**Q1.**The diagram below shows the production of human sperm cells.

(a)     Name the organ where the processes shown in the diagram above take place.

            ............................................................

**(1)**

(b)     (i)      Not every cell in the diagram above contains the same amount of DNA.

Cell **A** contains 6.6 picograms of DNA (1 picogram = 10-12 grams).

How much DNA is there in each of the following cells?

Cell **B** ......................... picograms

Cell **C** ......................... picograms

Cell **E** ......................... picograms

**(2)**

(ii)     How much DNA would there be in a fertilised egg cell?

            .......................................... picograms

**(1)**

(iii)     A fertilised egg cell divides many times to form an embryo.

Name this type of cell division.

            .............................................................

**(1)**

(c)     After a baby is born, stem cells may be collected from the umbilical cord. These can be frozen and stored for possible use in the future.

(i)      What are stem cells?

...................................................................................................................

...................................................................................................................

...................................................................................................................

...................................................................................................................

**(2)**

(ii)     Suggest why it is ethically more acceptable to take stem cells from an umbilical cord instead of using stem cells from a 4-day-old embryo produced by In Vitro Fertilisation (IVF).

...................................................................................................................

...................................................................................................................

**(1)**

(iii)     Stem cells taken from a child’s umbilical cord could be used to treat a condition later in that child’s life.

Give **one** advantage of using the child’s own umbilical cord stem cells instead of using stem cells donated from another person.

...................................................................................................................

...................................................................................................................

**(1)**

(iv)     Why would it **not** be possible to treat a genetic disorder in a child using his own umbilical cord stem cells?

...................................................................................................................

...................................................................................................................

**(1)**

**(Total 10 marks)**

**Q2.**          **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)**

**Q3.**          (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.

**(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

..........................................................................................................................

..........................................................................................................................

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**(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)**

**M1.**(a)     testis / testes

*allow testicle(s)*

**1**

(b)     (i)      **B** = 13.2

**C** =   6.6

**E** =   3.3

*all 3 correct = 2 marks*

*2 or 1 correct = 1 mark*

*If no marks awarded allow ecf for C* ***and*** *E based on answer to B*

*ie C = ½ B and E = ½ C for one mark*

**2**

(ii)     6.6

*allow twice answer for cell* ***E*** *in part bi*

**1**

(iii)      mitosis

*correct spelling only*

**1**

(c)     (i)      any **two** from:

•        cells that are able to divide

•        undifferentiated cells / not specialised

•        can become other types of cells / tissues **or** become specialised /differentiated

*allow pluripotent*

**2**

(ii)     4-day embryo is a (potential) human life

**or**

destroying/damaging (potential) human life

*allow cord would have been discarded anyway*

*ignore reference to miscarriage*

*allow cannot give consent*

**1**

(iii)     perfect tissue match **or** hard to find suitable donors

*allow same/matching antigens*

*allow no danger of rejection*

*allow no need to take immunosuppressant drugs (for life)*

*ignore genetically identical* ***or*** *same DNA*

**1**

(iv)     stem cells have same faulty gene / allele / DNA / chromosomes

*allow genetically identical*

*ignore cells have the same genetic disorder*

**1**

**[10]**

**M2.**          (a)     chromosomes

**1**

(b)     diagram showing four separate chromosomes two long and two short
(as in diagram 1)

*allow each chromosome shown as two joined chromatids
do* ***not*** *allow if chromosomes touching each other*

**1**

(c)     (i)      any **two** from:

•        can grow into any type of tissue / named tissue

•        used in medical research

•        used to treat human diseases

•        large numbers can be grown

**2**

(ii)     any **two** from:

•        expensive

•        grow out of control / ref cancers

•        may be rejected

•        need for drugs (for rest of life)

**2**

**[6]**

**M3.**          (a)     23

**1**

(b)     chromosome     nucleus      gene     cell

2                    3             1          4

**1**

(c)     (i)      any **one** from

(cells which are bigger) take up more space

(cells) have to get bigger **or** mature to divide

**1**

(ii)     chromosomes duplicate **or**make exact copies of self

*accept forms pairs of chromatids*

**1**

nuclei divide

*accept chromatids* ***or****chromosomes separate*

**1**

identical (daughter) cells formed

*accept for example, skin cells make
more skin cells* ***or*** *cells are clones*

**1**

(d)     any **two** from

*Differentiation mark*babies need **or** are made of different types of cells **or** cells that have
different functions

*accept different cells are needed
for different organs*

*Division or specialisation mark*as fertilised egg starts to divide each cell specialises to form a part of the body

*accept specialised cells make
different parts of the body*

*Growth mark*specialised cells undergo mitosis to grow further cells

*accept cells divide* ***or*** *reproduce
to form identical cells*

**2**

**[8]**