CELL DIVISION / QUESTIONS

Q1.

When an organism grows, new cells are produced by cell division.

(a) What type of cell division happens to produce new body cells?

Tick **one** box.

Differentiation	☐
Meiosis	☐
Mitosis	☐

(1)

(b) Why can cancers grow very large?

Tick **one** box.

Cancer cells are specialised	☐
Cell division is slow	☐
Cell division is uncontrolled	☐

(1)

(c) Give **one** factor which increases the risk of getting cancer.

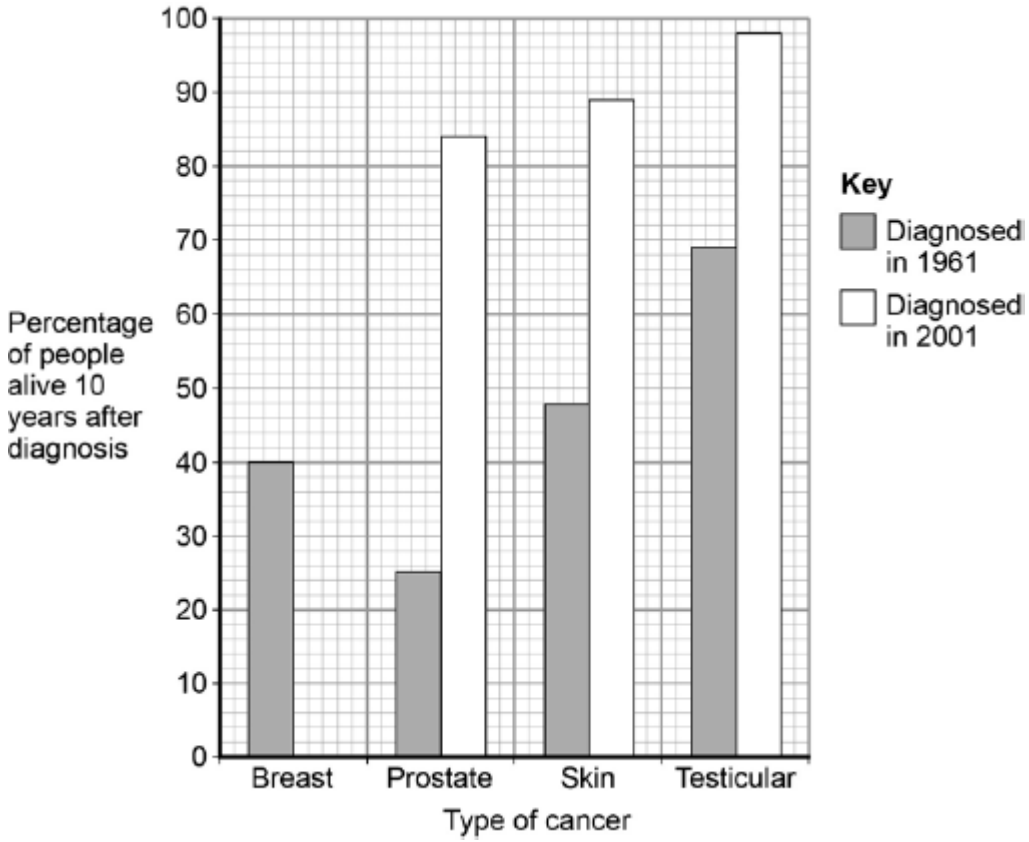
_____

(1)

(d) Survival rates for people with cancer have improved a lot.

People who are alive 10 years after diagnosis are usually considered to be cured.

The figure below shows data for people diagnosed with cancer in 1961 and 2001.



78% of people diagnosed with breast cancer in 2001 were alive 10 years later.

Complete the figure above to show this information.

(1)

(e) Which type of cancer diagnosed in 1961 had the highest survival rate?

Tick **one** box.

Breast ☐

Prostate ☐

Skin ☐

Testicular ☐

(1)

(f) Which type of cancer shows the biggest improvement in the percentage of people alive after 10 years?

Tick **one** box.

Breast ☐

Prostate ☐

Skin ☐

Testicular ☐

(1)

(g) Suggest **two** reasons why the survival rates for all cancers have increased.

1. _____

_____

2. _____

_____

(2)

(Total 8 marks)

Q2.

(a) In humans there are two types of cell division: **mitosis** and **meiosis.**

The table below gives statements about cell division.

Tick (✓) **one** box in each row to show if the statement is true for mitosis only, for meiosis only, or for both mitosis **and** meiosis.

The first row has been done for you.

Statement	**Mitosis only**	**Meiosis only**	**Both mitosis and meiosis**
How cells are replaced	✓		
How gametes are made			
How a fertilised egg undergoes cell division			
How copies of the genetic information are made			
How genetically identical cells are produced			

(4)

(b) Stem cells can be taken from human embryos.

In therapeutic cloning, an embryo is produced that has the same genes as the patient.

(i) Name **one** source of human stem cells, other than human embryos.

_____

(1)

(ii) Stem cells from embryos can be transplanted into patients for medical treatment.

Give **one** advantage of using stem cells from embryos, compared with cells from the source you named in part (i).

