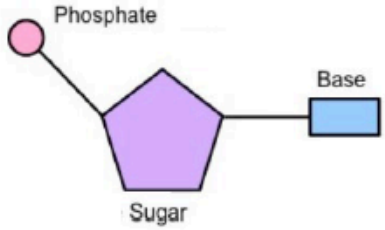
Mark Scheme

Q1.

Question number	Answer	Notes	Marks
(a) (i)	Any two from: • (movement of substances/named solute or gas) against a concentration gradient(1) • using energy/ATP(1)		2
(ii)	Any two from: • parent homozygous recessive/heterozygous / carriers (1) • one (recessive) allele inherited from each parent (1) • reference to homozygous recessive disorder/caused by recessive alleles (1)		2
(iii)	• protein/CFTR is not modified/folded/protein has an incorrect shape(1) • protein/CFTR not transported (to its destination)(1)		2
(iv)	1408 x 3 (1) 4224	Full marks for correct final answer. Max 2 marks ecf for final answer if it is correct from calculation	2

(v)	• (deoxyribose) sugar(1) • joined to a (nitrogenous) base/named base(1) • phosphate group attached to sugar (1)  	Allow one mark only if all 3 components just listed Fully labelled diagram for full marks	3
(b)	any three from • deletion(1) • of one codon/TTT (1) • phenylalanine missing from protein (1) • shape of final protein changed/different protein formed (1)	allow description of deletion	3
		Total for Question = 14 Marks	

Q2.

Question number	Answer	Notes	Marks
(a) (i)			1
(ii)	In the following order only: phagocytes; enzymes;		 1 1
(iii)	produce antibodies/release antitoxins;		1
(b)	<table><tr><th>Bacterial cell</th><th>Human skin cell</th></tr><tr><td></td><td>✓</td></tr><tr><td>✓</td><td>✓</td></tr><tr><td></td><td></td></tr><tr><td>✓</td><td></td></tr></table>	One mark for each correct row	3
(c)	**D** (a single-stranded helix containing the bases AUGC); A is incorrect as RNA is not a double-stranded helix B is incorrect as RNA is not a double-stranded helix C is incorrect as RNA does not contain the base T		1
		Total question = marks	

Q3.

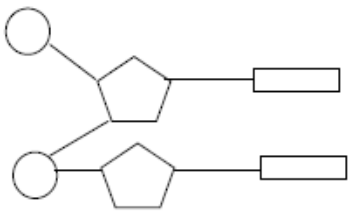
Question number	Answer	Notes	Marks
(a) (i)	<table><tr><th>Part</th><th>Name of part</th><th>Function</th></tr><tr><td>X</td><td>mitochondria;</td><td></td></tr><tr><td>Y</td><td></td><td>controls activities of the cell/stores DNA / genetic information;</td></tr></table>		1 1
(ii)	**A,** more cell structures can be seen with greater resolution		1
(iii)	60mm/6cm; 60 ÷ 0.05; 1200;	Ecf two marks for correct calculation from incorrect measurement Full marks for correct final answer	3
(b)	• diffusion; • from a high concentration (in the cell) to a lower concentration (in the blood)/down a concentration gradient;		1 1
		Total question = 8 marks	

Q4.

Question number	Answer	Notes	Marks
(a) (i)	A (DNA); B/C/ and D are found in or associated with other structures.		1
(ii)	correct circles of pair;		1
(iii)	only two pairs of homologous chromosomes/ would be 23 in a human cell;		1
(b)	• prophase, metaphase, anaphase and telophase; • (prophase) chromosomes become thicker/visible; • (metaphase) chromatids line up at equator; • (anaphase) chromatids separate and migrate to poles; • (telophase) chromosomes become thinner and form a nucleus;		5
			Total 8 marks

Q5.

Question number	Answer	Mark
(a)	A description that makes reference to the following points: • DNA double versus RNA single-stranded (1) • DNA contains thymine while RNA contains uracil (1) • DNA contains deoxyribose while RNA contains ribose (1)	3

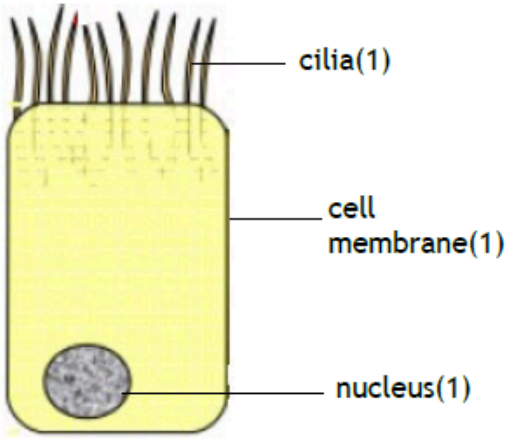
Question number	Answer	Mark
(b)	A drawing that includes: • organic bases attached to correct position on ribose (1) • phosphate attached at C3 and C5 (1) 	3

Question number	Answer	Additional guidance	Mark
(c)(i)	Process: • 37% must be thymine (1) • 100 – (2 × 37) = 26% must be guanine (G) and cytosine (C) (1) • so guanine = 26 ÷ 2 = 13% of nucleotides (1)	allow 3 marks for correct final answer	3

Question number	Answer	Mark
(c)(ii)	An explanation that makes reference to the following points: *muscle cell* adenine 37%/same amount as cheek cell (1) because genetically identical to cheek cell (1) *red blood cell* adenine 0% (1) no nucleus (1) DNA in nucleus/no DNA (1)	5

Question number	Answer	Mark
(d)	D	1

Q6.

