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BIOLOGY 4325, MARK SCHEME

Key

; indicates separate mark points
/ indicates alternatives
eq allow for correct equivalent
__ word underlined means no alternatives allowed

Paper 1F

1. (a) A
(b) D
(c) C
(d) B
(e) D
(f) C
(g) A
(h) C
(i) B
(j) C **(10)**

Total 10 marks

2. (a) bushes / grass; **(1)**

(b) leopard / lion / cheetah; **(1)**

(c) any correct food chain from web;
arrows in correct direction; different food chain max 1 for arrows **(2)**

(d) (i) Decrease / die; **(1)**
(ii) no zebras / no food / no primary consumers; **(1)**

Total 6 marks

3. B - alveolus;
C - trachea;
D - rib;
E - diaphragm; **(4)**

Total 4 marks

4. (a) R - phloem;
S - xylem; **(2)**

(b) water;
minerals / named mineral; I nutrients **(2)**

Total 4 marks

5. (a) idea of sterilise pieces of plant;
water;
jelly;
test tube;
cotton wool;
maximum of 2 **(2)**

(b) first and fourth boxes ticked;; **(2)**

Total 4 marks

6. (a) (i) exhaust; **(1)**
(ii) CFCs; **(1)**
(iii) respiration; **(1)**
(iv) global; **(1)**

(b) photosynthesis; **(1)**

Total 5 marks

7. (a) (i) plotting;; **(2)**
joining through each point; **(1)**
neat line; bar graph **(1)**
maximum of 3
(ii) range 17-18 / or from graph; **(1)**
(iii) yield increases;
(then) decreases;
ref to high/low temperatures;
maximum of 2 **(2)**

(b) fertiliser / mineral / named mineral / manure / make soil fertile/ eq;
increase carbon dioxide;
increase light;
water often;
suitable pH;
pesticide;
spray auxins;
biological control;
selective breeding;
maximum of 2 **(2)**

Total 9 marks

8. (a) (i) X on middle arrow; **(1)**
(ii) spinal cord; **(1)**

(b) (i) light; **(1)**
(ii) retina; **(1)**
(iii) optic ;
nerve / (sensory) neurone; **(2)**

(c) nose; smell;
skin; touch / pressure / temperature;
ears; sound / noise / balance;
tongue; taste;
maximum of 2 **(2)**

Total 8 marks

9. (a) (i) line to any chloroplast; **(1)**
(ii) chloroplast / plastid; **(1)**

(b) (i) complete cell + finger-like extension; **(1)**
(ii) long / eq;
increased surface area;
more water absorbed;
maximum of 2 **(2)**
(iii) osmosis;
high concentration of water to low concentration / high water potential to low / eq;
selectively permeable membrane; **(3)**

Total 8 marks

10.

(respiration)	release of energy;	
(growth)	increase in size / number of cells / eq;	
reproduction;	(production of offspring)	(3)

Total 3 marks

11. vena cava;
ventricle;
semi lunar;
pulmonary;
lung(s);
muscle / cardiac;
aorta; **(7)**

Total 7 marks

12. (a)

Event	Letter
protein is first digested	D;
fat is emulsified	A;
bile is produced	B;
insulin is released	E;

(4)

(b) (i) peristalsis; **(1)**
(ii) egestion / defecation; R excretion **(1)**

Total 6 marks

13. (a) (i) both with four chromosomes; **(1)**
(ii) 4; **(1)**

(b) (i) takes less time / quicker / eq; **(1)**
(ii) 2 hours: 2;
8 hours: 16; **(2)**

Total 5 marks

14. increase in number of microorganisms / eq;
breakdown / decompose/ decomposition;
bacteria / fungi;
oxygen reduced;
respiration;
fish die;
decrease in number of fish;
maximum of 5 **(5)**

Total 5 marks

15. (a) petal / corolla / perianth / tepals;
ovary / carpel / pistil;
stigma;
style; **(4)**