(1)

_____

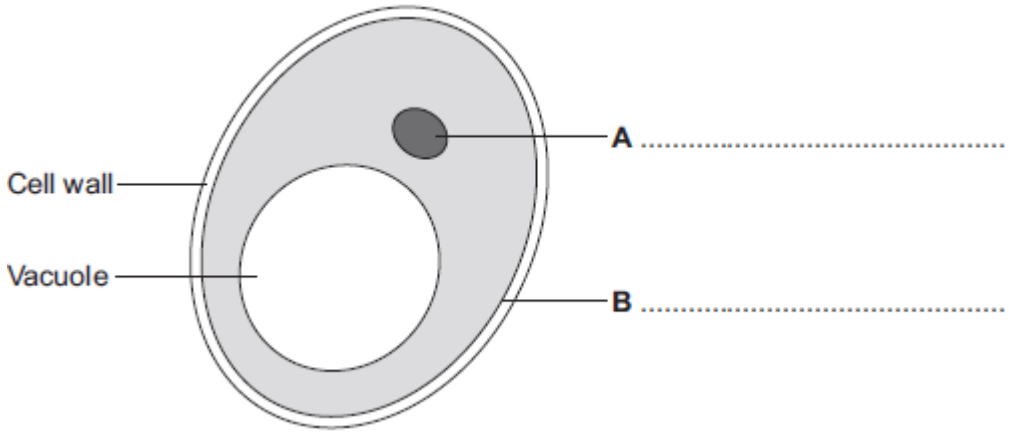
_____

(Total 6 marks)

Q3.

Human cells and yeast cells have some parts that are the same.

(a) The diagram shows a yeast cell.



Parts **A** and **B** are found in human cells and in yeast cells. On the diagram, label parts **A** and **B**.

(2)

(b) Many types of cell can divide to form new cells.

Some cells in human skin can divide to make new skin cells.

Why do human skin cells need to divide?

_____

_____

(1)

(c) Human stem cells can develop into many different types of human cell.

(i) Use the correct answer from the box to complete the sentence.

embryos	**hair**	**nerve cells**

Human stem cells may come from

_____

(1)

(ii) Use the correct answer from the box to complete the sentence.

cystic fibrosis	**paralysis**	**polydactyly**

Human stem cells can be used to treat

_____

(1)

(Total 5 marks)

Q4.

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.

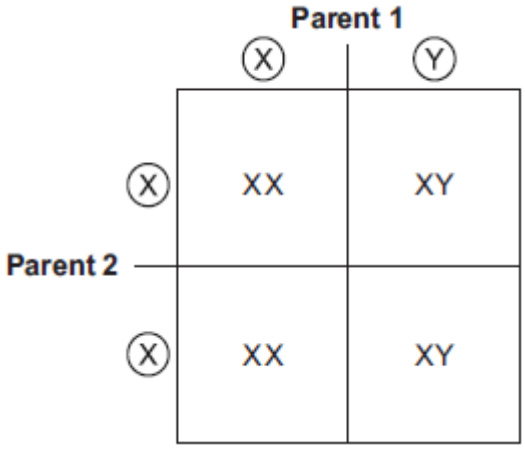
Draw a ring around the correct answer to complete the sentence.

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)

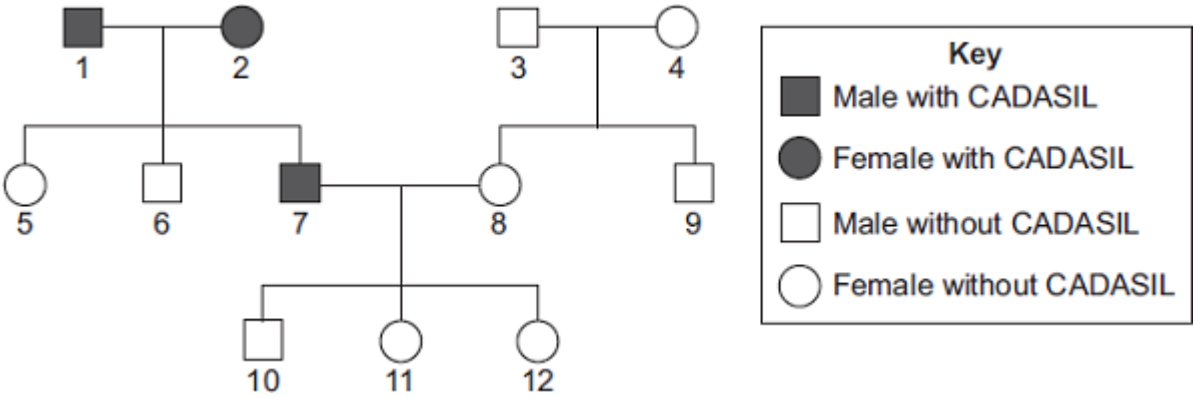
(Total 7 marks)

Q5.

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)

Q6.

(a) (i) Mitosis and meiosis are types of cell division.

For each feature in the table, tick (✓) **one** box to show if the feature occurs:

- only in mitosis
- only in meiosis.

Feature	Only in mitosis (✓)	Only in mitosis (✓)
Produces new cells during growth and repair		
Produces gametes (sex cells)		
Produces genetically identical cells		

(2)

(ii) Name the organ that produces gametes (sex cells) in:

a man _____

a woman _____

(2)

(b) **X** and **Y** chromosomes are the sex chromosomes. They determine a person's sex.

What sex chromosomes will be found in the body cells of:

(i) a man _____

(1)

(ii) a woman? _____

(1)

(c) A man and a woman decide to have a child.

What is the chance that the child will be a boy? _____

(1)

(Total 7 marks)

Q7.

