

- M1.** (a) **C** 1
- (b) cytoplasm **and** cell membrane dividing
accept cytokinesis for 1 mark 1
- to form two identical daughter cells 1
- (c) stage 4 1
- only one cell seen in this stage 1
- (d) $(4 / 36) \times 16 \times 60$ 1
- 107 / 106.7 1
- 110 (minutes)
allow 110 (minutes) with no working shown for 3 marks 1
- (e) binary fission
do not accept mitosis 1

(f) shortage of nutrients / oxygen

1

so cells die

or

death rate = rate of cell division

1

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- M2.** (a) A = meiosis
accept 'mieosis'
*do **not** accept 'miosis'* 1
- B = mitosis
*do **not** accept 'meitosis' etc* 1
- (b) fertilisation allow conception 1
- (c) (i) 23 1
- (ii) 46 1

[5]

M3. any **four** from:

- cells used to treat diseases do not go on to produce a baby
- produces identical cells for research
- cells would not be rejected
- allow cells can form different types of cells
- (immature) egg contains only genetic information / DNA / genes / chromosomes from mother **or** there is only one parent
- asexual / no mixing of genetic material / no sperm involved / no fertilisation **or** chemical causes development
- baby is a clone
- reference to ethical / moral / religious issues
allow ethically wrong
NB cloning is illegal gains 2 marks
ignore unnatural
- risk of damage to the baby
in correct context

[4]

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

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

meiosis

sexual

gametes

ovary **or** testes
or gonads

half number
of chromosomes

haploid **or**
23 chromosomes

reassortment **or**
variation possible
or not identical

4 cells produced

2 divisions

mitosis

asexual

growth

all other cells

same number
of chromosomes

diploid **or**
46 chromosomes

no reassortment
or no variation
or identical

2 cells produced

1 division

[6]

- M5.** (a) any **one** from
- chromosomes in pairs
 - inherited one of each pair from each parent
 - one of each pair in egg **and** one of each pair in sperm
 - so sex cells / gametes can have half the number
allow need to pair during cell division / meiosis
- 1
- (b) any **two** from:
- code
 - combination / sequence of amino acids
 - forming specific / particular proteins / examples
*If **no other mark** gained allow reference to controlling characteristics / appearance for **1** mark*
- 2
- (c) (i) C
- 1
- (ii) 30
- 1
- (d) (i) for growth / repair / replacement / asexual reproduction
*do **not** accept incorrect qualification, eg growth of cells **or** repair of cells*
they equals cells therefore do not accept they grow etc
- 1
- (ii) 44 **or** 22 pairs
- 1

[7]

M6. Marks should **not** be awarded for simply copying the information provided
A mark may be awarded for a comparison between treatments if the answer only involves copied information

any **four** from:

*For all 4 marks to be awarded, there must be at least 1 pro
and 1 con*

embryo stem cells – examples of

pros

- can treat a wide variety / lots of diseases / problems
- many available / plentiful
- using them better than wasting them
- painless

cons

- (possible) harm / death to embryo
- (relatively) untested / unreliable / may not work
*allow long term effects not known
or may be more risky*
- embryo can't be 'asked' / 'embryo rights' idea

adult bone marrow stem cells – examples of

pros

- no ethical issues (in collection) **or** permission given
- quick recovery
- (relatively) safe
allow does not kill (donor) / low risk
- well tried / tested / know they work

cons

- operation hazards eg infection
- few types of cell / tissue produced **or** few diseases / problems treated
- painful so may deter donors

Conclusion to evaluation:

A reasoned conclusion from the evidence

1

[5]

- M7.** (a) (i) DNA replication / copies of genetic material were made
'it' = a chromosome
allow chromosomes replicate / duplicate / are copied
ignore chromosomes divide / split / double 1
- (ii) one copy of each (chromosome / chromatid / strand) to each offspring cell
ignore ref. to gametes and fertilisation 1
- each offspring cell receives a complete set of / the same genetic material
allow 'so offspring (cells) are identical' 1
- (b) (i) meiosis
allow mieosis as the only alternative spelling 1
- (ii) Species A = 4 **and** Species B = 8 1
- (iii) sum of A + B from (b)(ii) e.g. 12 1
- (c) (i) similarities between chromosomes or similarities between flowers described
e.g. shape of petals / pattern on petals / colour / stamens 1
- can breed / can sexually reproduce
allow can reproduce with each other / they can produce offspring 1

(ii) any **two** from:

- offspring contain 3 copies of each gene / of each chromosome / odd number of each of the chromosomes
- some chromosomes unable to pair (in meiosis)
- (viable) gametes not formed / some gametes with extra / too many genes / chromosomes

or some gametes with missing genes / chromosomes

2

[10]

M8. (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 $\frac{1}{2}$ -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 / $\frac{1}{2}$ / 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]