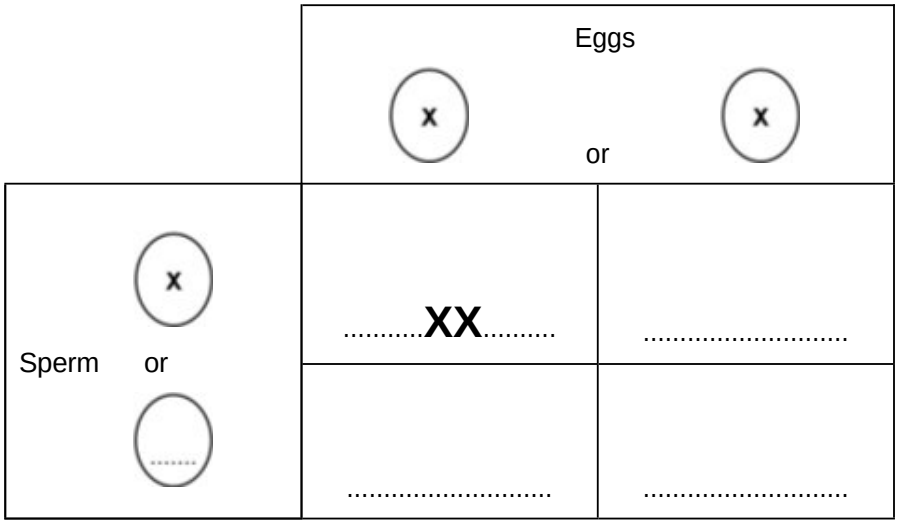
Q1. In humans, sex chromosomes control whether a person is male or female.

(a) Use letters **X** and **Y** to complete the Punnett square for sex inheritance.



(3)

(b) A couple already have three boys.

What is the probability that their next child will be a girl?

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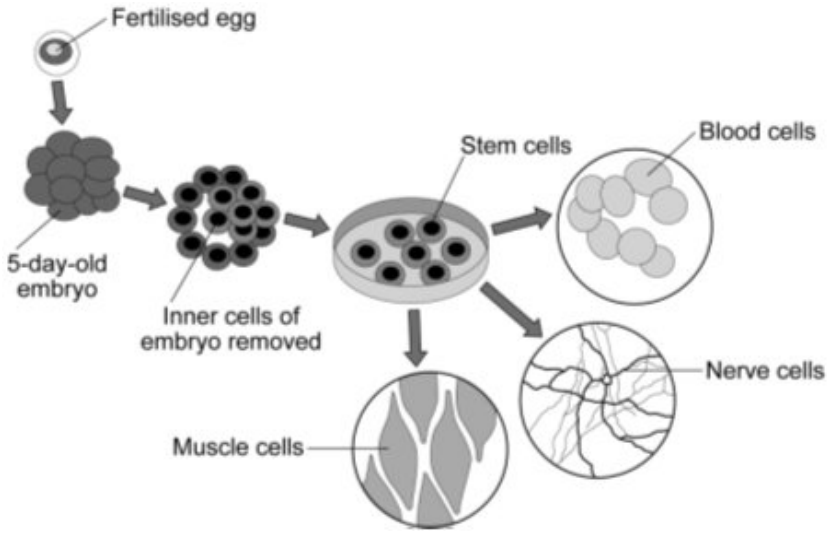
.....

(1)
(Total 4 marks)

Q2. The diagram shows one way that stem cells can be produced from human embryos.



Sue Medaris/University of Wisconsin-Madison

(a) Stem cells can be used to treat a condition such as paralysis.

Explain why.

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(2)

(b) During pregnancy, an umbilical cord and a placenta join the embryo to the mother. At birth the umbilical cord is cut.

Stem cells can be obtained from the umbilical cord.

Many people think that the stem cells for treating human conditions should be obtained from umbilical cords rather than human embryos.

Suggest **one** reason why.

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(1)

(c) Stem cells divide by mitosis. Gametes are formed by meiosis.

Give **two** differences between mitosis and meiosis.

1 .....

.....

2 .....

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(2)
(Total 5 marks)

Q3. Sometimes babies are born with extra fingers or toes as shown in the photograph.