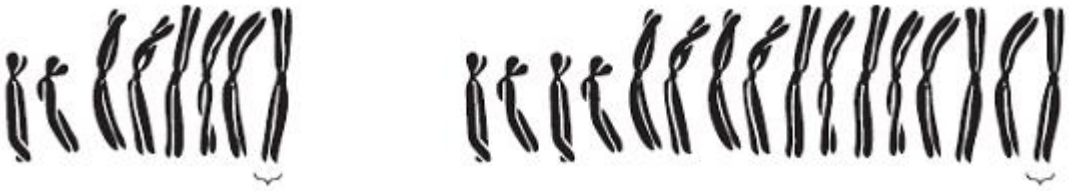
The photographs show the flowers of two closely-related species of plant.

Species A Species B

Images: © iStock/Thinkstock

The drawings show chromosomes from one cell in the root of each plant during cell division.

Species A Species B



One chromosome **One chromosome**

(a) The drawings show that each chromosome has two strands of genetic material.

(i) How does a chromosome become two strands?

_____

_____

(1)

(ii) Explain why each chromosome must become two strands before the cell divides.

_____

_____

_____

_____

(2)

(b) For sexual reproduction, the plants produce gametes.

(i) Name the type of cell division that produces gametes. _____

(1)

(ii) How many chromosomes would there be in a gamete from each of these two plant species?

Species A ☐ **Species B** ☐

(1)

(iii) It is possible for gametes from **Species A** to combine with gametes from **Species B** to produce healthy offspring plants.
How many chromosomes would there be in each cell of one of the offspring plants? ☐

(1)

(c) (i) Look back at the information at the start of the question and the information from part (b).

What evidence from these two pieces of information supports the belief that **Species A** and **Species B** evolved from a common ancestor?

_____

_____

_____

_____

(2)

(ii) For successful gamete production to take place, chromosomes that contain the same genes must pair up.

The drawings showing the chromosomes of **Species A** and of **Species B** are repeated below.

Species A Species B

The offspring plants cannot reproduce sexually.

Suggest an explanation for this.

_____

_____

_____

_____

_____

_____

(2)

(Total 10 marks)

Q8.

Stem cells can be collected from human embryos and from adult bone marrow.
Stem cells can develop into different types of cell.

The table gives information about using these two types of stem cell to treat patients.

Stem cells from human embryos	Stem cells from adult bone marrow
It costs £5000 to collect a few cells.	It costs £1000 to collect many cells.
There are ethical issues in using embryo stem cells.	Adults give permission for their own bone marrow to be collected.
The stem cells can develop into most other types of cell.	The stem cells can develop into only a few types of cell.
Each stem cell divides every 30 minutes.	Each stem cell divides every four hours.
There is a low chance of a patient's immune system rejecting the cells.	There is a high chance of a patient's immune system rejecting the cells.
More research is needed into the use of these stem cells.	Use of these stem cells is considered to be a safe procedure.

Scientists are planning a new way of treating a disease, using stem cells.

Use **only** the information above to answer these questions.

(a) Give **three** advantages of using stem cells from embryos instead of from adult bone marrow.

1. _____

2. _____

3. _____

(3)

(b) Give **three** advantages of using stem cells from adult bone marrow instead of from embryos.

1. _____

2. _____

3. _____

(3)

(Total 6 marks)

Q9.

Read the information about stem cells.

> Stem cells are used to treat some human diseases.
>
> Stem cells can be collected from early embryos. These stem cells have not begun to differentiate, so they could be used to produce any kind of cell, tissue or organ. The use of embryonic stem cells to treat human diseases is new and, for some diseases, trials on patients are happening now.
>
> Stem cells can also be collected from adult bone marrow. The operation is simple but may be painful. Stem cells in bone marrow mainly differentiate to form blood cells. These stem cells have been used successfully for many years to treat some kinds of blood disease. Recently there have been trials of other types of stem cell from bone marrow. These stem cells are used to treat diseases such as heart disease.

Evaluate the use of stem cells from embryos or from adult bone marrow for treating human diseases.

You should give a conclusion to your evaluation.

_____

_____

_____

_____

_____

_____

_____

_____

_____

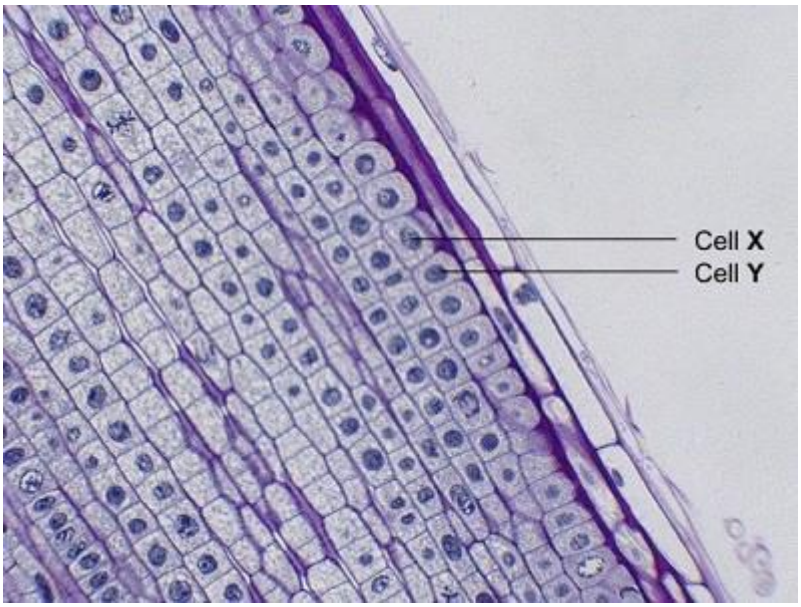
_____

(5)

(Total 5 marks)

Q10.

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)

Q11.

The diagram shows a strawberry plant.

The parent plant grows side shoots.

New plants grow on the side shoots.

