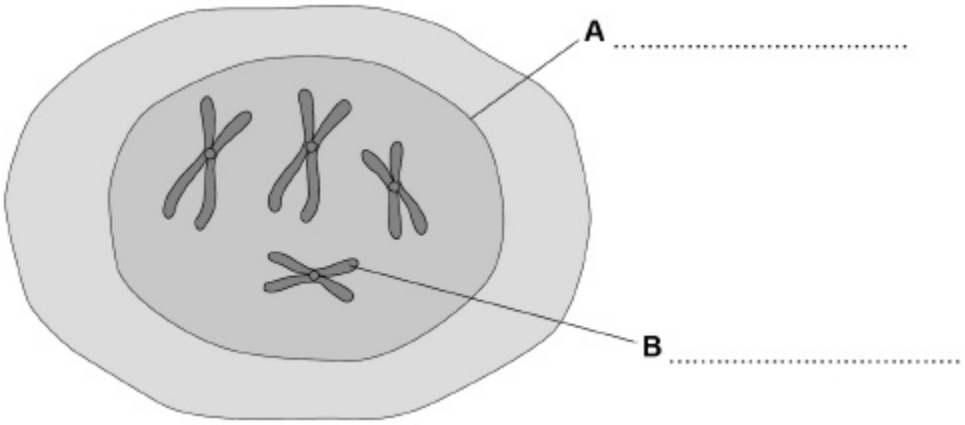
Time: **83 minutes**

Marks: **83 marks**

Comments:

1 **Figure 1** shows a body cell.

Figure 1



(a) Label structures **A** and **B**. Use words from the box.

chromosome	**mitochondrion**	**nucleus**	**ribosome**	**vacuole**

(2)

(b) Egg cells and sperm cells are sex cells.

What is the scientific name for sex cells?

Tick **one** box.

Clones ☐

Embryos ☐

Gametes ☐

Genotypes ☐

(1)

(c) An egg cell and a sperm cell join to produce a single new cell.

What is this process called?

Tick **one** box.

- Differentiation ☐
- Fertilisation ☐
- Growth ☐
- Speciation ☐

(1)

(d) The new cell divides many times.

What is this process called?

Tick **one** box.

- Meiosis ☐
- Mitosis ☐
- Mutation ☐
- Variation ☐

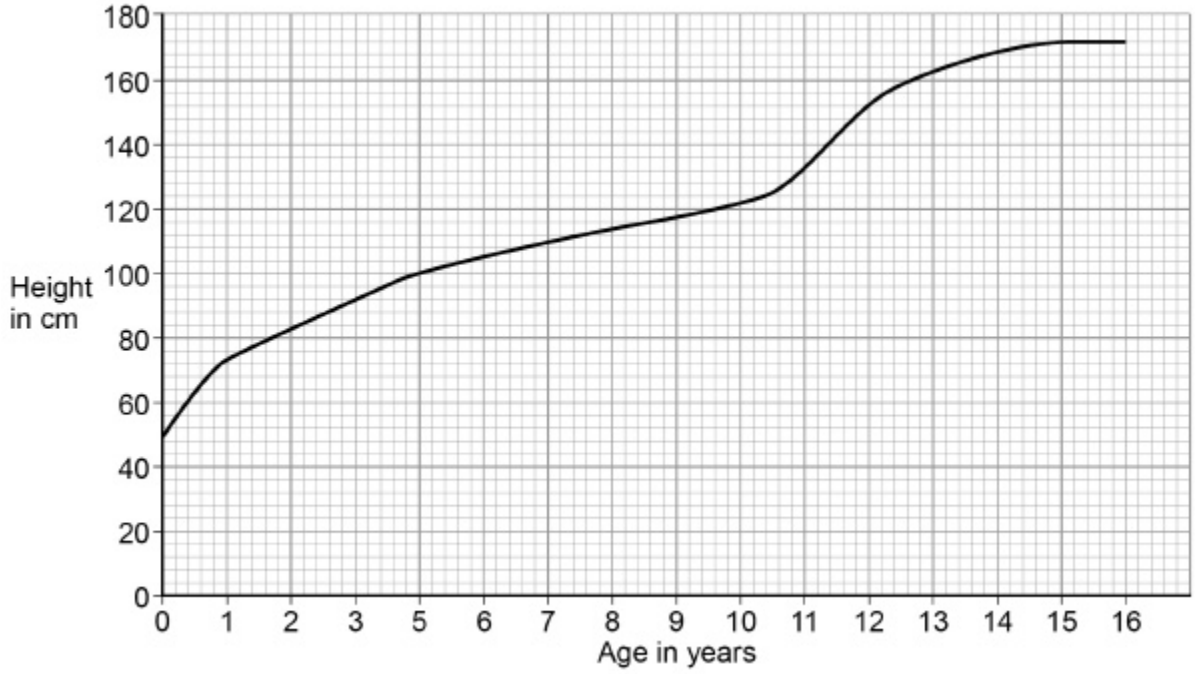
(1)

Cell division continues as an organism grows.