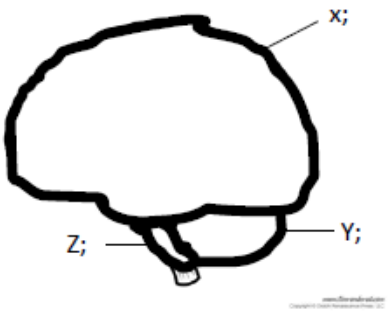
Question number	Answer	Notes	Marks
(a) (i)			3
(ii)	cilia → holds the genetic code cell membrane → controls entry and exit of nucleus → site where most chemical reactions occur makes proteins moves mucus through the trachea	Reject more than one line from each structure	3

(b) (i)	Tar (1)		1
(ii)	• (cilia)burned/destroyed/reduced in number(1) • paralysed/cannot beat to and fro/move mucus(1)		2
	Total for Question = 9 Marks		

Q7.

Question number		Answer	Notes	Marks
(a)	(i)	ovulation;		1
	(ii)	fertilisation		1
	(iii)	Any two from: • zygote/embryo/cells divides/splits; • each half develops into one offspring;		1 1
(b)	(i)	**A** FSH and LH;		1
	(ii)	Any four from: • removal of egg from female ovary; • collect sperm from male; • egg fertilised; • embryos formed; • embryo inserted into uterus/female;	Allow egg and sperm fuse Allow zygote formed	Max 4
			Total question = 9 marks	

Q8.

Question number	Answer	Notes	Marks
(a)		Letters can be anywhere within outline shown. Allow labels in place of than letters.	3
(b) (i)	Motor;		1
(ii)	Any one from the following: (sensory neurone): longer dendrites/shorter axon/cell body outside of spinal cord/CNS/in middle of neurone/transmit impulse to the CNS/brain/spinal cord (motor neurone) shorter dendrites/longer axon/cell body at one end of neurone/inside spinal cord/transmit impulses from CNS/brain/spinal cord	Answer must be comparative and state which type of neurone is being referred to	1
(iii)	• chemicals/neurotransmitters; • diffuse; • across a synapse; • bind to receptors (on post-synaptic membrane);		3
(c)	• stem cells are undifferentiated/unspecialised/can differentiate; • could be made to form nerve cells; • to replace damaged cells in brain;		1 1 1
		Total question = 11 marks	

Q9.

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>(a) (i)

(ii)</td><td>chromosomes (1)

  (1)  (1)</td><td></td><td>1

2</td></tr>
<tr><td>(b) (i)</td><td><table><tr><td>complementary bases pair up</td><td>3</td></tr><tr><td>DNA double helix unwinds</td><td>1</td></tr><tr><td>strands separate</td><td>2</td></tr><tr><td>two DNA strands form</td><td>4</td></tr></table></td><td></td><td>1</td></tr>
<tr><td>(c) (i)

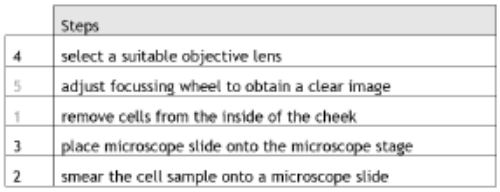
(ii)</td><td>thymine/T (1)

guanine/G/cytosine/C (1)</td><td>R thiamine/thyamine</td><td>1

1</td></tr>
<tr><td>(c)</td><td>any four from

• allows formation of gametes (1)
• haploid (1)
• allows variation to occur (1)
• which allows species to evolve (1)
• allows diploid number to be maintained (1)
• at fertilisation (1)</td><td></td><td>4</td></tr>
</table>

Q10.

Question number	Answer	Notes	Marks
(a) (i)		One mark for 4 before 5. One mark for 3 before 2	2
(ii)	more detail/organelles can be seen/organelles/named organelle seen more clearly (1)		1
(iii)	reference no stain applied to specimen(1)		1
(iv)	• reference to sterilising (named) equipment (1) • wash hands to avoid cross contamination(1) • incubate/store in sealed petri dish / container	allow valid sterilisation technique	2
(b) (i)	10 × 40 = 400	Full marks for correct answer without working	1
(ii)	reference to 1000 (1) 0.018 × 1000 = 18 (µm)	Full marks for correct final answer	2
		Total Question = 9 marks	

Q11.