The new plants will all have the same inherited characteristics as the original parent plant.

Complete the sentences to explain why.

Use words from the box.

asexual	**differentiation**	**embryos**	**fertilisation**
gametes	**genes**	**mitosis**	**sexual**

(a) The new plant is produced by _____ reproduction.

(1)

(b) In this type of reproduction, body cells divide by _____

(1)

(c) The new plant has the same _____ as the parent plant.

(1)

(Total 3 marks)

Q12.

The table shows the number of chromosomes found in each body cell of some different organisms.

Animals		**Plants**	
Species	**Number of chromosomes in each body cell**	**Species**	**Number of chromosomes in each body cell**
Fruit fly	8	Tomato	24
Goat	60	Potato	44
Human	46	Rice	24

(a) Nearly every organism on earth has an even number of chromosomes in its body cells.

Suggest why.

_____

_____

(1)

(b) Chromosomes contain DNA molecules.

Describe the function of DNA.

_____

_____

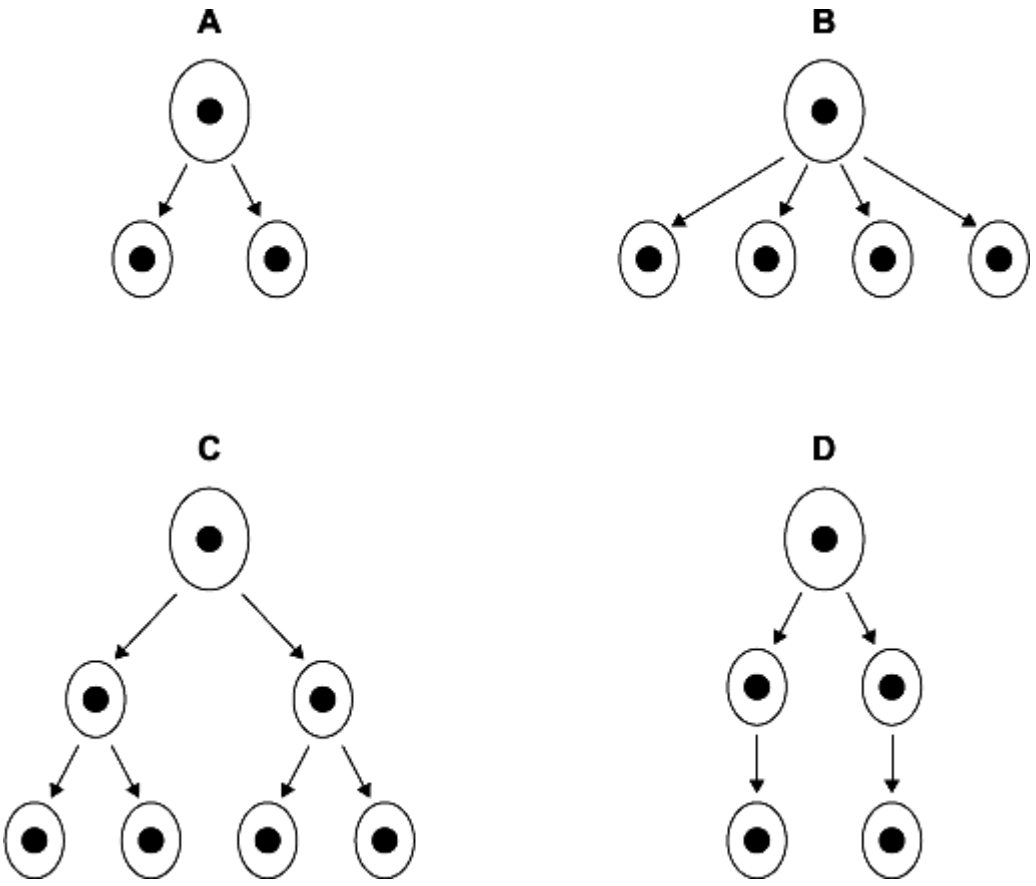
_____

_____

(2)

(c) Gametes are made in the testes by meiosis.

(i) Look at the diagrams.



Which diagram, **A**, **B**, **C** or **D**, represents how cell division by meiosis produces

gametes in the testes? ☐

(1)

(ii) How many chromosomes will each goat gamete contain?

_____

(1)

(d) Body cells divide by mitosis.

(i) Why is the ability of body cells to divide important?

_____

_____

(1)

(ii) When a body cell of a potato plant divides, how many chromosomes will each of the new cells contain?

_____

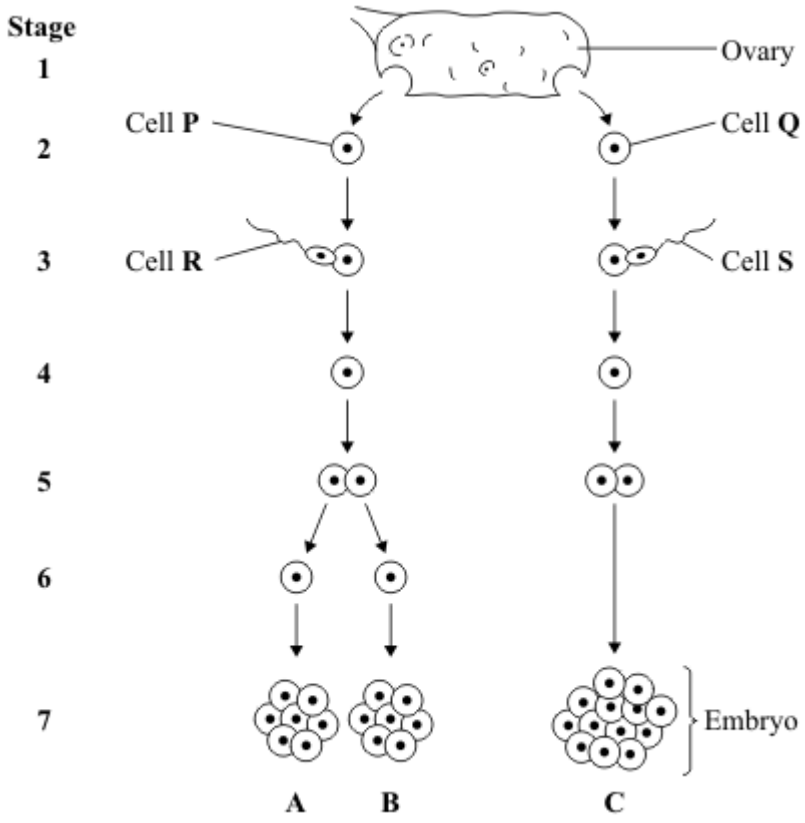
(1)

