**M1.**(a) salivary gland

**1**

(b) liver

**1**

(c) any **four** from:

- merozoites released (from liver) and enter the red blood cells
- (some of these) turn into schizonts
- (which) burst the red blood cells
- releasing (more) merozoites
- coincides with fever attacks.

*points credited must be in correct sequence*

**4**

(d) (i) three bases code for one amino acid

**1**

middle code of CTC is now CAC / T changed to A

**1**

so will be a different amino acid (in the chain)

**1**

(and so chain / protein will have a different shape) due to a different sequence of amino acids

**1**

(ii) correct parental genotypes (both **Aa**)

*allow ecf for 2nd and 4th marking points*

**or** correct gametes (**A+a** **A+a**)

*allow alternative symbols if defined*

**1**

correct derivation of offspring genotypes from gametes

**1**

**aa** identified (homozygous for) SCA

**1**

0.25

*allow 25% or 1 in 4 or 1:3 or 1 / 4*

**1**

(iii) **(Aa)** less likely to get malaria (than homozygous dominant / **AA**)

*allow resistance or protection if correctly qualified eg some protection*

***do not accept*** *'immune'*

**1**

**[15]**

**M2.**(a) (i) in the chromosome(s)

*ignore genes / alleles*

**1**

in the nucleus

*allow nuclei*

*allow mitochondria*

**1**

(ii) the DNA / chromosomes / genes are replicated / copied / multiplied / doubled / duplicated

*allow DNA is cloned*

*ignore same DNA / chromosomes / genes if unqualified*

**1**

(b) (i) 1 / one

**1**

(ii) 2 / two

**1**

(c) **B**

**1**

**[6]**

**M3.**(a) (different / alternative) forms of a gene

*do **not** accept types of genes*

**1**

(b) DNA isolated from embryo

**1**

(fluorescent) probe mixed with embryo DNA

1

probe (then) binds with embryo DNA

1

(UV light) to show alleles / gene for disorder

1

(c) genotypes of parents and gametes correct (Man **D** and **d**, Wife **d** and **d**)
*allow half-size genetic diagram with only one **d** from wife*

1

offspring genotypes correct (½ = **Dd** and ½ = **dd**)
*allow ecf if parental genotypes are wrong*

1

offspring phenotypes correctly assigned to genotypes

1

(d) genotypes of parents and gametes correct (**N** and **n**)
*allow ecf if parental genotypes are wrong*

1

offspring genotypes correct (**NN**, 2 × **Nn**, and **nn**)

1

offspring phenotypes correctly assigned to genotypes;

1

correct probability = 0.25 / ¼ / 25% / 1 in 4 / 1:3, only;
*do **not** allow '3:1 / '1:4*

1

**[12]**

**M4.**(a) (i) nucleus
*correct spelling only*
*accept mitochondrion*
*ignore genes / genetic material / chromosomes*

1

(ii) base(s)
*Accept all four correct names of bases*

*ignore nucleotides and refs to organic / N-containing*

1

(iii) 4

1

(iv) codes for sequence / order of amino acids

*ignore references to characteristics*

1

codes for a (specific) protein / enzyme

**or**

the sequence / order of <u>three</u> bases / compounds / letters

codes for a specific amino acid

**or**

the sequence / order of 3 bases / compounds / letters

codes for the order / sequence of amino acids

1

(b) (i) DNA

1

circular / a ring **or** a vector / described

1

(ii) kills any cells not having **kan**$^{r}$ gene / so only cells with **kan**$^{r}$ gene survive

1

hence surviving cells will also contain **Bt** gene / plasmid

1

(iii) cells divide by <u>mitosis</u>

*ignore ref to asexual reproduction*

*correct spelling only*

1

genetic information is copied / each cell receives a copy of (all) the gene(s) / all cells produced are genetically identical / form a clone

**1**

(iv) any **two** from:

- gene may be passed to pathogenic bacteria
- cannot then kill these pathogens with kanamycin
  **or**
  cannot treat disease with kanamycin
- may need to develop new antibiotics
- gene may get into other organisms
- outcome unpredictable

**2**

**[13]**