Growth in humans can be measured as an increase in height.

Figure 2 shows the height of a girl from birth (0 years) to 16 years.

Figure 2



(e) **Figure 2** shows the girl grew rapidly between birth and 1 year.

Then the girl grew steadily until a second phase of rapid growth.

At what age did this second phase of rapid growth start?

_____ years

(1)

(f) At what age did the girl stop growing in height?

_____ years

(1)

(g) New cells are still produced even when the girl stops growing.

State **one** use for these new cells **other** than for growth.

_____

(1)

(Total 8 marks)

2 In sexual reproduction, an egg fuses with a sperm.

(a) (i) Draw a ring around the correct answer to complete the sentence.

An egg and a sperm fuse together in the process of

cloning.
fertilisation.
mitosis.

(1)

(ii) Egg cells and sperm cells each contain the structures given in the box.

chromosome	**gene**	**nucleus**

List these three structures in size order, starting with the smallest.

1 _____ (smallest)

2 _____

3 _____ (largest)

(2)

(iii) The egg and the sperm contain genetic material.

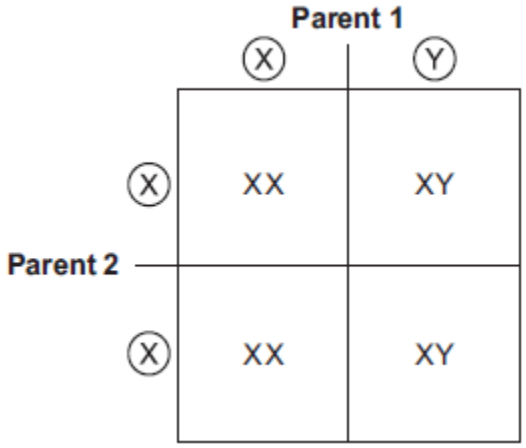
Draw a ring around the correct answer to complete the sentence.

The genetic material is made of

carbohydrate.
DNA.
protein.

(1)

(b) The diagram below shows the inheritance of **X** and **Y** chromosomes.



(i) Draw a tick (✓) on the part of the diagram that shows a sperm cell.

(1)

(ii) What is the chance of having a female child?

Give the reason for your answer.

_____

_____

_____

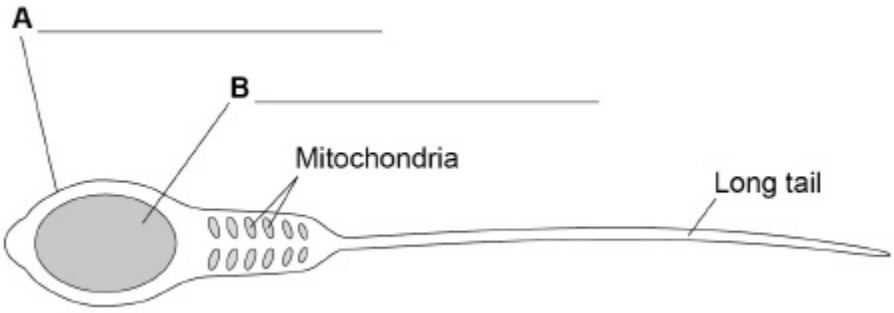
_____

(2)

(Total 7 marks)

3 **Figure 1** shows a human sperm cell.

Figure 1



(a) Label parts **A** and **B** on **Figure 1**.

Use words from the box below.

Cell membrane	**Cell wall**	**Cytoplasm**	**Nucleus**	**Plasmid**

(2)

(b) In **Figure 1** the microscope image of the sperm cell has a length of 12.5 mm.

The sperm cell has been magnified 2500 times.

Calculate the actual length of the sperm cell in mm.

Use the equation:

$$\text{Actual length} = \frac{\text{image length}}{\text{magnification}}$$

Actual length = _____ mm

(2)

(c) Sperm cells contain many mitochondria.

Describe how the mitochondria help the sperm to do its job.