(Total 7 marks)

Q13.

A woman gives birth to triplets.
Two of the triplets are boys and the third is a girl.
The triplets developed from two egg cells released from the ovary at the same time.

The diagram shows how triplets **A**, **B** and **C** developed.



(a) Which stages on the diagram show gametes?

Draw a ring around your answer.

1 and 2 **2 and 3** **3 and 7** **1 and 7**

(1)

(b) Embryo **B** is male.

Which of the following explains why embryo **B** is male?

Tick (✓) **one** box.

Cell **P** has an X chromosome; cell **R** has an X chromosome. ☐

Cell **P** has a Y chromosome; cell **R** has an X chromosome. ☐

Cell **P** has an X chromosome; cell **R** has a Y chromosome. ☐

(1)

(c) The children that develop from embryos **A** and **C** will **not** be identical.

Explain why.

You may use words from the box in your answer.

egg	**genes**	**sperm**

_____

_____

_____

_____

_____

(2)

(d) Single cells from an embryo at **Stage 7** can be separated and grown in a special solution.

(i) What term describes cells that are grown in this way?

Draw a ring around your answer.

lleles **screened cells** **stem cells**

(1)

(ii) What happens when the cells are placed in the special solution?

Tick (✓) **two** boxes.

The cells divide ☐

The cells fertilise ☐

The cells differentiate ☐

The cells separate ☐

(2)

(iii) Give **one** use of cells grown in this way.

_____

_____

(1)

(iv) Some people might object to using cells from embryos in this way.

Give **one** reason why.

_____

_____

_____

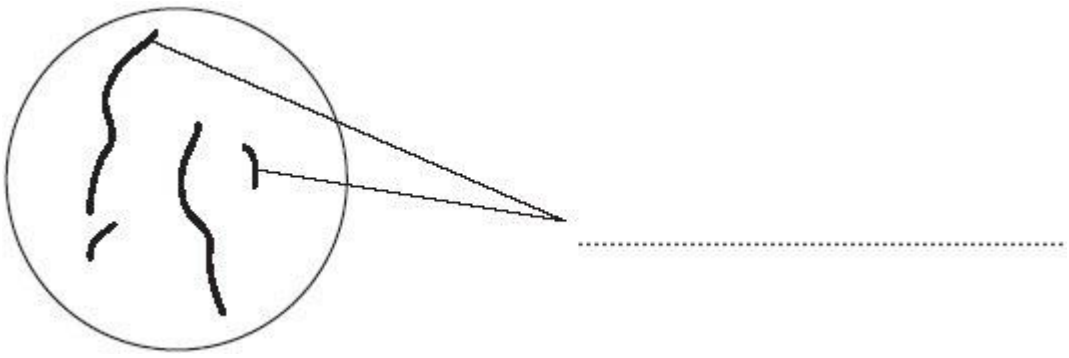
(1)

(Total 9 marks)

Q14.

Diagram 1 shows the nucleus of a body cell as it begins to divide by mitosis.

Diagram 1



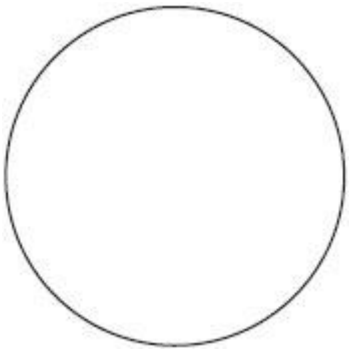
(a) Use a word from the box to label **Diagram 1**.

alleles	**chromosomes**	**gametes**

(1)

(b) Complete **Diagram 2** to show what the nucleus of one of the cells produced by this mitosis would look like.

Diagram 2



(1)

(c) Stem cells from a recently dead embryo can be grown in special solutions.

Some facts about stem cells are given below.

- Stem cells from an embryo can grow into any type of tissue.
- Stem cells may grow out of control, to form cancers.
- Large numbers of stem cells can be grown in the laboratory.
- Stem cells may be used in medical research or to treat some human diseases.
- Patients treated with stem cells need to take drugs for the rest of their life to prevent rejection.
- Collecting and growing stem cells is expensive.

Use **only** the information above to answer these questions.

(i) Give **two** advantages of using stem cells.

1. _____

_____

2. _____

_____

(2)

(ii) Give **two** disadvantages of using stem cells.