(b) (i) iodine; **(1)**
(ii) blue / black / blue-black; **(1)**

(c) (i) Bb (heterozygous); **(1)**
(ii) third box along; **(1)**

Total 8 marks

16. (a) (i) Q; **(1)**
(ii) P; **(1)**

(b) (i) kill bacteria / remove / get rid of / pasteurise / sterilise; **(1)**
(ii) (added) bacteria not killed / not denatured / eq; **(1)**
(iii) optimum / best / ideal / eq;
for enzymes;
for bacteria to reproduce;
for lactic acid production;
enough time to make yoghurt;
maximum of 2 **(2)**
(iv) kill / remove / get rid of / bacteria / eq;
so yoghurt not spoiled / contaminated / eq; **(2)**

Total 8 marks

Paper 2H

1. (a) (i) line to any chloroplast; **(1)**
(ii) chloroplast / plastid; **(1)**

(b) (i) complete cell + finger-like extension; **(1)**
(ii) long / eq;
increased surface area;
more water absorbed;
maximum 2 **(2)**
(iii) osmosis;
high concentration of water to low concentration / high water potential to low / eq;
selectively permeable membrane; **(3)**

Total 8 marks

2.

(respiration)	release of energy;
(growth)	increase in size / number of cells / eq;
reproduction;	(production of offspring)

(3)

Total 3 marks

3. vena cava;
ventricle;
semi lunar;
pulmonary;
lung(s);
muscle / cardiac;
aorta; **(7)**

Total 7 marks

4. (a)

Event	Letter
protein is first digested	D;
fat is emulsified	A;
bile is produced	B;
insulin is released	E;

(4)

(b) (i) peristalsis; **(1)**
(ii) egestion / defecation; R excretion **(1)**

Total 6 marks

5. (a) (i) both with four chromosomes; **(1)**
(ii) 4; **(1)**

(b) (i) takes less time / quicker / eq; **(1)**
(ii) 2 hours: 2;
8 hours: 16; **(2)**

Total 5 marks

6. increase in number of microorganisms / eq;
breakdown / decompose/ decomposition;
bacteria / fungi;
oxygen reduced;
respiration;
fish die;
decrease in number of fish;
maximum of 5 **(5)**

Total 5 marks

7. (a) petal / corolla / perianth / tepals;
ovary / carpel / pistil;
stigma;
style; **(4)**

(b) (i) iodine; **(1)**
(ii) blue / black / blue-black; **(1)**

(c) (i) Bb (heterozygous); **(1)**
(ii) third box along; **(1)**

Total 8 marks

8. (a) (i) Q; **(1)**
(ii) P; **(1)**

(b) (i) kill bacteria / remove / get rid of / pasteurise / sterilise; **(1)**
(ii) (added) bacteria not killed / not denatured / eq; **(1)**
(iii) optimum / best / ideal / eq;
for enzymes;
for bacteria to reproduce;
for lactic acid production;
enough time to make yoghurt;
maximum of 2 **(2)**
(iv) kill / remove / get rid of / bacteria / eq;
so yoghurt not spoiled / contaminated / eq; **(2)**

Total 8 marks

9. (a) (i) 0.4; **(1)**
(ii) 4.0 - 5.6 or 1.6 / 4.0;
40; **(2)**

(b) nitrogen;
gas / from air;
to ammonium / nitrate;
amino acid(s);
protein;
maximum of 4 **(4)**

(c) used up / leached / washed / eq; **(1)**

Total 8 marks

10. (a)

Nucleus in original egg cell	Nucleus in egg cell X	Tick
haploid	haploid	
haploid	diploid	3;
diploid	haploid	
diploid	diploid	

(1)

(b) (i) scales linear + scales over half the axes;
points plotted correctly;
tidy line through points; **(3)**

(ii) 26 / read from graph; **(1)**

(iii) increase in age has decrease in survival / eq; **(1)**

(c) transfer of gene/allele/DNA/genetic material;
from an organism to different organism / eq; **(2)**

Total 8 marks

11. (a) Pneumococcus; **(1)**

(b) phagocytes;
ingest / engulf / eat / eq;
digest / breakdown / ref. enzymes;
lymphocytes;
antibodies;
clump/stick/lyse/neutralise; ; (ie 2 max for this point)
maximum of 5 **(5)**

Total 6 marks

12. (a) 600;
9; **(2)**

(b) (i) LHS; RHS; balanced; **(3)**

(ii) not eaten / inedible;
not digested / indigestible / egested;
excreted / urine / sweating;
movement;
heat loss;
death / decomposers;
maximum of 2 **(2)**