This condition is called polydactyly.

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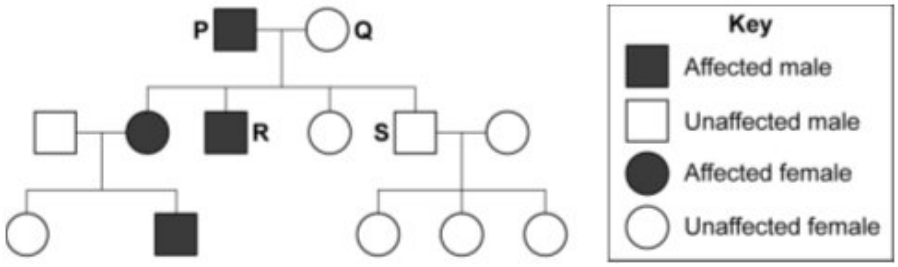
The diagram shows the inheritance of polydactyly in a family.



(a) Polydactyly is caused by a dominant allele, **D**.
The recessive allele of the gene is represented by **d**.

Use **one** genetic diagram to show the inheritance of the polydactyly gene by **R** and **S**.

(4)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate*.

Embryos can be screened for genetic disorders.

Many people would favour the use of embryo screening for cystic fibrosis but not for polydactyly.

Compare the issues involved in the use of embryo screening for cystic fibrosis and for polydactyly.
You should use your knowledge and understanding of the process and the two conditions.

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(6)
(Total 10 marks)

Q4. 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.

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(Total 6 marks)

M1. (a)

(X)	(XX)	XX
Y	XY	XY

1 *mark for Y in sperm box*
1 *mark if XX box correct*
1 *mark if both XY boxes correct*

3

(b) 1 : 1 or 50% or ½ or 0.5 or 1 in 2 or 1 out of 2 or 50 : 50

*do **not** accept 50/50*
accept equal (probability)

1

[4]

M2. (a) because stem cells can (be made) to differentiate

1

into nerve / muscle cells

1

(b) ethical issues with destruction / damage to embryo

1

(c) mitosis one cell division, meiosis two cell division

1

cells produced by mitosis have two sets of chromosomes,
cells produced by meiosis have one set of chromosomes

accept cells produced by mitosis are genetically identical, cells produced by meiosis have some genetic differences

1

[5]

M3. (a) (genotype / gametes from **P** / father) **D** and **d** (*)

1

(genotype / gametes from **Q** / mother) **d** and **d** / accept **d**(*)

1

offspring genotypes correctly derived from correct gametes(*)

1

offspring phenotypes **R** and **S** identified

1

(*) eg may be in punnett square
allow own upper and lower case symbols or
allow any symbol correctly used with key

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

No relevant content.

0 marks

There is a brief description of the issues involved in screening for at least one condition.

Level 1 (1–2 marks)

There is some description of issues involved in screening for both conditions but there is a lack of both pros and cons for the two conditions.

Level 2 (3–4 marks)

There is a clear, balanced and detailed description of the issues involved in screening for both conditions, giving pros and cons for each condition.

Level 3 (5–6 marks)

examples of biology points made in the response

For cystic fibrosis

pros:

- reduce number of people with cystic fibrosis (in population)
- reduce health-care costs
- allows decision / emotional argument,
  eg allows people to make choices about termination

cons:

- possible damage / risk to embryo / fetus / baby
- possible harm / risk to mother
- (may) have to make ethical / moral / religious decisions

for polydactyly:

- cures ‘disfigurement’
- but condition not life threatening
- so risks to foetus / mother unjustified

[10]

M4. **one** mark for each of the following comparisons to a maximum of **6**

*candidates **must** make a clear comparison*

meiosis	**mitosis**
sexual	asexual
gametes	growth
ovary **or** testes **or** gonads	all other cells
half number of chromsomes	same number of chromosomes
haploid **or** 23 chromosomes	diploid **or** 46 chromosomes
reassortment **or** variation possible **or** not identical	no reassortment **or** no variation **or** identical
4 cells produced	2 cells produced
2 divisions	1 division

[6]