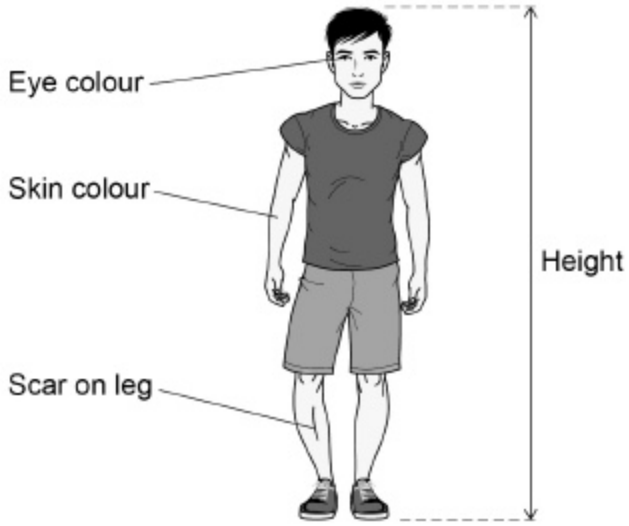
(2)

Figure 2 shows four characteristics of a man.

The characteristics may be due to:

- the environment **only**
- genes **only**
- both genes **and** the environment.

Figure 2



(d) Complete the table.

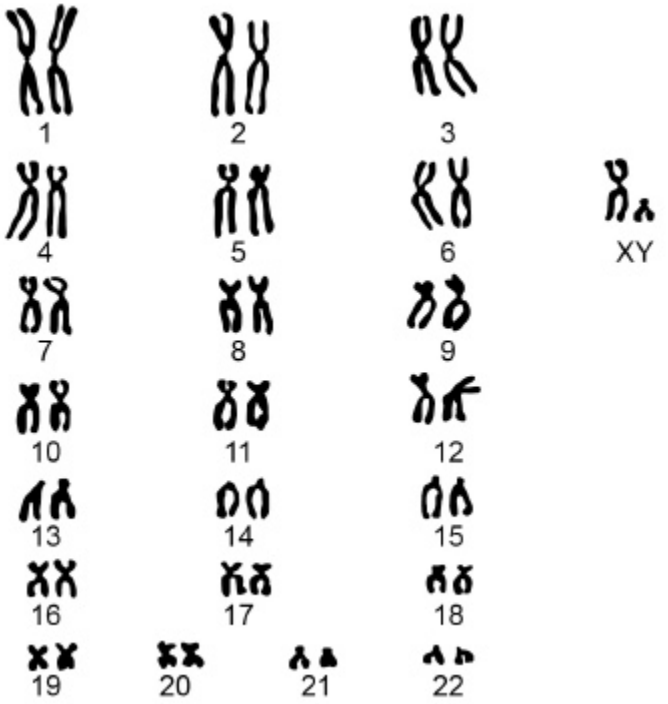
Tick (✓) **one** box in each row to show what each characteristic is due to.

Characteristic	Characteristic is due to		
	Environment only	Genes only	Genes and the environment
Eye colour			
Height			
Scar on leg			
Skin colour			

(2)

Figure 3 shows the full set of chromosomes from a human male.

Figure 3



(e) How can you tell from **Figure 3** that this person is male?

_____

_____

(1)

(f) How many chromosomes are there in a human sperm cell?

_____

(1)

(g) A sperm cell and an egg cell join at fertilisation.

The fertilised egg cell then divides to form an embryo.

Describe how the fertilised egg divides to form an embryo.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 13 marks)

4 Scientists have produced many different types of GM (genetically modified) food crops.

(a) Use words from the box to complete the sentence about genetic engineering.

clones	**chromosomes**	**embryos**	**genes**

GM crops are produced by cutting _____ out of the

_____ of one plant and inserting them into the cells of a crop

plant.

(2)

(b) Read the information about GM food crops.

- Herbicide-resistant GM crops produce higher yields.
- Scientists are uncertain about how eating GM food affects our health.
- Insect-resistant GM crops reduce the total use of pesticides.
- GM crops might breed naturally with wild plants.
- Seeds for a GM crop can only be bought from one manufacturer.
- The numbers of bees will fall in areas where GM crops are grown.

Use this information to answer these questions.

(i) Give **two** reasons why some farmers are in favour of growing GM crops.

1. _____

_____

2. _____

_____

(2)

(ii) Give **two** reasons why many people are against the growing of GM crops.

1. _____

_____

2. _____

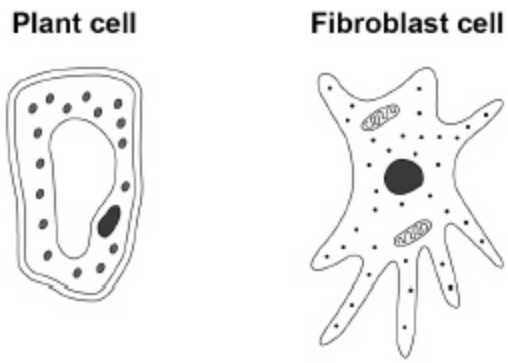
_____

(2)

(Total 6 marks)

5 **Figure 1** shows two different cells. Fibroblast cells can be found in animals.

