1. A

[1]

2. D

[1]

3. C

[1]

4. D

[1]

5. B

[1]

6. C

[1]

7. B

[1]

8. C

[1]

9. C

[1]

10. D

[1]

11. (a) (i) (population) 1 and (population) 2 *(both needed)* 1

(ii) (population) 11/7/7 and 11 1

(b) *Pan*IA 0.75 and *Pan*IB 0.25 / 3 *Pan*IA to 1 *Pan*IB 1
Both must be correct for the mark to be awarded, accept frequencies in form of ratio.

(c) (i) greatest/great frequencies of *Pan*IA at lowest/low latitudes / a rapid drop in frequency at (60–65 degrees latitude) / lowest/low frequencies at highest/high latitudes 1
Answers which describe/imply the correct step-wise relationship should get credit. Answers stating or implying a negative correlation alone should not get credit.

(ii) lowest/low frequencies of *Pan*IA at lowest/low temperatures / a rapid increase in frequency at (8–10 degrees Celsius) / highest/high frequencies at warmest/warm temperatures 1
Answers which describe/imply the correct step-wise relationship should get credit. Answers stating or implying a negative correlation alone should not get credit.

(d) (cod with) *Pan*IA allele selected/favoured/better adapted to warmer water;
(cod with) *Pan*IB allele selected/favoured/better adapted to colder water;
cod that survive can reproduce and pass alleles on to offspring; 2 max
It takes a whole organism to reproduce in order to pass on the allele, hence we expect reference to the fish to gain this last marking point.

(e) higher frequency of *Pan*IA/*Pan*IA *Pan*IA (cod) in warm (surface) water;
higher frequency of *Pan*IB/*Pan*IB *Pan*IB (cod) in colder (deeper) water;
interbreeding results in *Pan*IA *Pan*IB cod/heterozygous cod; 2 max

(f) *Pan*IA *Pan*IA (cod) may spread further north / *Pan*IB *Pan*IB (cod) may move/retreat further north;
numbers of *Pan*IA *Pan*IA (cod) may increase / frequency of *Pan*IA allele may increase;
*Pan*IB *Pan*IB (cod) may become extinct / frequency of *Pan*IB allele may decrease; 2 max

[11]

12. (a) anaphase 1

(b) growth (through increasing cell number);
embryonic development;
tissue production/repair;
(asexual) reproduction; 2 max

(c) uncontrolled mitosis/cell division 1

(d) pair of homologous chromosomes moves in same direction/does not separate during anaphase I / chromatids move in same direction/do not separate during anaphase II;
leaving a cell with an (some) extra chromosome(s)/missing chromosome(s);
an example; *(e.g. Down syndrome / trisomy 21)*; 2 max

[6]

13. (a) rough endoplasmic reticulum/RER/rough ER / ribosome 1

(b) vesicles are formed (from the rough ER);
they are received by Golgi apparatus;
Golgi apparatus forms vesicles that transport substances to membrane; 2 max

(c) aerobic respiration takes place in the mitochondria;
important for energy/ATP production;
pyruvate broken down into carbon dioxide and water; 2 max

(d) they are cut in different planes / due to three-dimensional nature/shape 1

[6]

14. (a) *Both name and function required to achieve **[1]**.*

A: *name*: flagella/flagellum

function: used for locomotion / beats in whip-like action to propel cell;

B: *name*: pili/pilus

function: used for adhesion (to another cell/surface) / transfer of genetic material (between cells);

ECF, for one mark, can be applied if both parts of the pair are reversed. 2

(b) *Award **[1]** for a similarity.*
both have a plasma/cell membrane/ribosomes/cytoplasm/genetic material;

*Award up to **[2]** for differences. Candidate must make a valid comparison, not simply describe each. Award **[2 max]** if features of prokaryotic and eukaryotic cells are not compared directly, item by item, although a table is not necessary.*

Prokaryote	Eukaryote
naked DNA	DNA associated with proteins;
DNA in cytoplasm/no nucleus	DNA enclosed in nuclear envelope/membrane / nucleus;
70S ribosomes	80S ribosomes;
no membrane-bound organelles	internal membranes that form membrane-bound organelles;
circular chromosome	linear chromosomes;
fission	mitosis;
no introns or exons	introns and exons;
Smaller in size(approximately) 10 microns	larger in size up to (approximately) 100 microns;
cell wall present	cell wall only present in plants/fungi; *Do not accept cell wall sometimes present.*

3 max

[5]

15. (a) *Award **[1]** for each structure clearly drawn and correctly labelled.*
cell wall —with some thickness;
plasma membrane — shown as single line or very thin;
cytoplasm;
pilus/pili — shown as single lines;
flagellum/flagella — shown as thicker and longer structures than pili and embedded in cell wall;
70S ribosomes;
nucleoid / naked DNA;
approximate width 0.5 μm / approximate length 2.0 μm;
*Award **[4 max]** if the bacterium drawn does not have the shape of a bacillum (rounded-corner rectangle with length approximately twice its width).*
*Award **[4 max]** if any eukaryotic structures included.* 5 max

(b)

passive	active
Diffusion / osmosis / facilitated diffusion	active transport / ion pumps / exocytosis / pinocytosis / phagocytosis
a second passive method *(from above)*	a second active method; *(from above)*
does not require energy	requires energy/ATP;
down concentration gradient	against concentration gradient;
no pumps needed	requires protein pumps;
oxygen across alveoli / other example	glucose absorption in ileum / other example;

Both the passive and active movements must be contrasted to receive a mark.
*Award **[3 max]** if no examples are given. Responses do not need to be shown in a table format.* 4 max

(c) occurs during aerobic respiration;
oxidative phosphorylation occurs during the electron transport chain;
hydrogen/electrons are passed between carriers;
releasing energy;
finally join with oxygen (to produce water);
occurs in cristae of mitochondria;
chemiosmosis is the movement of protons/hydrogen ions;
protons move/are moved against their concentration gradient;
into the space between the two membranes;
protons flow back to the matrix;
through the ATP synthase/synthetase (enzyme);
energy is released which produces more ATP/combines ADP and Pi; 9 max

*(Plus up to **[2]** for quality)*

[20]