1. _____

_____

2. _____

_____

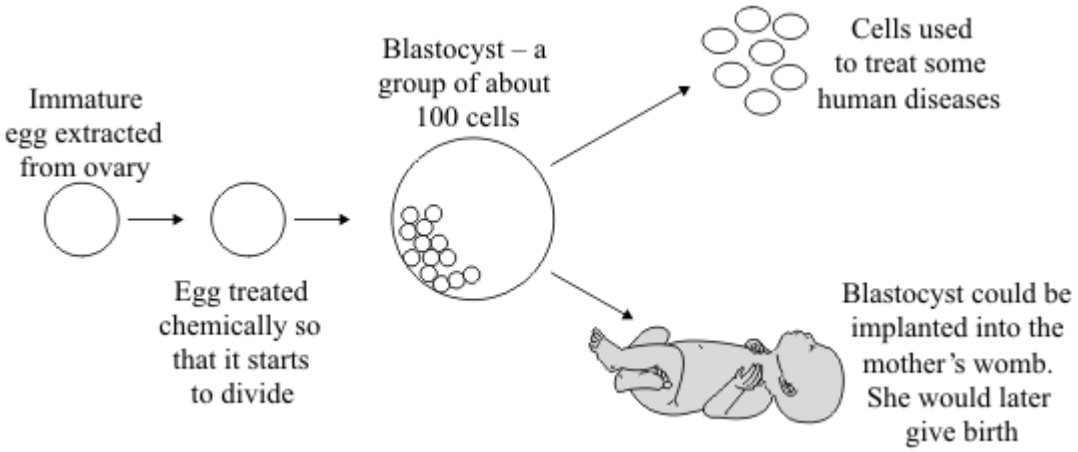
(2)

(Total 6 marks)

Q15.

The diagram shows how an immature egg could be used either to produce cells to treat

some human diseases or to produce a baby.



Scientists may be allowed to use this technique to produce cells to treat some human diseases, but not to produce babies.

Using information from the diagram, suggest an explanation for this.

_____

_____

_____

_____

_____

_____

_____

_____

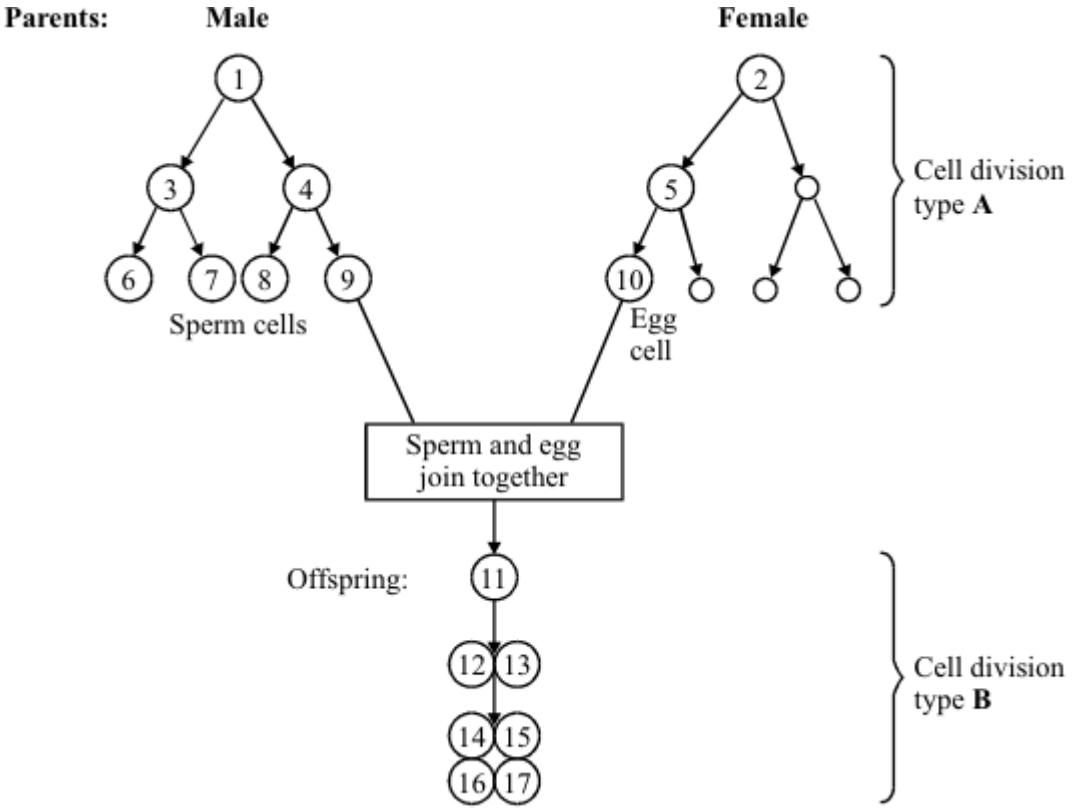
_____

_____

(Total 4 marks)

Q16.

The diagram shows two patterns of cell division. Cell division type **A** is used in gamete formation. Cell division type **B** is used in normal growth.



(a) Name the two types of cell division, **A** and **B**, shown in the diagram.

Type **A** _____

Type **B** _____

(2)

(b) Name the process in which an egg and sperm join together.

_____

(1)

(c) Cell **1** contains 46 chromosomes. How many chromosomes will there be in:

(i) cell **10**; _____

(1)

(ii) cell **14**? _____

(1)

(Total 5 marks)

Q17.

Meiosis and mitosis are different types of division in human cells. Compare the two processes by referring to where each takes place and the kind of products that are made.

