

Human Biology

Advanced GCE A2 H423

Advanced Subsidiary GCE AS H023

Examiners' Reports

January 2011

HX23/R/11J

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Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

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Chief Examiner's Report

General Comments

The Principal Examiners identified some general points that Centres should consider and which are contained within this set of reports. However, it was a pleasing session overall.

There will always be marked differences between units in the January session in terms of the composition of the cohorts. F221 and F224 are predominantly taken by 'first time' candidates, whereas F222 and F225 are taken predominantly by re-sit candidates.

Units F223 and F226 are not offered in the January series, although aggregation is possible as re-sit candidates can carry forward marks obtained from these units in the June 2010 session.

Understanding and answering the questions

The importance of identifying and implementing the command word in a question has been mentioned in previous reports. While candidates sitting F222 and F224 did this well, candidates on F221 were less adept. This suggests that 'first time' candidates, who are making the 'jump' from GCSE to GCE, need to be better trained in this exam technique.

The tendency to 'skim read', such that the candidate writes an answer to the question they assume is being asked, was very evident this session, particularly in F225.

The use of the command word 'suggest' should indicate to candidates that a question requires deeper thinking and application rather than direct recall. While there is no formal testing of synoptic content at AS, all A2 units (F224, F225 and F226) contain synoptic assessment.

F224: this unit contains some synoptic assessment relating to units F221 and F222.

F225: this unit contains some synoptic assessment relating to units F221, F222 and F224.

'Suggest' type questions can be a trigger for candidates to demonstrate a broader knowledge of the Human Biology specification and 'AVP' marking points (Alternative Valid Points) are available within the mark scheme to accommodate those suggestions. While some of the examples of 'AVP' marks might relate to material the 'first time' candidate has not yet been exposed to, centres should be reassured that there is no requirement to teach beyond the specification requirements. 'Suggest' questions at A2 frequently signify 'Stretch and Challenge' questions.

The requirement in a question to compare two sets of data requires more than just a description of one set of data followed by a description of the second. Examiners are looking for comparative ideas, with statements which refer to both. For example, terms such as 'greater' or 'lower' are needed, or a sentence structure which uses terms such as 'whereas' or 'however', or the idea that one difference is 'only 6% whereas the other group shows a difference of 12%'. This was an issue that was apparent on both of the A2 papers this session.

A common feature across the units was the lack of precision in candidates' responses. Examples were noted in F221, Q2, where potassium or sodium alone was not credited as examiners were looking for potassium or sodium ions.

As in previous sessions, key terms and definitions were tested (Q6, F221, Q1 (e), F222, Q6 (a) F224 and Q4 (a) and (d) in F225). Again, there was evidence that candidates could not state or use terms precisely and classroom strategies such as 'bingo' or 'matching pairs' are as relevant at A-level as they are for lower school teaching in developing students' skills in this area.

Dealing with Data

Candidates are expected to describe patterns from graphs and tables in written units and, while many do this successfully, marks may be lost for poor use of data quotes. Data need to be quoted accurately from graphs, using correct units, as described on the axes. Many candidates are aware of the need to do this, but a careful scrutiny of available mark schemes would indicate that there is rarely more than one mark available for the use of data to support a description. Candidates therefore need to be selective in their choice of data rather than quoting figure after figure in the hope of securing the mark for 'data quotes'.

Mathematical Requirement

Calculations of percentage change are still proving to be a challenge for candidates. The calculation on F225 proved particularly difficult. For example, the image of the eye provided for Q5 showed a magnification of $\times 2$. While many candidates noticed this, very few made an adjustment for the scale of magnification before calculating the percentage change.

As in previous series, there was evidence that many candidates could not successfully round up or down to the nearest whole number, suggesting that this is another skill that requires much rehearsal in the classroom.

