1

(a) Correct answer of 342.8 − 343 = 2 marks;;

Credit incorrect answers that show the numerator as 144 (or 186-42) or denominator as 42 for 1 mark;

2

(b) 1. More air / oxygen enters / air / oxygen enters quickly / quicker;

1. Accept: converse for carbon dioxide

1. Can be in any correct context eg insect, tracheoles, muscle

1. Neutral: air / oxygen enters

(So) maintains / greater diffusion or concentration gradient;

2

(c) Large(r) SA:VOL / short(er) diffusion distance (to tissues);

Accept: thin diffusion pathway

1

(d) 6 / 6.6 / 6.7 / 7 / 7.5 / 8 = 2 marks;;

Different answers given for different interpretations of the graph

Award 1 mark for incorrect answers that have divided 60 by any number;

2

(e) Less / no water lost / (more) water retained;

Accept: less dehydration / less evaporation

***Q** Reject: less 'transpiration'*

***Q** Reject: less water lost by osmosis*

1

(f) 1. Greater surface area exposed to air;

Neutral: shorter diffusion distance

2. Gases move / diffuse faster in air than through water;

*2. **Q** Neutral: 'harder to diffuse'*

2. Accept gases diffuse directly, rather than through water

3. Increases volume / amount of air;

1 max

[9]

2

FOR

1. (If the husband smokes) there's a greater risk of dying from lung cancer / emphysema / cervical cancer;

2. The more the husband smokes, the greater the risk of dying from lung cancer / emphysema;

3. Suitable use of figures from the table to illustrate answer;

AGAINST

4. Little difference in risk of dying of stomach / heart disease;

5. Other factor (than husband smoking) / named factor might cause death;

6. Only one sample / further studies needed;

4 max

[4]

3

(a) (i) For person with pancreatitis / blocked pancreatic duct:

1. At 0 h / start higher than healthy person / higher than healthy person throughout;

2. Rises then falls whereas healthy person falls then rises;

3. At 48 h / end, below the starting value whereas healthy person is the same (as at start);

Differences required for all points

2 max

(ii) 1. Little / less / no amylase can enter small intestine;

Accept gut or intestine but reject wrong locations e.g. stomach

2. Little / less / no starch digested (in intestine);

2

(b) 1. Amylase is specific (to starch);

2. No starch in human blood / cells / tissues / starch only in plants;

2

(c) 1. Could digest own body / own proteins;

e.g. 'could digest carrier proteins in body cells' would score 2 marks

e.g. 'could digest antibodies in blood' would also score 2 marks

2. Example of protein digested e.g. membrane protein, antibody, named protein in blood;

Do not credit unsuitable example such as muscle proteins

2

[8]

4

(a) 1. Enzyme hydrolyses / breaks down protein to amino acids;

2. Products are soluble / can be washed away;

2

(b) **Arguments for biological washing powder:**

3 max if only arguments against biological washing powder are referred to

1. More effective with all stains;

   Accept different ways of expressing 'effective' e.g. higher % of stain removed

2. Greater improvement with salad dressing / chocolate milkshake / chocolate pudding;

Arguments against biological washing powder:

3. Little / less improvement with raspberry sorbet / raspberry smoothie;

4. Only tested 5 / a small number of stains;

5. Only chose stains that would work / didn't select stains that wouldn't work;

6. Only included results that did work / didn't show results that didn't work;

7. Only one set of results / not repeated;

8. Only compared against one washing powder / may not be true for other washing powders;

   Ignore references to unknown masses of powder, temperature of washes or other aspects of technique or different fabrics

4 max

(c) 1. Enzyme **S** effective across a wider range of temperatures;

2. Enzyme **S** *more* active above 50 °C / active up to 80 °C / active above 60 °C;

3. Enzyme **S** more active below (about) 37 °C temperature;

4. (Although) Enzyme **P** has higher rate of reaction at optimum / 40 – 50 °C;

5. Enzyme **P** denatured above 50 °C;

   *Answers should be in the context of choosing enzyme **S** but, if **P** is chosen, points 4 and 5 may still be awarded, if described*