Figure 1



(a) Give **two** structures found in plant cells that are **not** found in an animal cell.

1. _____

_____

2. _____

_____

(2)

(b) Fibroblast cells make protein fibres.

Which parts of a cell make proteins?

Tick (✓) **one** box.

Cell membrane	☐
Mitochondria	☐
Ribosomes	☐

(1)

(c) Which structure in the fibroblast cell contains chromosomes?

_____

(1)

(d) Chromosomes carry genes.

What is a gene?

_____

_____

_____

_____

(2)

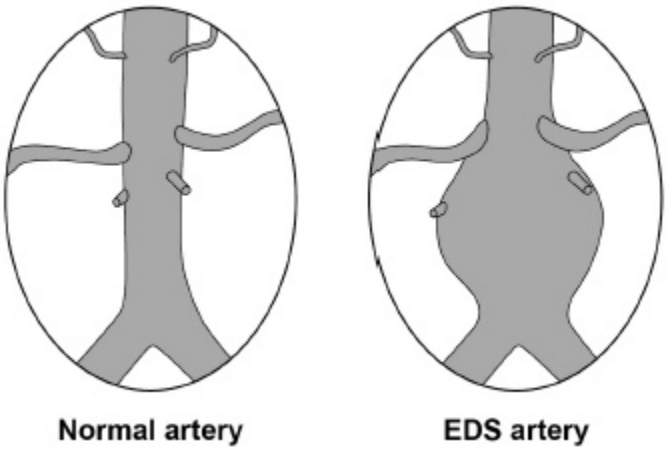
(e) Ehlers Danlos syndrome (EDS) is a genetic disorder caused by a mutated gene.

The fibroblast cells in a person with EDS make very few protein fibres.

Protein fibres provide support for tissues.

Look at **Figure 2**.

Figure 2



Suggest why a person with EDS might bleed from an artery.

_____

_____

_____

_____

(2)

The DNA in the mutated EDS allele has a different sequence of bases from the DNA in a normal allele.

Figure 3 shows the sequence of bases in the same section of DNA from a normal allele and from a mutated EDS allele.

The bases are represented by the letters A, T, C and G.

Figure 3

(f) Identify how the bases have changed in the mutated DNA sequence.

_____

_____

(1)

(g) The table shows DNA base sequences and the amino acids they code for.

DNA base sequence	**Amino acids**
ATT, ATA	Isoleucine
CGA, CGT, CGC	Arginine
CTA, CTG, CTT	Leucine
CCC, CCG	Proline

How will the mutated DNA base sequence alter the amino acid order?

_____

_____

(1)

(h) EDS is caused by a dominant allele.

Two parents have a child who does **not** have EDS.

The mother has EDS.

The father does **not** have EDS.

Draw a genetic diagram to find the probability that the parents' next child will have EDS.

You should identify in your diagram any children who have EDS.

Use the following symbols:

D = allele for EDS
d = allele for not having EDS

Probability = _____

(4)

(Total 14 marks)

6 The number of people in the UK with tumours is increasing.

(a) (i) Describe how tumours form.

_____

_____

(1)

(ii) Tumours can be malignant or benign.

What is the difference between a malignant tumour and a benign tumour?

_____

_____

(1)

(b) Describe how some tumours may spread to other parts of the body.