(c) carnivores; **(1)**

Total 8 marks

13. (a) A;
A;
E;
B; **(4)**

(b) (i) water;
urea;
ammonia;
uric acid;
creatinine;
hormones;
vitamins; **(2)**

(ii) **maximum of 2**
contain glucose;
cannot lower sugar/glucose levels / sugar/glucose levels high / cannot convert (sugar/glucose) to glycogen / cells do not absorb sugar/glucose;
maximum of 2 **(2)**

(c) nephron drawn has shortest Loop of Henle; **(1)**

Total 9 marks

14. (a) diffusion (of oxygen);
from alveoli to capillary;
high concentration to low concentration / conc. higher in alveoli / conc lower in capillary / down conc. gradient;
maximum of 2 **(2)**

(b) (i) oxygen difference = 8;
9600; **(2)**

(ii) lowers value / lowers uptake; **(1)**

(iii) increase the oxygen / use oxygen cylinder / eq; **(1)**

Total 6 marks

15. (a) (i) diffusion (in);
stomata / correct ref. to guard cells; **(2)**

(ii) photosynthesis; **(1)**

(b) (i) phloem; **(1)**

(ii) sucrose; **(1)**

(c) (i) in shoot tip + in roots / all parts of plant; **(1)**

(ii) make their own / use non radioactive CO_2 / not exposed to radioactive CO_2; **(1)**

(iii) 6037; **(1)**

(iv) active uptake;
low concentration to high concentration / eq
energy / ATP;
respiration;
maximum of 3 **(3)**

Total 11 marks

16.

Description of process	Name of process
removal of toxic waste from the body	(excretion)
fusion of male and female gametes	fertilisation;
evaporation of water from the leaves of a plant	transpiration;
maintaining a constant level of substances in the body	homeostasis;
growth of a plant shoot towards light	(photo)tropism;
increasing the diameter of small arteries	(vaso)dilation;
adjustments made by the eye to produce a clear image on the retina	focusing / accommodation;

(6)

Total 6 marks

17. (a) adenine / A;
cytosine / C;
(2)

(b) 600;
(1)

(c) restriction enzyme / endonuclease;
cut DNA / gene;
ligase;
join/insert/stick/put into DNA / eq;
plasmid(s);
vector;
recombinant DNA / recombinant bacteria;
maximum of 5
(5)

Total 8 marks

Paper 3

1. (a) (i) °C./ degrees Celsius / centigrade; **(1)**
(ii) 57 (°C); **(1)**

(b) 230 - 245; cm^3 ; **(2)**

(c) C;
no insulation / eq to trap air / not covered / equiv.; **(2)**

Total 6 marks

2. (a) (i) increase surface area / contact between food and reagent / allow food to dissolve/ make a solution / fit food into tube; **(1)**
(ii) Benedict's solution; **(1)**
(iii) Prevent solution boiling / spurting out of tube / less chance of injury / maintain constant temperature/ safer; **(1)**
(iv) time for colour to appear / so reaction can take place /eq; **(1)**

(b) blue; red;
blue; (allow TE from start colour) **(3)**

Total 7 marks

3. (a) rubber tube / capillary tube / beaker; **(1)**

(b) rubber tube and plant / rubber tube and capillary tube / rubber tube / between shoot and tube; **(1)**

(c) (i) by capillary tube + bubble / ruler overlaps bubble; **(1)**
(ii) mm/cm/mm^3/cm^3 per min/hour/second; **(1)**

Total 4 marks

4. (a) (i) female small: tally correct; total 7; (allow TE) **(2)**
male small tally correct; total 7; (allow TE) **(2)**
(ii) points ; (allow TE)
x axis correct;
y axis correct;
bar chart; **(4)**

(b) (i) male 27; (allow TE)
female 26;
normal 39;
vestigial 14; **(4)**
(ii) male and female; 1:1 / similar/equal numbers;
OR
normal and small; 3:1/eq; **(2)**

Total 14 marks

5. (a) keep oxygen/ air out / anaerobic / eq; **(1)**

(b) amount of glucose; measured;
amount of yeast; measured;
concentration of solution; measured;
maximum of 2 **(2)**