_____

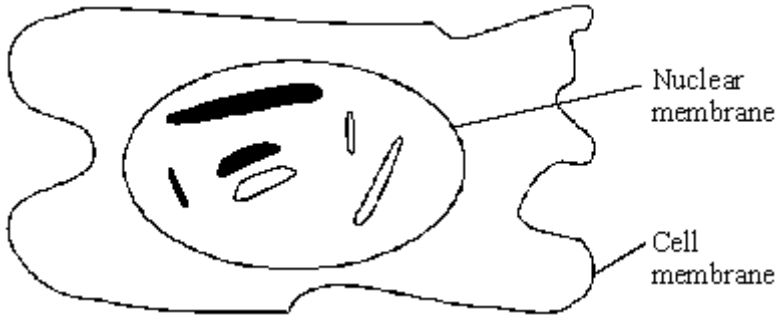
_____

_____

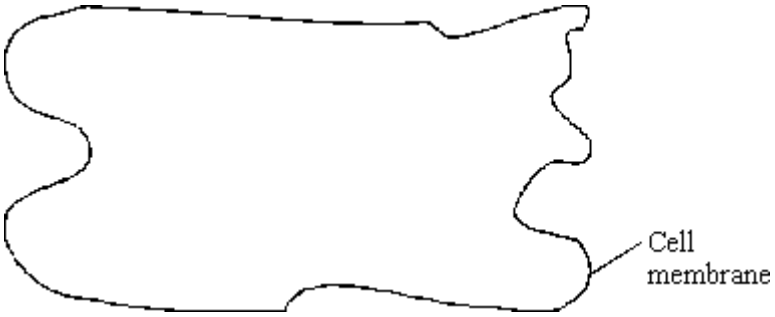
(Total 6 marks)

Q18.

(a) The diagram shows a normal body cell which has six chromosomes.

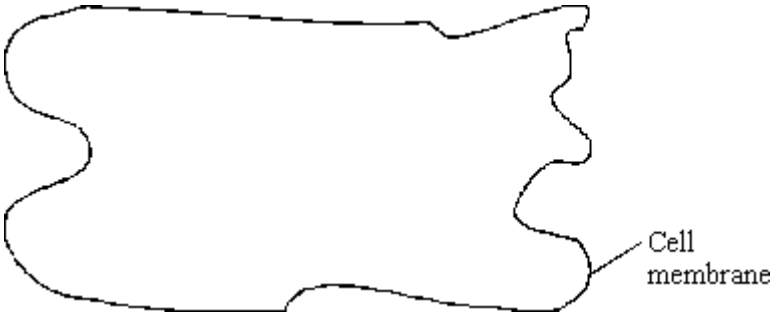


(i) Complete the diagram below to show **one** cell produced from this cell by *mitosis.*



(3)

(ii) Complete the diagram below to show **one** cell produced from the original cell by *meiosis.*



(2)

(b) Thalassaemia is a blood disease. It is determined by a single recessive allele. A person with one recessive allele does **not** get the disease but does act as a carrier. People with this pair of recessive alleles can become ill.

(i) Draw a genetic diagram to show the inheritance of' this disease if both parents are heterozygous.

[Use the symbols T = dominant allele and t = recessive allele]

(3)

(ii) What are the chances of a baby inheriting the disease?

_____

(1)

(iii) What are the chances of a baby being a carrier if both parents are heterozygous?

_____

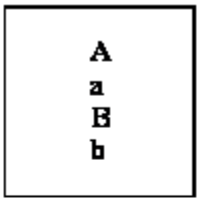
(1)

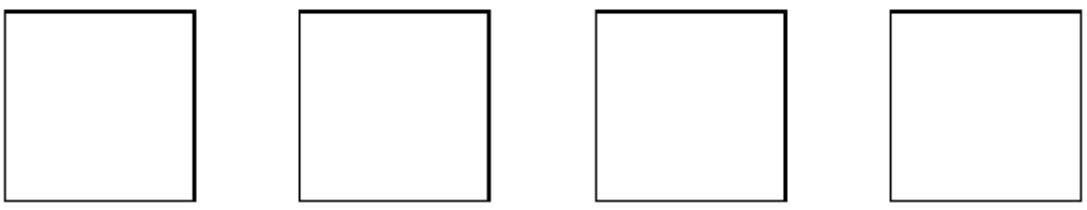
(Total 10 marks)

Q19.

In the cell shown in the diagram as a box, one chromosome pair has alleles **Aa**. The other chromosome pair has alleles **Bb**. The cell undergoes meiosis.

(a) Complete the diagram of the four gametes to show the independent assortment, or reassortment, of genetic material during meiosis.

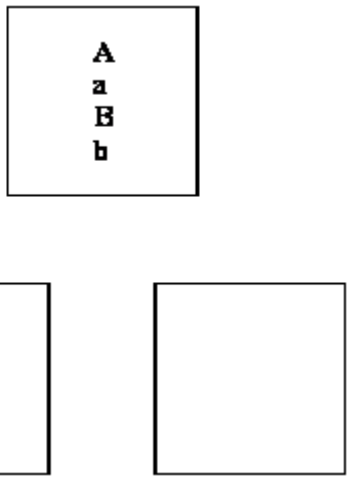




(2)

(b) If the cell undergoes mitosis instead of meiosis, draw the two daughter cells which

result to show the chromosomes in each.



(2)

(c) State the number of chromosomes in:

(i) a normal human cell;

_____

(1)

(ii) a human gamete;

_____

(1)

(iii) the daughter cell from mitosis of a human cell.