_____

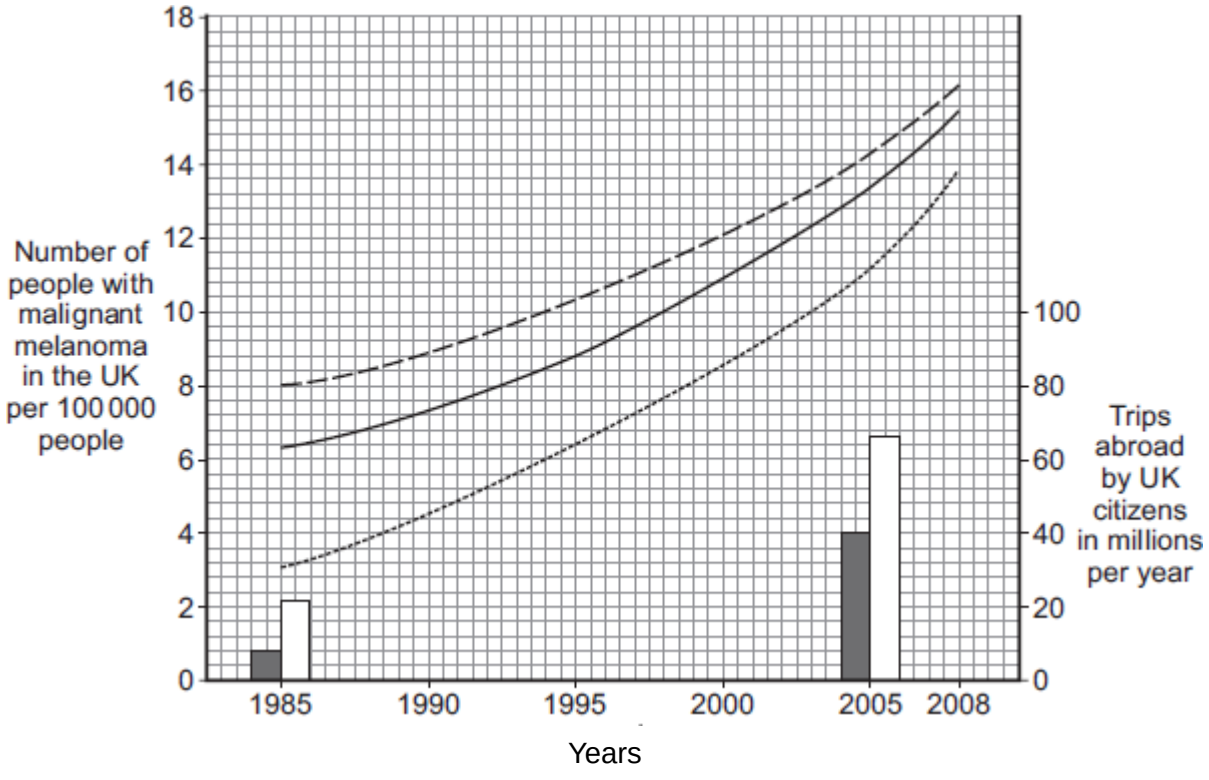
_____

(1)

(c) People from Northern Europe have fair skin and many people have malignant melanoma skin cancer.

The graph shows how the number of people in the UK with malignant melanoma changed between 1985 and 2008.

The bars on the graph show the number of people in the UK who travelled abroad and the number who took cheap holidays in the sun in 1985 and 2005.



Key

——— Mean for all areas

– – – Mean for people from rich areas

—·— Mean for people from poor areas

□ Total number of trips abroad

■ Number of cheap holidays in the sun

(i) Describe the trends in the number of people with malignant melanoma skin cancer between 1985 and 2008.

(3)

(ii) Use the data about the number of trips abroad to suggest an explanation for the trends you have described in part **(c)(i)**.

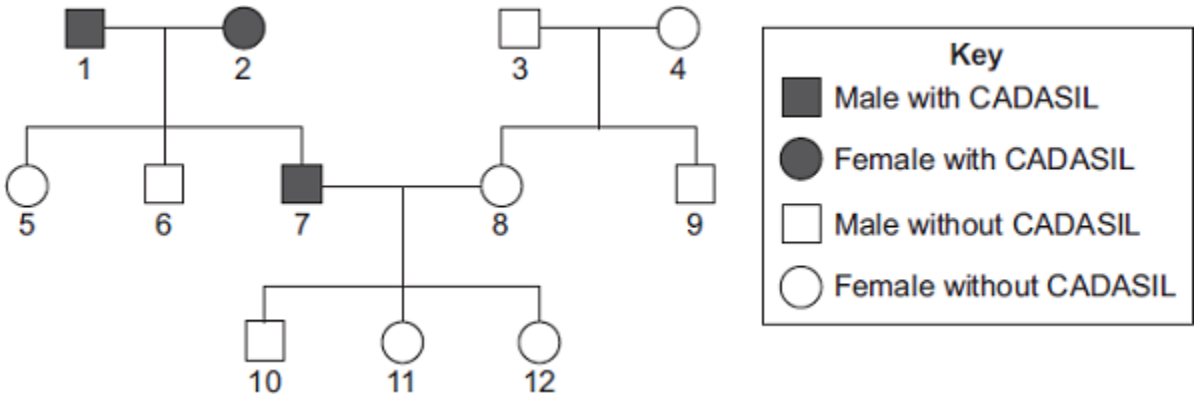
(2)

(Total 8 marks)

7 CADASIL is an inherited disorder caused by a dominant allele.

CADASIL leads to weakening of blood vessels in the brain.

The diagram shows the inheritance of CADASIL in one family.



(a) CADASIL is caused by a *dominant allele*.

(i) What is a *dominant allele*?

(1)

(ii) What is the evidence in the diagram that CADASIL is caused by a dominant allele?

_____

_____

(1)

(iii) Person **7** has CADASIL.

Is person **7** homozygous or heterozygous for the CADASIL allele?

Give evidence for your answer from the diagram.

_____

_____

(1)

(b) Persons **7** and **8** are planning to have another baby.
Use a genetic diagram to find the probability that the new baby will develop into a person with CADASIL.