(c) (i) 54; **(1)**

(ii) increases and decreases / optimum;
to 50 ; **(2)**

(iii) yes (supported);
no (supported); **(2)**

(iv) enzymes denatured/ destroyed / yeast killed;
less / no respiration;
shape changed/active site altered/no longer bind with substrate/eq;
maximum of 2 **(2)**

(d) 30/third reading at 60 °C; **(1)**

(e) (i) use gas syringe/burette / eq.;
bubbles vary in size/volume more accurate (how results are made more accurate);

use thermostatically controlled water bath;
more accurate temperature control;

repeat collect more readings;
improve average / ensure average is typical / reduce likelihood of anomalous readings;
maximum of 2 **(2)**

(ii) collect more results around 50 °C ;
allows accurate estimate of optimum temperature;

collect results below 10 °C ;
extend range; **(2)**

Total 15 marks

6. C both places;
O stated same species;
R random / repeated;
M1 counting;
M2 scale / multiply up;
S1 sampling /area;
S2 quadrat;
maximum of 4 **(4)**

Total 4 marks

BIOLOGY 4325, CHIEF EXAMINER'S REPORT

Paper 1F

Question 1
By definition this paper is sat by the less able candidates in a centre and the multiple choice items were chosen to start the paper in order to give these pupils confidence at the start of the examination. Their performance indicated that this strategy was well founded. Most students performed at a high level but it was evident that a few questions posed difficulty. A small number thought that carbon dioxide was the gas evolved in photosynthesis.

Question 2
This question was well answered showing that the candidates had a firm grasp on the meaning of the terms producer and secondary consumer. Most were able to construct an accurate food chain, though some made up their own food chain with no reference to the food web in the question. It was disappointing to see food chains with the arrows going the wrong way. The vast majority of candidates deduced that a disease that killed all the zebra would reduce the number of lions as their food source had disappeared. A few more able candidates commented on the fact that the lions might prey more on the antelope to compensate for the shortfall of zebra.

Question 3
Clearly, candidates are able to recall the names of the parts associated with the lungs and the thorax when aided by the degree of information provided. Almost all candidates had little difficulty with this question.

Question 4
A good number of candidates realised that phloem and xylem were the two tissues in question but many confused them by thinking R was xylem and S was phloem. Despite the help given in the stem of part (b), many named a carbohydrate as their answer. Water and minerals appeared on a good number of scripts and it might help students to note that the examiners prefer the term minerals to the term nutrients in the context of this type of question.

Question 5
Candidates struggled to express their ideas as to how the plants could be treated to ensure that they were not contaminated with microorganisms. Surface sterilisation was seldom seen as were ideas regards sterilising parts of the apparatus. Most were able to appreciate that the technique enables plants to be produced that are clones containing the same genes.

Question 6
Prompted by the boxed information, most candidates did very well with this question. The most frequent error was to confuse the processes of respiration and photosynthesis.

Question 7
Far too many candidates extrapolated their line to the origin. They should be encouraged to only join the points for the data they have been given. Describing data presented in graph form seemed to pose little difficulty, though some only referred to the yield increasing, failing to appreciate that at high temperatures it decreases. Many gave sensible suggestions about how a farmer could increase the yield of a crop.

Question 8
Most appreciated that the brain would be involved between the receptor and the effector. Only the more able candidates recalled the spinal cord as the other part of the central nervous system. Many were unclear about light as the stimulus that is detected by the receptors in the eye and about the retina as the part that contains the receptors. Most knew that the optic nerve was involved in passing messages from the eye to the brain, and part (c) posed little difficulty for the vast majority.

Question 9
The better candidates understood that they needed to draw a line from F to a chloroplast and to name this structure in (a) (ii). Some of the drawings were wonderful and clearly showed good understanding of the structure of a root hair cell. Some candidates had misread the question and produced drawings of where the root hairs cells occur on a root. The way in which the structure of a root hair cell helps it carry out its function was understood by many but only the better candidates were able to express the role of osmosis in water uptake.

Question 10
Candidates were able to recall that reproduction is the characteristic of living organisms that helps them produce offspring. However, only the better candidates were able to provide accurate, erudite descriptions of respiration and growth.

Question 11
The format of the question helped the better candidates to perform well in this question. However, it is clear that the weaker candidates have little idea about circulation, or of the structure of the heart.