Question number	Answer	Notes	Marks
(a)	Three from: • (parasite) carried by mosquito/mosquito is a vector; • mosquito bites human; • parasite/infected blood drawn/sucked up into mosquito; • infected blood transmitted to other people;		Max 3
(b)(i)	• fewer deaths caused by *P.vivax* in R than Q • (but) more deaths caused by *P.vivax* in R than in Q as a proportion of the total; • 190 000 fewer deaths caused by *P.vivax* in R/300 less deaths in Q caused by *P.vivax*; • 0.5% deaths caused by *P.vivax* in Q/62.5% of deaths caused by *P.vivax* in R;		1 1 1
(ii)	more mosquitoes in one region than another/climate favours breeding of mosquitoes/more dense population of people/better health care/use of (named) preventative measures;		1

(c)	Three from: Fewer people with malaria/reduced incidence of malaria; Immunity/antibodies against parasite/herd immunity; Reduction in population of/death of parasite; Less transmission (from one person to another);		Max 3
(d)	Three from: (sexual reproduction) • gives rise to variation in offspring; • variation provides a survival advantage; • parasite more likely to survive in a changing environment; (asexual reproduction) • parasite can reproduce faster; • no need to find a mate/only one parent needed; • larger number of offspring produced;	Answer must contain at least one advantage of each method	Max 3

Q12.

Question number	Answer	Mark
(a)	Adult (stem cells)	1

Question number	Answer	Mark
(b)	No rejection or same tissue type	1

Question number	Answer	Mark
(c)	W = nucleus (1) X = cell membrane (1) Y = cytoplasm (1)	3

Question number	Answer	Mark
(d)	A description that makes reference to any of the three following points: • (stem cells) differentiate/become specialised (1) • (stem cells) divide (1) • by mitosis (1) • forming genetically identical cells (1)	3

Question number	Answer	Mark
(e)	A description that makes reference to any three of the following points: • burn/wound healed more quickly (1) • takes less time to treat (1) • chemicals needed to produce tissue (1) • less risk of contamination (1)	3

Question number	Answer	Mark
(f)	A description that makes reference to two of the following points: • extracting embryonic stem cells (1) • may harm embryos (1) • potential life (1)	2

Q13.

Question number		Answer	Notes	Marks
a	(i)	• 24 – 10(1) • 2 (hours)	Full marks for correct final answer	2
	(ii)	Any two from: • cell organelles double in number (1) • named organelle • protein synthesis(1)	Ignore DNA/nucleus replicate	2
	(iii)	• diploid cells/cells with full number of chromosomes/cells with 46 chromosomes(1) • genetically identical(1)		2
	(iv)	<table><tr><th>Stage</th><th>Events</th></tr><tr><td>metaphase</td><td>chromosomes align at the centre of the cell / equator(1)</td></tr><tr><td>anaphase</td><td>chromatids pulled to opposite poles(1)</td></tr><tr><td>telophase</td><td>nuclear membrane forms (around chromosomes) (1)</td></tr></table>	Allow chromosomes for chromatids throughout Ignore cytokinesis or description Allow nucleus formed (around chromosomes)	3
b		Any two from: • adds nucleotides(1) • to exposed bases on one strand of DNA molecule/to template strand/by complementary base pairing(1) • to produce a new DNA strand/molecule(1)	Allow bases	2
			Total for Question = 11 marks	

Q14.

Question number	Answer	Notes	Marks
(a) (i)	• prophase, metaphase, anaphase and telophase;;	minus 1 for each error	2 marks
(ii)	• chromosomes lined up; • equator shown/aligned at equator; • one member of each bivalent above, the other below;		3 marks
(b) (i)	A (DNA); B not part of DNA C not part of DNA D found only in RNA not DNA		1 mark
(ii)	length = 20 mm; $\frac{20}{750}$ = 0.026 mm; = 26.0/26.7 µm;	allow 20 -22 ECF	3 marks
(c)	• two genetically identical cells; • diploid/2n;		2 marks
			Total 11 marks

Q15.

Question number	Answer	Notes	Marks
(a) (i)	• join with ovum; • during fertilisation;		2
(ii)	any two from • ribosomes; • endoplasmic reticulum/ER; • chromosomes;		2
(b)	• site of (aerobic) respiration; • energy released/ATP produced; • sperm motile/active/swim;		3
(c)	3µm = 0.003 mm; distance between X and Y = 145 mm; $\frac{145;}{0.003}$ =48333/48000;	ECF = 2	4
			Total 11 marks

Q14.

Q16.

Question number	Answer	Notes	Marks
(a) (i)	absorbs uv light; reduces/prevents risk of skin cancer;		2
(ii)	eye/ retina/ choroid/ red blood cell/ haemoglobin ;		1
(b) (i)	mother x father Hh hh; gametes H h h; fertilisation Hh hh; phenotype white forelock normal;		4
(ii)	chance of producing a boy is 0.5/½; chance of producing offspring with condition 0.5/½; chance of producing boy with condition is ½ × ½ = ¼;		3
(c)	Any 4 from different (genetic) code produced; different order of amino acids; codes for different proteins/enzymes; enzyme substrate complex not formed; causes change in pigment;		4
			Total 14 marks