INSET

OCR runs courses relating to different aspects of the specification. OCR has a programme of training events for the autumn and spring terms. It is also possible to arrange for in-house courses to be held at your centre, either for your centre alone or in conjunction with other centres in your locality, dealing with your specific requirements. It is therefore likely that such an arrangement could be organised for a date that is more suitable to you than the main training events.

Further details can be obtained from the OCR website www.ocr.org.uk.

F221 Molecules, Blood and Gas Exchange

General Comments

Overall, this question paper was well attempted by candidates, suggesting that centres are now more confident in preparing candidates for the new specification and the examination. The majority of candidates were able to complete the paper in the time available and most attempted every question. There was no evidence to suggest that shortage of time was an issue.

There were no obvious misinterpretations of the rubric except occasionally where candidates lost marks because they had not focused correctly on the command word at the start of the question. Candidates need to be aware of the important differences between the words describe, explain and suggest. The word suggest is often a trigger for candidates to display their knowledge and understanding, and to apply their knowledge to a particular context.

Percentage calculations, as shown in Question 5(b)(ii), are still problematic for some candidates, who fail to select the correct figures to use.

Whilst it was pleasing to note an improvement in the ability of candidates to interpret data from graphs, some candidates are still failing to gain marks for quotation of figures from data due to the omission of units.

This session, the overall performance of the candidates showed a relatively normal distribution of marks. There was certainly a wide range of ability and attainment. Question 1 was particularly accessible to candidates of all abilities, whilst more able candidates were able to display their knowledge and attained high marks across the range of questions in the paper.

Comments on Individual Questions

Q.1 This question tested candidates' knowledge of protein biochemistry. A flow diagram for part (c) was used as a way of eliciting responses about protein structure.

- (a)** The majority of candidates achieved the mark available for this part of the question. Where credit was not given, it was often for not providing enough detail e.g. 'alpha', 'beta', 'pleated sheet', 'coiled helix' etc...
Some candidates confused the two types of secondary structure or put 'a' and 'b' instead of alpha and beta, which failed to gain credit.
A few candidates seemed to have misread the question and instead of naming the two types of secondary structure, provided other levels of protein structure e.g. primary / tertiary.
- (b)** Many candidates correctly identified the hydrogen bond and went on to describe this bond as being weak. However, more able candidates were able to elaborate further and describe the features of this bond, such as the attraction involved between the slightly negative oxygen and slightly positive hydrogen. A number of candidates incorrectly referred to peptide bonds and condensation reactions.
- (c)** It was pleasing to see the majority of candidates gaining at least one or two marks for this part of the question. However, the stem of the question made explicit references to protein structure, so it was disappointing to see some answers containing references to various carbohydrates or nucleic acids.
The most common incorrect answers seen by examiners were for 'quaternary' being identified as 'secondary' and 'fibrinogen' being used as an example of a fibrous protein.

- (d)** (i) Most candidates correctly stated ribosomes or RER. Some candidates failed to gain credit by just stating 'endoplasmic reticulum' which was not specific enough for the marking point.

(ii) In general, this question was well answered by the majority of candidates.

Q.2 In this question, candidates were asked to recall information regarding body fluids. In part b(ii) candidates were required to complete a table with ticks and crosses to show the composition of blood plasma and tissue fluid.

- (a)** The majority of candidates were able to achieve at least one of the marks for correctly stating glucose or oxygen as examples of dissolved substances. Examiners did not credit references to sodium or potassium without clarification that they were ions.

- (b)** (i) The majority of candidates were able to identify the vessel as being from the lymphatic system, but answers which incorrectly referred to e.g. lymph node, lymph gland, lymph vein, lymph stem failed to gain credit.

(ii) Examiners were pleased to note that the majority of candidates were using ticks and crosses correctly with few 'hybrid ticks', i.e. a tick with a cross line through it. However, it was disappointing for examiners not to be able to award marks where candidates had not completed the table according to instructions, i.e. candidates did not use crosses but appeared to leave the boxes blank.