Question 12
Many were unable to link the correct process to the letter in the diagram. Though most knew that peristalsis was responsible for moving food through the gut, few knew that egestion, not excretion, is the term used to describe the removal of undigested food from the body.

Question 13
This question challenged most candidates. A very small number appreciated that each daughter cell would look exactly like the parent cell, most drawing two chromosomes in each daughter cell. Clearly the term diploid is not understood by the vast majority, at least in the context of the information provided. It was not unusual to see the daughter cells with the haploid number of chromosomes drawn, and many gave 2 or 46 as their answer to the diploid number of the parent cell. Most appreciated that increasing temperature would cause cell division to quicken, though many struggled to express this point clearly. Most failed to calculate that there would be 2 cells after 2 hours and 16 after 8 hours.

Question 14
Candidates would benefit from practising writing extended prose as there will always be a question of this type in the examination paper. Precision, relevance and erudition are required. Those who fully understood the role of bacteria in decomposing dead organic material, consuming oxygen by aerobic respiration and the consequence of this on the survival of fish were few in number. Often answers showed confused understanding with fish being killed by toxins in the raw sewage or describing, in too much detail, algal blooms and eutrophication.

Question 15

Most were able to name the petal and the ovary correctly but had more difficulty in identifying the stigma and style. A disappointing number of candidates believed that the Benedict's test is used to test for starch, though many appreciate that Bb represents the heterozygous genotype and that a flower that is homozygous recessive would produce pollen devoid of starch.

Question 16

Most understood that the nucleoid is made of DNA and that P was the cytoplasm. Part (b) was answered well, though expression was often difficult to decipher.

In part (b), the examiners preferred the idea of bacteria being killed rather than being denatured, and the term 'germs' is to be avoided. Cooling is needed so as not to kill the added bacteria, and recognition of the optimum temperature for reproduction of bacteria or the functioning of their enzymes was expected in (b) (iii). The better candidates appreciated the need to kill surface bacteria before adding fruit in order not to contaminate the product.

Paper 2H

Question 1
Most candidates were able to draw a label line to a chloroplast and to correctly name the organelle. Drawings varied in quality but many appreciated that the cell is similar in shape, but differs in that it possesses a root hair extension. Many understood that the increase in surface area would allow more water to be absorbed. There was evidence of confusion between active uptake and osmosis in part (b)(iii), but those who understood that water is absorbed by osmosis were also able to write about the need for a water concentration gradient and that a selectively permeable membrane is involved.

Question 2
Candidates were able to recall that reproduction is the characteristic of living organisms that helps them produce offspring. However, only the better candidates were able to provide accurate, erudite descriptions of respiration and growth.

Question 3
This question was well answered by most candidates. The more difficult parts concerned recalling the name of the valve as the semi lunar valve, and recalling that the heart is mostly composed of muscle tissue.

Question 4
Most candidates answered part (a) with little difficulty. There was some confusion shown by weaker candidates who thought protein is first digested in the oesophagus, that bile is produced by the pancreas, that fat is emulsified in the liver and that insulin is released from the liver. A pleasing number of candidates knew that peristalsis is the process that moves food through the gut but many thought excretion is responsible for removing undigested food from the body rather than the correct response of egestion.

Question 5
This question challenged many and indicated that the process of mitosis is difficult for students to understand. It was not unusual to see the daughter cells with the haploid number of chromosomes drawn, and many gave 2 or 46 as their answer to the diploid number of the parent cell. Most appreciated that increasing temperature would cause cell division to quicken, though many struggled to express this point clearly. Many failed to calculate that there would be 2 cells after 2 hours and 16 after 8 hours.

Question 6
It seems that candidates would benefit from practising writing extended prose as there will always be questions of this type in the examination paper. Precision, relevance and erudition are required. Those who fully understood the role of bacteria in decomposing dead organic material, consuming oxygen by aerobic respiration and the consequence of this on the survival of fish, did very well. Often answers showed confused understanding with fish being killed by toxins in the raw sewage or describing in too much detail the algal blooms and eutrophication.

Question 7
Most candidates were able to correctly identify the flower parts though weaker candidates thought the stigma and style were the anther and filament. The use of iodine solution to test for starch and the resulting blue black colour was known by many. Possibly helped by the layout of part (c), many were able to appreciate that the genotype was heterozygous in part (i), and that in part (ii), pollen from a homozygous recessive flower would not contain any starch.