   In points 2 and 3, a temperature must be stated. Allow ± 5 degrees of values shown

3 max

(d) 1. Stains caused by different substances;

2. Enzymes are specific;

3. Active site specific to substrate / other substrates cannot fit active site;

   This could be expressed in other ways e.g. 'other substrates are not complementary to the active site'

3

[12]

5 (a) Any **three** from:

1. Light;
2. Carbon dioxide;
3. Type of soil;
4. Minerals / nutrients;
   Accept named example
5. Water (in soil);
6. Humidity (of air);
7. pH (of soil)
8. Planting density;
   Idea of equally spaced

3 max

(b) Already levelled out (before 20 °C);

1

(c) Young leaves (may) have different number of stomata (per mm^2) / number of stomata (per mm^2) changes during development (of leaf);
Accept reference to density of stomata

1

(d) Any **two** from:
Points 1 and 2 need context of 'more'

1. Molecules have more kinetic energy;
   Accept KE
2. Faster diffusion of water / more evaporation of water (as temperature increases in leaf);
   For this point, diffusion must relate to movement of water
3. For this point, diffusion must relate to movement of water

2 max

[7]

6 (a) 1. The more recent the sample the greater the concentration;
Accept converse
This could be expressed by reference to time e.g. 'concentration has increased since 25 000 years ago

2. Increases most in last 5000 years / more or less constant / slight increase between 30 000 and 15 000 years ago;

2

(b) 1. Variation in data / spread of data;

Reject references to range e.g. 'range of data'

2. Around the mean;

Both marks are possible in the context of using the data

2

(c) 1. Yes as pine leaves not in organic matter of the same age;

2. No as organic matter would be the same age as the pine leaves;

Accept either approach

1 max

(d) Can get more CO_2 for photosynthesis;

More CO_2 enters leaf is insufficient.
Accept light-independent (reaction) as equivalent

1

(e) Any **three** from:

1. (Overall data show) negative correlation;

Do not allow description of correlation because in question stem

2. Little change in number of stomata in last 10 000 years;

3. Small sample size;

4. Only one species studied;

5. Other factors / named factor may have affected number of stomata;

6. Evidence does not support the conclusion between 30 000 and 25 000 years ago / between 5000 years ago and present day;

Accept reference to either one of these age ranges

7. Appropriate reference to standard deviations (in comparing means);

E.g. no overlap between 15 000 and 10 000 years ago

3 max

(f) Any **three** from :

1. Thick cuticle;

2. Small leaves / low surface area;

Accept other ways of describing 'small', e.g. 'needle-like'

3. Hairy leaves;

4. Sunken stomata;

5. Rolled leaves;

3 max

[12]

7

(a) (**P**) Trachea / windpipe <u>and</u> (**Q**) bronchus;

*For **P** or **Q**, accept (ring of) cartilage (i.e. not for both)*

Accept bronchi

Reject bronchioles

Ignore reference to left or right lung

1

(b) 1. Increases volume (in lungs / thorax);

Context must be lungs / thorax

Ignore space increases

2. Lowers pressure (in lungs / thorax);

Accept lungs / chest expand

Ignore reference to 'change in pressure'

3. Air (pushed) in by higher outside pressure / down pressure gradient;

Ignore reference to 'sucked in'

2 max

[3]

8

(a) Aorta;

1

(b) 1. Left ventricle pumps to whole body (except lungs) / pumps blood further;

Accept converse for right ventricle

Reject 'push'

2. Left ventricle does most work / produces a greater pressure / produces a greater force;

2

(c) 1. (Valve **A**) atrioventricular valve;

Accept bicuspid / mitral

2. Semi-lunar valve;

Accept aortic valve

Ignore references to left and right

2

(d) **X** because (no mark)

Accept other valid calculations - probabilities

1. 52.1% survived without replacement compared to 12.1% / difference of 40%;

   If correct figures written in table, award marks

2. 10.9% required repair or replacement of artificial heart compared to 41.4% / difference of 30.5%;

   Max 2 if incorrect rounding of values

3. 37% died compared to 46.6% / difference of 9.6%;

OR

(X / Y = 119 divided by 58 = 2.05)

14.4; 49.2; 55.4;

Note that this ratio could be reversed i.e. 58 divided by 119 multiplied by numbers in top row

Accept rounded to 14; 49; and 55;

3

[8]

9

By osmosis (no mark)

No mark awarded for naming terms e.g. osmosis, facilitated diffusion, active transport, co-transport etc.