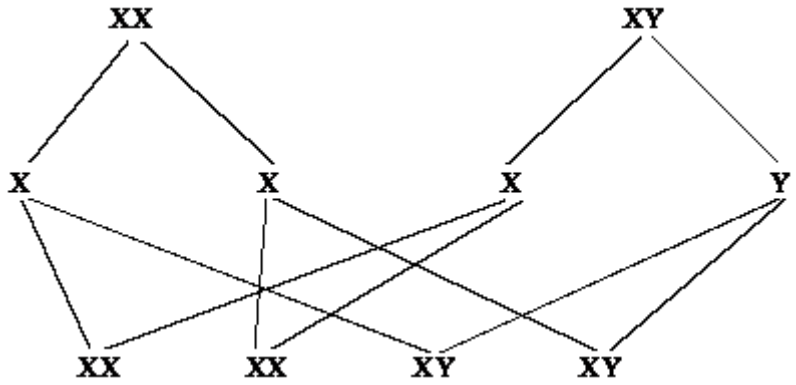
_____

(1)

(Total 7 marks)

Q20.

The genetic diagram shows how the chromosomes divide and combine in human reproduction.



(a) Draw circles around the symbols for the **two** male gametes.

(2)

(b) State the chance of a child being a girl.

_____

(1)

(c) (i) How many pairs of chromosomes are there in a human body cell?

_____

(1)

(ii) How many chromosomes are there in a human egg cell?

_____

(1)

(d) Chromosomes contain genes. From what substance are genes made?

_____

(1)

(e) In the process of mitosis, how do the number of chromosomes in the daughter cells compare to that in the original cell?

_____

(1)

(Total 7 marks)

Q21.

(a) How many pairs of chromosomes are there in a body cell of a human baby?

_____

(1)

(b) Place the following in order of size, **starting with the smallest,** by writing numbers **1 – 4** in the boxes underneath the words.

chromosome	nucleus	gene	cell
☐	☐	☐	☐

(1)

(c) For a baby to grow, its cells must develop in a number of ways.

Explain how each of the following is part of the growth process of a baby.

(i) Cell enlargement

_____

(1)

(ii) The process of cell division by mitosis

_____

_____

_____

_____

_____

_____

(3)

(d) Why is cell specialisation (differentiation) important for the development and growth of a healthy baby from a fertilised egg?

_____

_____

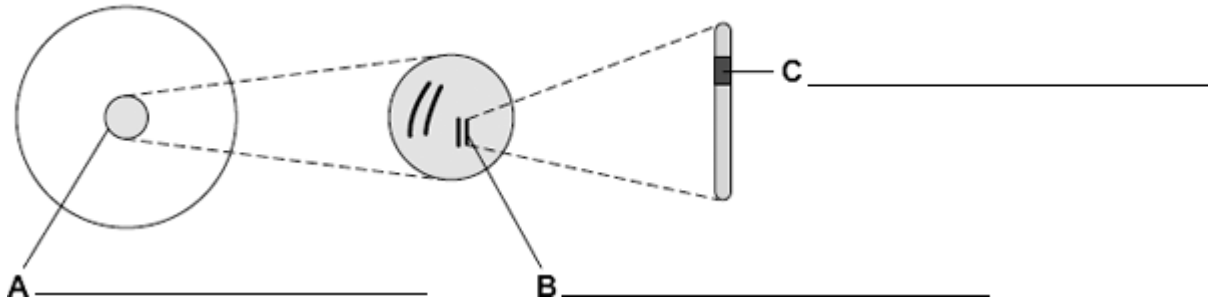
(2)

(Total 8 marks)

Q22.

Diagram 1 shows an animal cell and some of the structures inside the cell.

Diagram 1



(a) Use words from the box to label structures **A**, **B** and **C**, on **Diagram 1**.

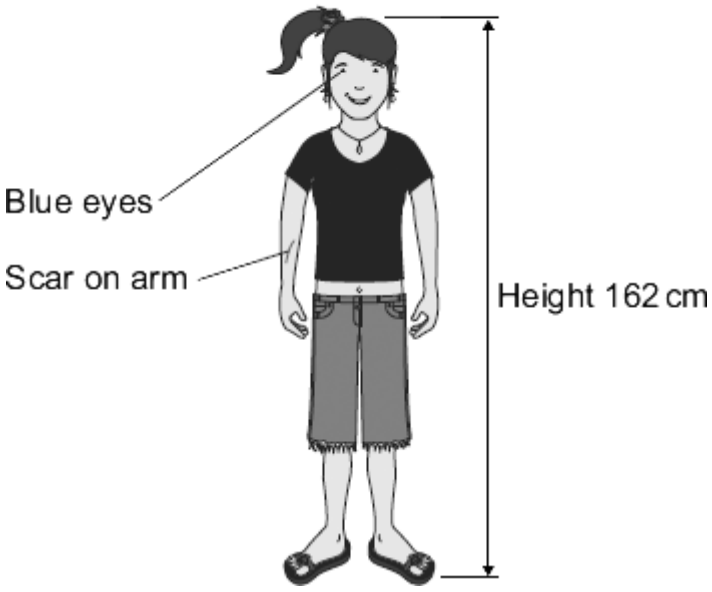
Characteristic	**Chromosome**	**Gamete**	**Gene**	**Nucleus**

(3)

(b) Factors that may affect characteristics include genes and the environment.

Diagram 2 shows some of the characteristics of a girl.

Diagram 2



Draw **one** line from each characteristic in **List A** to the factor(s) that affect the characteristic in **List B**.

List A **Characteristic**	**List B** **Factor(s) that affect the characteristic**
	Affected by genes only
Blue eyes	
	Affected by environment only
Height 162 cm	
	Affected by both genes and the environment
Scar on arm	
	Affected by neither genes nor the environment

(3)

(Total 6 marks)