Use the following symbols to represent alleles.

D = allele for CADASIL
d = allele for not having CADASIL

Probability = _____

(4)

(c) Scientists are trying to develop a treatment for CADASIL using stem cells.

Specially treated stem cells would be injected into the damaged part of the brain.

(i) Why do the scientists use stem cells?

_____

_____

_____

_____

(2)

(ii) Embryonic stem cells can be obtained by removing a few cells from a human embryo. In 2006, scientists in Japan discovered how to change adult skin cells into stem cells. Suggest **one** advantage of using stem cells from adult skin cells.

_____

_____

(1)

(Total 10 marks)

8 Retinoblastoma is one of the most common cancers in children.

It causes malignant tumours to develop in the retina of the eye.

(a) What is a malignant tumour?

_____

_____

_____

_____

_____

_____

(3)

Light receptors are found in the retina of the eye.

Figure 1 shows the number of receptors across a section of a retina in a child without a tumour.

Figure 1

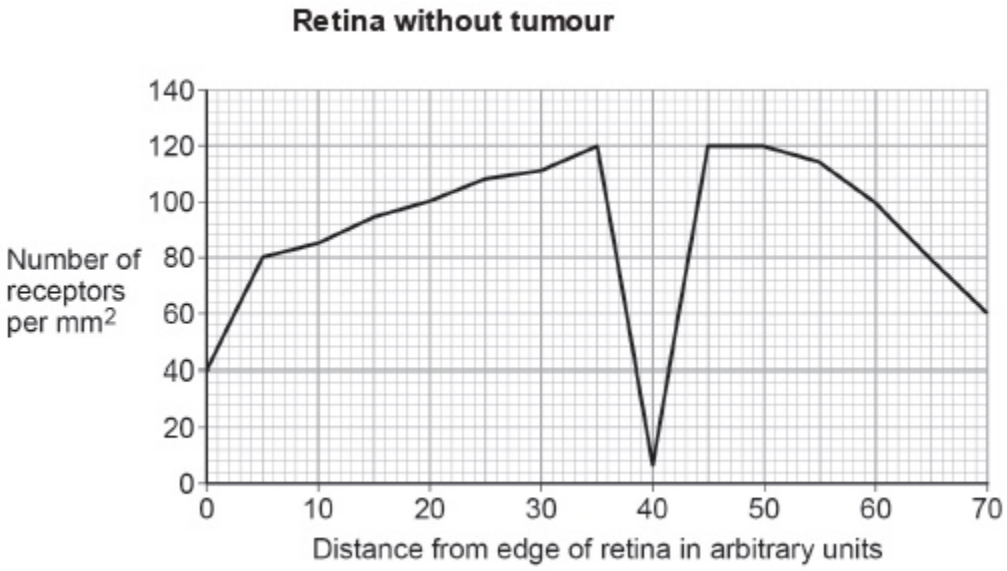
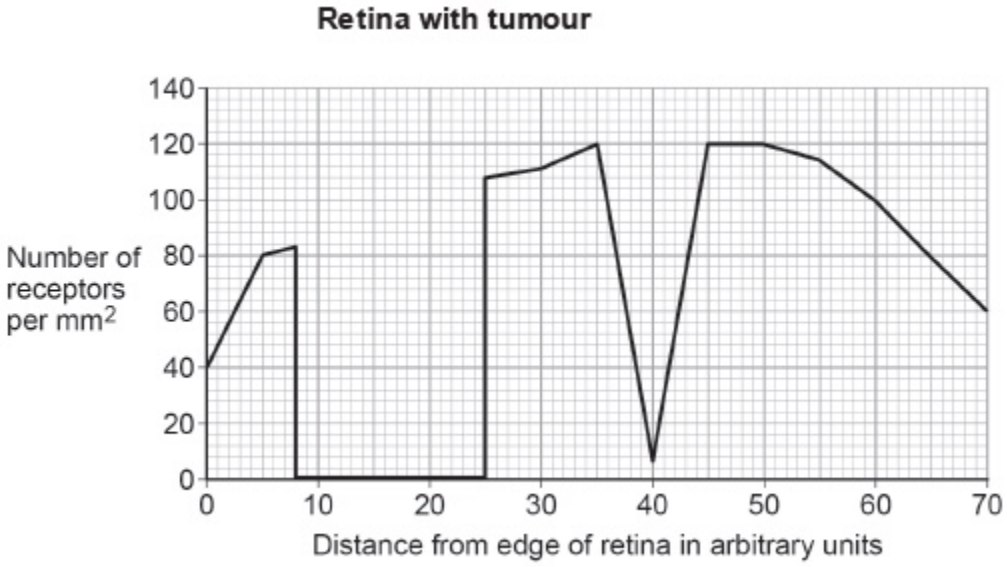


Figure 2 shows the number of receptors across a section of a retina in a child with a tumour.