1. From a high water potential to a low water potential / down a water potential gradient;

2. Through aquaporins / water channels;

QWC ignore large / small WP

By facilitated diffusion (no mark)

QWC ignore reference to high / low concentrations of water or high / low concentration of solution

3. Channel / carrier protein;

4. Down concentration gradient;

By active transport (no mark)

QWC ignore ' along' concentration gradients

5. Carrier protein / protein pumps;

6. Against concentration gradient;

7. Using ATP / energy (from respiration);

Co-transport subsumed into mark scheme for active transport and facilitated diffusion

By phagocytosis / endocytosis (no mark)

Can award MP2, 3, 5 for 3 marks with no context given

8. Engulfing by cell surface membrane to form vesicle / vacuole;

Ignore lipid diffusion as in stem of question

By exocytosis / role of Golgi vesicles (no mark)

9. Fusion of vesicle with cell surface membrane;

5 max

[5]

10

(a) (i) Made of (different) tissues / more than one tissue;

1

(ii) 1. (Muscle) contracts;

Assume that 'they' or 'it' = muscle

2. (Arteriole) narrows / constricts / reduces size of lumen / vessel / vasoconstriction;

Ignore: references to pressure

***Q** Correct context for muscle contracts, vessel constricts*

2

(b) (i) Short diffusion distance / pathway;

Accept: thin diffusion pathway

1

(ii) (More) time for exchange / diffusion (of substances);

Accept: example of more time for specific substance to be exchanged

1

(c) 1. Water potential (in capillary) not as low / is higher / less negative / water potential gradient is reduced;

Accept: 'blood or plasma' instead of 'capillary'

2. Less / no water removed (into capillary);

Accept converse: water remains in the tissue

3. By osmosis (into capillary);

***Q** Marking points 2. and 3. must be in the context of movement into the capillary*

Neutral: reference to more tissue fluid being formed as in the question stem

Neutral: reference to lymphatic drainage

3

[8]

11 (a) Open / use tap / add water from reservoir;

1

(b) 1. Seal joints / ensure airtight / ensure watertight;

Answer must refer to precautions when setting up the apparatus

Ignore: references to keeping other factors constant

2. Cut shoot under water;

3. Cut shoot at a slant;

4. Dry off leaves;

5. Insert into apparatus under water;

6. Ensure no air bubbles are present;

7. Shut tap;

8. Note where bubble is at start / move bubble to the start position;

2 max

(c) 1. Water used for support / turgidity;

Accept: water used in (the cell's) hydrolysis or condensation (reactions) for one mark. Allow a named example of these reactions

2. Water used in photosynthesis;

3. Water produced in respiration;

4. Apparatus not sealed / 'leaks';

2 max

(d) As number of leaves are reduced (no mark),

Accept: converse arguments

1. Less surface area / fewer stomata;

3. Less evaporation / transpiration;

4. Less cohesion / tension / pulling (force);

3

[8]

12 (a) (i) (We should maintain biodiversity to)

Prevent extinction / loss of populations / reduction in populations / loss of habitats / save organisms for future generations (idea of);

Neutral: references to 'playing God' / animal rights

1

(ii) A suitable example of how some species may be important financially e.g.