- (c)** (i) In general, this question was well answered by the majority of candidates.

(ii) More able candidates were able to suggest an answer involving the removal of clotting factors, but many candidates simply repeated the information in the stem of the question or made references to the storage temperature for serum.

Q.3 This question required candidates to apply their knowledge to a new situation, with the theory of endocytosis being linked to the uptake of cholesterol by the cell. The majority of candidates could state how substances were transported across cell surface membranes, but less able candidates found it more difficult to use detail in their answers to part (c)(i).

- (a)** (i) In general, this question was well answered by the majority of candidates.

(ii) In general, this question was well answered by the majority of candidates.

- (b)** Most candidates understood that glucose is large in size, relative to the oxygen diffusing directly across the phospholipid bilayer and were able to gain one mark for this part of the question. However, few candidates referred to the polarity of the glucose molecule and many answers went on to describe facilitated diffusion which was not credited by examiners.

More able candidates were able to gain credit for correct reference to glucose being lipid-soluble, thereby achieving two marks for this part of the question.

- (c)** (i) Generally, this part of the question showed few good answers with many candidates making simple comments about the substance passing through the cell surface membrane with little detail of the process. Some candidates failed to list the correct sequence of events, such as, the substance being enveloped in a vesicle prior to approaching the cell surface membrane, and did not demonstrate sufficient understanding of the process to gain credit. There were also some very confused answers with a few candidates

describing endocytosis as a molecule entering the cell through proteins or incorrectly describing the process of exocytosis.

More able candidates were able to develop their answers and gain credit for including detail such as, substances being engulfed as the cell surface membrane invaginates, or describing scenarios such as phagocytosis or receptor-mediated endocytosis.

(ii) Examiners were mainly looking for references to the structure or function of the cell surface membrane which was identified by more able candidates. However, many candidates made vague responses to the cell which was not credited.

Q.4 The biochemistry of lipids was being tested in this question. The majority of candidates showed good knowledge of triglyceride structure, but parts of the question which required application of knowledge regarding the structure and role of fatty acids proved more challenging.

- (a)** Examiners reported that this part of the question was generally well answered and full marks were awarded to those who successfully structured their answers with correct use of scientific terms.
Few answers referred to the use of enzymes in the process of breaking down triglycerides and most candidates were awarded their marks for discussing the fact that the structure of the triglyceride was made up of three fatty acids bonded via ester bonds to glycerol, and that these were broken by the process of hydrolysis. Most frequent incorrect answers included mistaking glycerol for glyceride (from triglyceride) or stating that fatty acids were bonded to glucose. It is worth mentioning that the quality of written communication (QWC) mark available was only awarded if the key words were spelt correctly and used in context.
- (b)** Overall, this part of the question was not well answered, with the majority of candidates mistakenly giving the roles of stored fats in the body rather than fatty acids e.g. insulation / protection of organs or energy store.
- (c)** (i) Although the majority of candidates identified the double bond in the fatty acid chain, they failed to gain credit because their references to double bonds were often vague and not clear as to whether they were between two carbon atoms. A few candidates incorrectly referred to carbon and hydrogen 'molecules'.
(ii) As with (c)(i), few candidates made explicit references to the number of double bonds between carbon atoms. Frequently, candidates referred to the number of unsaturated fatty acids bound to the glycerol backbone rather than the number of double carbon bonds within a single fatty acid chain.

Q.5 This question was not answered as well as expected. There were two procedures requiring straight forward recall, but some candidates misinterpreted the question being asked and failed to gain credit. Although there have been improvements in the ability of candidates to interpret data, it is still an area for development, particularly when calculations are involved.

(a) Candidates were asked to describe the relatively straight forward procedure of using a peak flow meter, but few good answers were seen by examiners. Most candidates made reference to the speed of the exhaled air rather than breathing out for as long a duration as possible. The majority of candidates gaining marks for this part of the question made reference to the preparatory stages of using the peak flow meter including deep inhalations and standing up. Some candidates incorrectly described the use of a spirometer, which was confused with the peak flow meter.