Figure 2



(b) Describe the effect the tumour has on the receptors in the eye.

Use data from **Figure 1** and **Figure 2**.

_____

_____

(1)

(c) Explain why the changes to the receptors seen in **Figure 1** and **Figure 2** might affect the child's vision.

_____

_____

_____

_____

_____

_____

(2)

Some forms of retinoblastoma are genetically inherited.

The allele for retinoblastoma is recessive.

(d) What does recessive mean?

_____

_____

(1)

(e) A man and a woman have a child who developed retinoblastoma.

Neither parent has retinoblastoma.

Draw a genetic diagram to show the probability that the parents' next child will develop retinoblastoma.

You should identify any of the children with retinoblastoma.

Use the following symbols:

R = allele for not having retinoblastoma

r = allele for retinoblastoma

Probability = _____

(4)

(Total 11 marks)

9 (a) Animal breeders use sexual reproduction to produce new strains of animals.

How does sexual reproduction produce variation?

_____

_____

_____

_____

(2)

(b) A salmon is a type of fish.

Scientists have created a GM (genetically modified) 'super' salmon.

The scientists transferred a gene from a fish called a pout into a salmon. The gene increases the secretion of growth hormone in the salmon. The GM salmon grows much faster than an ordinary salmon, reaching market size up to one year earlier. Many more GM salmon will be grown in fish farms.

(i) Describe how a gene can be transferred from a pout into a salmon.

_____

_____

_____

_____

_____

_____

(3)

(ii) The government might not allow the production of GM salmon.

Suggest **one** reason why.

_____

_____

(1)

(Total 6 marks)

1 (a) A = nucleus

1

B = chromosome

1

(b) gametes

1

(c) fertilisation

1

(d) mitosis

1

(e) 10 (years)

allow 10 to 10.7 years
allow 10 years 0 months to 10 years 9 months

1

(f) 15 (years)

allow 14.6 to 15 years
allow 14 years 9 months to 15 years 0 months

1

(g) replace (worn out/damaged) cells

allow repair

1

[8]

2 (a) (i) fertilisation

1

(ii) in sequence:

accept 1 next to gene, 2 next to chromosome and 3 next to nucleus in box

1 gene
2 chromosome
3 nucleus

*allow 1 mark for smallest **or** largest in correct position*

2

(iii) DNA

1

(b) (i) On diagram:

tick drawn next to **X** and / or **Y** from Parent 1

tick(s) must be totally outside grid squares

allow ticks around "parent "

extra ticks elsewhere cancel

1

(ii) 0.5 / ½ / 50% / 1:1 / 50:50 / 1 in 2

allow 2/4 / 2 in 4 / 2 out of 4 / 'even(s)' / 'fifty – fifty'

*do **not** allow 1:2 or '50 / 50' or '50 – 50'*

1

2 (out of 4) boxes are **XX**

or

half of the sperm contain an **X**-chromosome

*allow **XY** is male and 2 (out of 4) boxes are **XY***

1

[7]

3 (a) **A**. cell membrane

1

B. nucleus

1

(b) $\frac{12.5}{2500}$

1

0.005 (mm)

allow 5×10^{-3}

1

an answer of 0.005 mm scores 2 marks

1

(c) to release energy

*do **not** allow produce / create / make energy*

1

(for) movement (of tail)

1

(d)

Characteristic	Characteristics due to		
	Environment only	Genes only	Genes and the environment
Eye Colour		✓	
Height			✓
Scar on leg	✓		
Skin colour			✓

allow 1 mark for 2 or 3 correct

1

(e) (one X and) one Y chromosome

1

(f) 23

1

(g) mitosis

1

copies of genetic material made

allow genes / chromosomes / DNA is doubled / duplicated

1

(two) genetically identical [body] cells

1

[13]

4 (a) genes

1

chromosomes

1

(b) (i) higher yield

1

less use of pesticides

1

(ii) any **two** from:

- uncertain about effects on health
- fewer bees
- might breed with wild plant
- seeds only from one manufacturer

2

[6]

5 (a) any **two** from:

- cell wall
- (permanent) vacuole
- chloroplasts

2

(b) ribosomes

1

(c) nucleus

1

(d) section of DNA

1

[that] codes for a protein

1

(e) weak/thin blood vessel wall/lining

1

likely to burst/leak

allow rupture for burst/leak

1

(f) identification of change from CGC to CCC

allow if clearly identified on Figure 3

1

View with Figure 3

Mark with (g)

(g) (amino acid changed from) arginine to proline

allow ecf from (f)

1

Mark with (f)

(h) genetic diagram including:

allow alternative symbols if defined

correct gametes **or** parental genotypes

*do **not** allow if alternative symbols used and not defined*

1

D and **d** and **d** and **d**
or **Dd** and **dd**

offspring genotypes correctly derived:

allow genotypes correct for student's parental gametes

1

Dd Dd dd dd

identification of **Dd** as child with EDS

allow correct identification of student's offspring genotypes

1

0.5 / ½ / 1 in 2 / 50% / 1 : 1

allow ecf from student's derivation.