1. medical / pharmaceutical uses;

2. commercial products / example given;

3. tourism;

4. agriculture;

5. saving local forest communities;

1 max

(b) 1. Fewer plant species / decrease in plant diversity;

Accept: converse arguments for islands with a high percentage of forest remaining

1. Neutral: fewer plants

2. Fewer habitats nesting sites / niches / food sources / varieties / less protection from predators / hunters / environment;

2. Neutral: fewer homes

2. Neutral: less food

2

(c) 1. Number of (individuals / birds of) each species;

1. Neutral: number of species

2. Total number of individuals / birds of all species;

2. Accept: 'total number of birds' as given context for 'all species' in the investigation

2

(d) 1. (Larger birds have) a low(er) SA:VOL;

Neutral: reference to fat / feathers

2. (So) less heat loss / more heat retained;

MP2 is independent of MP1

2

[8]

13 (a) 1. Random;

Random number generator = 2 marks

2. Method e.g. number generator / number out of a hat;

Same age = 2 marks

OR

3. Matched / all the same;

4. For e.g. age / sex;

2 max

(b) 1. (Differences) are real / significant / not due to chance;

It = the difference

2. (As) bars / SDs do not overlap;

2. Accept: 'standard errors do not overlap' as told 'standard deviation' in the question stem

2

(c) 1. No / slight (placebo) effect;

2. Group **2** and **3** results are similar / the same / SDs / bars overlap;

*2. Accept: other descriptions of Groups **2** and **3***

*2. Accept: that Groups **2** and **3** are not significantly different*

2

(d) 1. (Allows) anomalies to be identified / ignored / effect of anomalies to be reduced / effect of variation in data to be minimised / concordant results;

Accept: 'outliers' instead of anomalies

1. Reject: idea of not recording anomalies / preventing anomalies from occurring

1. Accept: 'cancels out anomalies' as bottom line response

2. (Makes) average / mean (more) reliable;

*2. **Q** Neutral: makes the average / mean more accurate*

2. Ignore: 'more reliable' alone

2

(e) (i) 1. Unethical / unfair not to treat patients;

2. Dangerous / could cause an asthma attack;

1 max

(ii) 1. Ensures normal treatment does not affect results / improvements are only due to the spray;

2. (As) normal treatment is short-lived / effective for less than 24 hours / (24h) is long enough for normal treatment to wear off;

2

(f) (i) 1. (Improvement scores) are qualitative / subjective / rely on own judgement / different patients may assess symptoms differently;

Accept: converse arguments for measuring FEV_1 e.g. quantitative / objective patients cannot lie

2. Some patients may lie / exaggerate / want to please doctors;

1. Neutral: empirical evidence

2

(ii) 1. Not blind / patients knew they were not receiving treatment / patients did not receive treatment;

2. (So) more likely to underestimate / give lower scores / did not expect to improve / less improvement;

2

[15]

14 (a) 1. (Risk) decreases, then increases;

2. (Risk) increases from 2 (drinks per day);

Accept increases risk above 3

2

(b) Age affects heart disease / age affects how alcohol affects the body;

Accept age affects results

Accept 'removes confounding variable'

Accept 'controlling a variable'

1

(c) *To gain 3 marks candidates must have mp1 and 2 from mps 2-5*

1. (True because) studies show decreased risk up to 3 drinks per day;
   Accept any <u>evidence</u> from graph

1

2. (False because) eg all show an increased risk above 5 drinks / day, eg **A** and **B**, show increased risk (of heart disease) above 4 per day;
   Accept any <u>evidence</u> from graph

3. Data only about heart disease / alcohol causes other diseases / social problems;

4. Amount of alcohol per drink may vary;

5. May be due to other factor

2 max

[6]

15

(a) 1. Flatten / moves down;
   1. Ignore: additional information about rib movements

2. (Diaphragm muscle) contracts;

2

(b) 1. Diaphragm contracts / moves down / flattens;
   Ignore refs to rib movement

2. Increases volume (of thorax) <u>and</u> decrease in pressure;
   2. Accept pressure lower than atmospheric pressure

3. Air moves from high to lower pressure / down pressure gradient;
   3. Reject: by diffusion

3

(c) 1. Diffusion;
   Accept down diffusion gradient

2. Across (alveoli) epithelium / (capillary) endothelium;
   2. Accept: capillary epithelium / squamous cell

2 max

[7]