Question 8
Most understood that the nucleoid is made of DNA and that P was the cytoplasm. Part (b) was answered well, though expression was often difficult to decipher. In part (b), the examiners preferred the idea of bacteria being killed rather than being denatured, and the term 'germs' is to be avoided. Cooling is needed so as not to kill the added bacteria, and recognition of the optimum temperature for reproduction of bacteria or the functioning of their enzymes was expected in (b)(iii). Most good candidates appreciated the need to kill surface bacteria before adding fruit in order not to contaminate the product.

Question 9
A good number of candidates were able to calculate a 0.4 tonnes per hectare increase in crop yield. A few failed to read the question carefully and calculated a 1.6 tonnes per hectare increase. In part (a) (ii), the correct answer of 40% was often seen on scripts.
With incorrect answers, credit was available for some indication of correct working. Knowledge of the nitrogen cycle is limited and many candidates introduced the names of other types of bacteria and the role they play. In part (c), a good number of candidates appreciated that the chemical fertiliser might be used up or leached.

Question 10
The terms haploid and diploid are not understood by about half the candidates and only the more able deduced that the nucleus in the original egg cell was haploid and that it had been replaced by a diploid nucleus. Graphs were well drawn, though many ignored the request to join the points with straight lines. A common error in part (a)(ii) was to take 50 hour old donor cells and give the answer in the 30's, that is taking the starting point from the independent axis rather than the dependent axis. Almost all candidates appreciated the pattern in the data showing that the older the donor cell the lower the percentage of offspring that survived. Defining the term transgenic was challenging for most. The idea of DNA or a gene being transferred was credited, as was the idea that the transfer took place from one organism to another.

Question 11
It is appreciated that pneumonia can be caused by bacteria or by a virus. However, the specification clearly states that *Pneumococcus* is the name of the pathogen that candidates are expected to know. There was evidence of many excellent answers explaining the role of white blood cells. Weaker candidates referred to white blood cells "fighting" bacteria whilst the good candidates named the white blood cells involved and gave detailed explanations of how they helped to destroy pathogens.

Question 12
Candidates were able to calculate that 600 Kj of energy should be in the herbivore box and better candidates calculated 9 Kj for the top carnivores. Those who failed to appreciate that the 15% of the energy in the carnivores was transferred to the top carnivores calculated a range of incorrect answers, the most common being 4 (15 goes into 60 four times), 6 (10% of 60) and 10 (10% was being transferred in the first two links of the food chain). The weaker candidates struggled to produce a balanced chemical equation for respiration. A good number of candidates were aware of reasons why energy transfer is not very efficient, most making reference to movement, excretion and egestion. Only the weaker candidates failed to recognise that the carnivores were the secondary consumers in the food chain.

Question 13

The more able candidates appreciated that the Bowman's capsule is in region A, and that ultrafiltration occurs in the same region. A large number of candidates believed that ADH has its effect on the loop of Henle, rather than the collecting duct, and many were unaware that selective reabsorption of glucose occurs at the proximal convoluted tubule.

In part (b)(i), water and urea were the anticipated answers, though other acceptable responses were rewarded. The role of insulin in lowering blood glucose levels was understood by many that were able to link this idea to the fact that the abnormal urine might contain glucose. Candidates who used the term glucose were rewarded in preference to those who used the term sugar. Almost all candidates appreciated that beavers would have the shortest loop of Henle.

Question 14

Diffusion of oxygen from a high concentration in the alveoli to a low concentration in the capillary was a concept that most candidates appreciated. In part (b), most candidates were able to calculate the correct value for oxygen uptake as 9600. Candidates were not expected to add units to their calculated value. Almost all realised that emphysema would reduce the value for oxygen intake, but only the more able candidates understood that treatment for emphysema involved increasing the oxygen concentration of the air breathed in. Answers referring to carbon monoxide levels or other substances were not in the context of the question.