(b) (i) It was pleasing to see that many candidates gained two marks for describing that the graph increased to age 35 then decreased. More able candidates then went on to use figures with units from both axes and suggested reasons why the changes occur, most frequently with reference to lung capacity or the strength of the intercostal muscles.

Some candidates offered explanations which were often too vague to gain credit e.g. 'muscles get weaker as you get older'.

Candidates were specifically asked to describe the graph for men, yet still some candidates made comparisons to that of women which did not earn credit.

(ii) Candidates who were able to select the correct data from the graph generally went on to successfully complete the calculation and were awarded two marks. However, there are still a large number of candidates who either cannot select the data to use or struggle to put the correct data into a percentage calculation.

(c) (i) Many candidates achieved both marks for this part of the question. The most common answers seen by examiners were choking, heart attack, named respiratory diseases and drug overdose. Some candidates stated 'taking drugs' which was not considered worthy of credit.

(ii) As in Q5(a), candidates were asked to describe a specific procedure and why it is used, in this case, expired air resuscitation (EAR).

This procedure appeared to be well known to the majority of candidates who easily reached the maximum of three marks.

A few candidates confused EAR with CPR and described performing chest compressions which are not part of the EAR procedure so failed to gain credit.

However, most candidates described the initial stages of the procedure well in order to gain full marks, and this question was accessible to most candidates.

Q.6 In their answers to this question, candidates were asked to apply their knowledge of the circulatory system and blood vessels.

(a) (i) In general, this question was well answered by the majority of candidates.

(ii) Few candidates were awarded this mark as many failed to understand the concept of substances flowing in one direction.

(b) (i) This question was targeted at high demand and, not surprisingly, some candidates struggled to describe accurately how the tissues worked together to maintain blood flow. More able candidates made references to the tissues in the tunica media controlling and changing the size of the lumen's diameter or to the fact that these tissues help to maintain high pressure within the artery.

Many candidates gave insufficient detail in their answers, and failed to describe events such as, elastic tissue stretching and recoiling, or smooth muscle contracting and relaxing. There were also a number of ambiguities about the roles of tissues e.g. contracting and recoiling for an elastic tissue. However, many candidates were able to correctly state the tissues involved to earn the quality of written communication (QWC) mark.

(ii) Examiners were able to credit the majority of candidates with the maximum two marks available for this part of the question.

Candidates were asked to describe the differences between the size of lumen in the artery and the vein and its effect on blood flow. This gave rise to many answers that made good comparative statements between relative blood pressures and speed of flow between these two types of blood vessel.

Only a few candidates got the relative pressures and speed of flow mixed up between the two vessels.

F222 Growth, Development and Disease

General Comments

This paper was of appropriate level of demand and comparable to papers of previous series. Most candidates were able to complete all questions in the time available and attempted every section of the paper.

There were no obvious misinterpretations of the command words for the questions but some candidates lost marks because they had not clearly identified the scientific information needed to answer the question adequately. This was evident in question 5.

The overall performance of the candidates showed a relatively normal distribution of marks. More able candidates were able to display their knowledge and attained high marks across a wide range of topics. The less able candidates had areas of relative weakness, yet on a few questions their knowledge was very good, for example in questions 1 and 4.

It was pleasing to note that many candidates had obviously studied the pre-release material and were able to use the information to produce some good answers to questions 1 and 2.

This session, there was some improvement in the quoting of data but many candidates are still finding it difficult to correctly quote the units when the data is given as number of cases per 100 000, for example question 3 (a)(ii). The calculation of percentage difference is also still proving to be difficult for some candidates.

Comments on Individual Questions

Q.1 This question was based on the case study '**BRCA-1 FREE AT BIRTH**' (Case Study 1). This question was designed to be an accessible start to the exam.