1

[14]

6 (a) (i) (as a result of) uncontrolled / abnormal growth / division of cells

ignore mutation

allow cells dividing with no contact inhibition

1

(ii) benign tumours do not invade / spread to other tissues / do not form secondary tumours

accept converse for malignant

accept benign tumours do not metastasise

1

(b) via the blood / circulatory system

accept via lymphatic system

1

(c) (i) incidence is increasing

1

more rapidly (over the years)

ignore figures

1

difference between rich and poor areas is getting less

or

the incidence is rising fastest in people from poor areas

accept converse for people from rich areas

1

(ii) risk factor is UV from sunlight

ignore ionising radiation

1

more UK citizens going abroad or taking holidays in the Sun

or

poorer people can afford holidays in the Sun

or

more poorer people are taking holidays in the Sun

1

[8]

7 (a) (i) allele expressed even when other allele present **or** expressed if just one copy of allele is present **or** expressed if heterozygous

if present other allele not expressed

1

(ii) 2 affected parents have unaffected child **or 1** and **2** → **5** / **6**

or if recessive all of **1** and **2**'s children would have CADASIL

1

(iii) heterozygous – has unaffected children **or** because if homozygous all children would have CADASIL

1

(b) genetic diagram including:

accept alternative symbols, if defined

1

correct gametes:

D and **d**
and d (and **d**)

ignore 7 / 8 or male / female

1

derivation of offspring genotypes:

Dd Dd dd dd

*allow just **Dd dd** if ½-diagram*
allow ecf if correct for student's gametes

1

identification **of Dd** as CADASIL
or dd as unaffected
allow ecf if correct for student's gametes

1

correct probability: 0.5 / ½ / 1 in 2 / 50% / 1 : 1

1

(c) (i) stem cells can differentiate **or** are undifferentiated / unspecialised

1

can form blood vessel cells / brain cells

or

stem cells can divide

1

(ii) ethical argument - eg no risk of damage to embryo or adult can give consent for removal of cells **or** adult can re-grow skin

more ethical qualified

ignore religion unqualified

or
if from a relative then less chance of rejection **or** if from self then no chance of rejection
or
skin cells more accessible

1

[10]

8 (a) any **three** from:

- uncontrolled/abnormal growth of cells

  ignore ref to cancer

- which can invade other/neighbouring tissues
- (cells) spread to other organs
  or in the blood
  or to the rest of the body
- form secondary tumours in other organs

  allow can metastasize

3

(b) destroys/no receptors between 8 and 25 arbitrary units.

1

(c) any **two** from:

- where there are no receptors light will not be detected
- so no impulses are sent to the brain
- so no image is formed there

or

so there is a gap in the vision/visual field

2

(d) only expressed if the dominant/other (allele) is not present

or

only expressed if 2 (recessive alleles) are present

allow will not be expressed if the dominant (allele) is present

1

(e) parental genotypes correctly identified (on genetic diagram) as:

Rr **and** Rr
(correct parental genotypes) **Rr** and **Rr**

or

(correct gametes) **R** and **r** and **R** and **r**

1

offspring genotypes correctly derived (may be shown in a diagram, *allow ecf from parental gametes*)

RR Rr Rr rr

1

identification of **rr** as having retinoblastoma

eg rr − has retinoblastoma

1

probability correct as 0.25

allow 25 / 25% / $\frac{1}{4}$ / 1 in 4 / 1 out of 4 or 1:3 ratio

*do **not** allow 3:1 or 4:1*

1

[11]

9 (a) fusion of gametes / named gametes

allow meet / join / fertilise

1

results in mixing of genetic information / DNA / chromosomes

accept genetic information / DNA / chromosomes from two parents

1

(b) (i) use enzyme

1

to cut gene from pout <u>chromosome / DNA</u>

1

insert <u>gene</u> into salmon chromosome / DNA / egg / embryo / nucleus

accept use of plasmid as carrier

ignore salmon / cell

1

(ii) eg fear of gene transfer to wild salmon / extinction of wild salmon / fear of harmful effect on consumers / unsure of long term effects

ignore cruel / ethics / morals / religion / unnatural / economics

1

[6]