Question 15

A good number of candidates recalled that carbon dioxide diffuses into the leaf through the stomata and that photosynthesis makes carbohydrate that is transported in the phloem. The xylem was incorrectly named by some candidates, but the most common error was to name glucose, or more surprisingly starch, as the carbohydrate transported in the phloem. Many candidates understood that the presence of radioactivity in the shoot tip and the root tip provided evidence of translocation up and down the phloem. Part (c)(ii) was more challenging, though some did appreciate that these leaves synthesis their own carbohydrate. Most correctly calculated 6037 counts per minute, and many gave good answers to part (iv), with the best candidates fully understanding the need for respiration to release the energy needed for active uptake of mineral ions

Question 16

This question was designed to aid specification coverage. It was well answered by many candidates. The consistent errors were to confuse fertilisation with sexual reproduction, homeostasis with osmoregulation and vasodilation with vasoconstriction.

Question 17

Many understood that adenine was 30% of the DNA sample and that cytosine was 20%. However, the spelling of these important terms left a lot to be desired. Credit was given for correct use of the letters A and C. Most were able to calculate 600 as the correct number of thymine bases contained in the DNA sample. Many candidates were unable to give an accurate account describing the procedures used to genetically modify bacteria.

Paper 3

The first paper sat by the candidates produced a good range of marks and showed that many candidates were familiar with experimental work in biology.

Question 1

This question provided an opportunity for all levels of candidates to get marks for observation and measuring and recognising appropriate units. Most were able to correctly identify the units for temperature and correctly read the thermometer shown. A small number of candidates were unable to estimate the volume of water present in the beaker. The final part of the question expected the candidates to predict and explain the outcome of heat loss from the beaker without insulation: most could correctly describe and explain this.

Question 2

This question provided candidates with the opportunity to demonstrate their understanding of the methods used in a simple food test. The responses indicated that most candidates were familiar with the test for simple sugars and could give the positive and negative result.

Question 3

This question illustrated a simple potometer and candidates were asked about its set up and use. Most were able to state where water would be during the experiment and to identify where an airtight seal was required. Although most candidates could show where a ruler should be placed to measure water loss, some candidates failed to overlap the ruler scale with the air bubble. The weaker responses placed it at right angles away from the apparatus as used in experiments on the effect of light intensity on photosynthetic rate. The best candidates were able to give an appropriate unit for transpiration rate such as cm min^{-1} or cm^3 min^{-1}.

Question 4

This question enabled candidates to demonstrate their abilities in observing, data handling and analysis. They were required to classify and count the offspring from a Drosophila cross, produce a tally chart and use this to draw a bar chart. A few candidates miscounted but were allowed credit for their subsequent bar charts, thus ensuring that the marks for each component of the question were independent. They were then asked to describe a pattern seen in the results and could have gained full credit from a description of the sex ratio or the 3:1 ratio observed in the offspring.

Question 5

This question described the sort of coursework investigation that a candidate might carry out in IGCSE biology. Many candidates were able to recognise the role of the oil in keeping the conditions anaerobic. However, quite a number could not correctly identify one key factor that David would need to control. We expected a factor such as concentration of glucose which could be controlled by carefully measuring and using the same volume and concentration for each temperature. Centres need to help candidates identify the experimental variable and the control variables when planning an investigation. Candidates were usually able to calculate an average reading based on raw data. Most could describe the results and were able to explain the limitations of David's prediction. To gain full credit when describing the results we would expect candidates to describe the increase in respiration with temperature up to 50°C and the decline after this temperature. The candidates were also asked to explain the results at 80 °C using their biological knowledge. The best candidates were able to explain how high temperatures denature enzymes by changing the shape of the active site, and that this would lead to little respiration. Almost all the candidates were able to identify the anomalous result at 60 °C.

Candidates had most difficulty in suggesting one way that the reliability or accuracy of the experiment could be improved and to explain how it would improve the experiment. To improve the **accuracy** of the experiment David could have collected the gas in a gas syringe or an inverted measuring cylinder. This could be explained by describing how counting bubbles is inaccurate as bubbles could be of different sizes. Candidates could have suggested taking more readings at each temperature thus improving the **reliability** of the experiment. This could be explained by describing how more readings will increase confidence in the average result, reducing the effect of any atypical or freak result. Finally candidates were asked to suggest a further experiment that David could carry out to provide more information on the effect of temperature on respiration. Some of the best responses described how David could extend his study by examining more temperatures either side of 50°C to discover the optimum more precisely.