- (a)**
- (i) Many candidates gained one mark for this question by correctly stating that risk is the chance or likelihood of developing breast cancer at a certain age. Some candidates then went on to gain the second mark by correctly describing the additive nature of cumulative risk.
 - (ii) Most candidates were able to correctly describe that cumulative risk increases with age and some correctly quoted figures to support their answer.
 - (iii) Candidates were expected to refer to gene mutations, that they are acquired during the lifetime (for sporadic breast cancer) and inherited as a faulty gene (for familial breast cancer). Many candidates lost marks by failing to refer to genes and by naming mutagens instead of describing their effect.
- (b)**
- (i) There were some good descriptions of random sampling including a selection of participants without bias and detailed descriptions of random sampling methods.
 - (ii) Candidates were asked to give a disadvantage of using random sampling. Good answers referred to the sample not being representative of the population or describing how it was not representative. However, some candidates confused advantages and disadvantages and said that it did not have bias.
- (c)**
- (i) This question asked candidates to calculate the percentage decrease in mortality. Many candidates gave the correct answer of 40 and gained two marks. However, some candidates lost one mark for not giving the answer to the nearest whole number and some were unable to carry out the calculation correctly.

(ii) Candidates answered this question well and most gave three reasons for the reduction in mortality including: better treatment available, improved diagnosis or screening and more awareness and knowledge of the disease.

(d) Some candidates were able to correctly suggest why not all carriers of the *BRCA-1* gene mutation do not develop breast cancer. They explained that some individuals may not have exposed themselves to mutagens and acquired further gene mutations in proto-oncogenes. A few candidates described the *BRCA-1* gene mutation as involving a simple recessive-dominant interaction of alleles which is not correct so was not credited.

(e) (i) Many candidates correctly defined apoptosis as programmed cell death and gained two marks. A few candidates lost a mark by failing to state that the cell death was controlled, programmed or triggered by signals.

(ii) There were some very good answers to this question. Most candidates gained three or four marks by correctly naming and describing treatment for breast cancer. The most common answers referred to: lumpectomy, mastectomy, radiotherapy, tamoxifen, immunotherapy and complementary therapy. A few candidates lost marks by stating that radio waves were used instead of ionising radiation, and a few confused mastectomy and mammography.

Q.2 This question was based on the case study '**RHESUS INCOMPATIBILITY**' (Case Study 2). This question assessed a variety of skills and proved to be a very good discriminator.

(a) (i) Candidates were asked to complete a gap fill question describing how the body recognises foreign cells. There was a good range of marks on this question but only the most able candidates gained all six marks. The most common mistakes were, to confuse antibody and antigen, to fail to give complementary and to give T killer instead of T helper.

(ii) Many candidates found it very difficult to describe the roles of cells and molecules in the specific immune response. Most candidates gained one mark for correctly describing the role of memory cells in the secondary immune response. A few candidates were able to state that plasma cells produced antibodies. Only a very small number of candidates correctly described the role of B cells and cytokines. Candidates were expected to know that B cells divide by mitosis and differentiate into plasma cells or memory cells, and that cytokines are signals produced by T helper cells to stimulate division of B cells and T cells.

(b) (i) Some candidates gave the expected answer for the type of immunity as acquired or artificial and passive. However, some candidates lost one mark by only giving one of these terms whilst others failed to gain any marks by giving incorrect answers.

(ii) Only the most able candidates were able to correctly explain why this type of immunity lasts a few weeks by stating that the antibodies were not produced as a result of an immune response and were broken down by the body.

(c) Many candidates calculated correctly the number of babies saved by the use of the anti-D Rhesus injections. However, a few candidates misread the question and although they carried out the calculation correctly they went on to give the number of babies who did not develop Rhesus incompatibility. Some candidates also lost marks by rounding up 36.4 to 37.