Question 6

asked candidates to describe how they could compare the population sizes on flat This question and sloping ground. Some candidates did not describe an experiment at all but stated the different factors found on flat or sloping ground. The examiners were pleased to see some very good accounts of how quadrat frames could be used to count the number of plants in a specific sized area and by repeating this and scaling up the results to estimate the population size. This could be repeated in the flat and sloping land. The candidates that had experience of such a study were at an advantage when attempting this question.

BIOLOGY 4325 COURSEWORK, PRINCIPAL MODERATOR'S REPORT

The number of students entered for this component of the IGCSE examination was as follows:

Spec Code	Subject	Number entered
4325	Biology	162

All centres that entered students for this component of the examination had their science coursework moderated by Edexcel's Co-ordinating Principal Moderator. The moderating instrument used was the Sc1 criteria as used by Home centres, using exemplars provided by the JCQ (Joint Council for Qualifications) as a guide.
Centres entering students for the coursework component of the IGCSE examinations in 2005 therefore had their coursework moderated to the same standards as for all Home centres.

Biology 4325

The tasks chosen by the centres were generally appropriate for IGCSE students. Osmosis, catalase, yeast fermentation and protein digestion are all familiar tasks to Home centres, and can yield the full range of GCSE grades. The one exception was the diffusion of ammonia task, which is potentially dangerous due to the nature of the chemicals used, and also more chemistry than biology in its nature. For these reasons it is not recommended.

Several of the scripts had no teacher annotation on them, with marks recorded only on the FIMAS (Final Mark Aggregation) form. Teachers are respectfully reminded that when scripts are marked, they should use the printed coursework mark criteria as a guide, putting minimal annotation such as P6b, P8a, and P8b alongside the point in the script where the student achieves the mark description.

Skill Area Comments
Skill P: P8b. To achieve this mark description, students normally carry out a pilot test. They choose two values from their proposed range (normally one at either end) and try out their proposed method. Students must, in addition, give the results from the pilot testing **and** say how the pilot informs the planning for the main task.
Skill O: O8a. One of the key features for this mark description is that there should be some element of precision. Please note that the counting of bubbles is not deemed sufficiently precise for the award of O8a. Similarly, where temperatures are measured, O8a cannot be awarded where the temperatures are recorded at **exactly** ten degree intervals (eg 20, 30, 40, 50, 60 etc). Students are expected to record **actual temperatures** used (eg 21, 29, 42, 50, 61 etc) where O8a is awarded.
Teachers should note also that the calculation of averages does not form part of the assessment in this skill area.
Skill A: A6a. The description for this mark clearly states that, where appropriate, graphs should have lines of best fit (ie **not** dot-to-dot graphs) where the variables are continuous. Several such graphs were seen this year. (Note that this issue has been discussed with, and agreed, by the Institute of Biologists).
A6b. At this mark description, students are not merely required to discuss the shape of the graph, but also need to explain what it shows using some scientific knowledge and understanding.
A8a. The scientific knowledge and understanding must be at grade A/A* level.
A8b. Students normally discuss **in detail** (ie about half of one page) how their results match their prediction.

Skill E: centres were frequently too generous in the award of six marks in this skill area. This mark is normally commensurate with grade A/A* performance, and some **detail** is expected when students discuss the range of evidence obtained, the closeness of repeat readings (ie reliability of the data); as well as providing reasonable explanations for any anomalous data.
Where further work is proposed, similar considerations apply: students are expected to give about half of one page of detail, either discussing areas of the graph which need more attention (perhaps at a peak or a trough), **or** they give procedural details for the proposed investigation of a second, **linked** variable.

BIOLOGY 4325, GRADE BOUNDARIES

Grade	A*	A	B	C	D	E	F	G
Option 1				60	48	37	26	15
Option 2	No candidates this session							
Option 3	82	71	60	49	35	28		
Option 4	86	74	62	51	37	30		

Option 1: candidates taking paper 1F and paper 3
Option 2: candidates taking paper 1F and submitting coursework
Option 3: candidates taking paper 2H and paper 3
Option 4: candidates taking paper 2H and submitting coursework

Note: Grade boundaries may vary from year to year and from subject to subject, depending on the demands of the question paper.

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