- (d) Most candidates correctly stated that the anti-D antibodies were unlikely to transmit virus infections because donated blood is screened before use.
- (e) This question, asking why it is important for pregnant women to be tested for immunity to Rubella, proved to be quite discriminating. Many candidates gained one or two marks for stating that Rubella affects the development of the fetus, naming a defect or stating that it increases the risk of miscarriage or still birth. Only the more able gained a third mark for stating that it is caused by a virus that can cross the placenta and pass into the developing baby's blood. A few candidates were confused and described how the virus would pass between mother and child after birth.
- Q.3** This question, on tuberculosis (TB), provided a good range of marks and was accessible to candidates of all abilities.
- (a) (i) Credit was only given to candidates who stated that incidence was the number of new cases of a disease. Many candidates confused incidence and prevalence and just referred to the number of cases of a disease.
- (ii) This was the first extended writing question and required candidates to use the information about the incidence of TB in Europe and Africa, to describe and suggest reasons for the differences. More able candidates described the trends accurately and quoted figures with the correct units. They then went on to suggest several different reasons for the differences, including availability of vaccinations and antibiotics, living conditions, prevalence of HIV, malnourishment, weakened immune system, quality of care and education. Less able candidates described the trends but failed to quote figures with correct units and only suggested one or two different reasons for the differences.
- (b) (i) Most candidates answered this question correctly by stating that clinical trials were used, to test the effectiveness of the vaccine, find out about possible side effects and decide the correct dosage.
- (ii) Epidemic was correctly defined by most candidates as a sudden increase in the number of cases of a disease in a given area. A few candidates confused it with pandemic and stated that the disease spread across the world.
- (iii) Candidates displayed a good knowledge of 'herd immunity'. The more able candidates explained that by vaccinating a large percentage of a population, most people become immune, limiting the spread of the disease, as there is a very small chance of a person with the disease coming into contact with a susceptible person.
- Q.4** This question assessed candidates understanding of chronic obstructive pulmonary disease (COPD) and how it causes changes in the bronchioles and alveoli.
- (a) (i) Most candidates understood the term chronic disease and described it as a disease which has a slow onset and lasts a long time.
- (ii) Some candidates correctly gave emphysema and chronic bronchitis as conditions which contribute to COPD. A surprising number of candidates gave the names of other chronic diseases not associated with COPD.
- (iii) There were some correct answers describing different ways of measuring lung volumes but a significant number of candidates seemed not to know and just gave answers such as blood pressure and X-rays which were not credited.

- (b) The more able candidates gave some good explanations of why people with COPD are provided with air with enriched oxygen. These answers included reference to COPD sufferers having a reduced surface area for gas exchange and the need for extra oxygen to increase the rate of diffusion of oxygen into the blood.
- (c) In this extended answer, candidates were asked to provide a balanced account of how tobacco smoke causes changes in the bronchioles and alveoli. More able candidates gave a detailed account including reference to the effect on the goblet cells, ciliated epithelial cells and walls of the alveoli. They also described the way in which smoke removed the inhibition of the elastase produced by macrophages and resulted in the breakdown of elastin. The answers from less able candidates tended to focus on the effect on the bronchioles including inflammation, infection and the formation of scar tissue.

More able candidates gained the QWC mark for referring to changes in both the bronchioles and the alveoli, whereas the less able candidates failed to describe changes in the alveoli and were not credited with the QWC mark.

Q.5 This question assessed the understanding of the terms used to describe aspects of coronary heart disease and the sequence of events that can lead to a heart attack.

- (a) Almost all candidates gave the correct answer of non-infectious disease.
- (b) (i) This question asked candidates to complete a crossword by giving the answer to three descriptive clues. This proved to be challenging and only the more able candidates gained three marks. Most candidates gained a mark for atheroma but only a few were able to correctly identify endothelium and coronary artery. A common mistake for 2 down was to put endometrium and for 3 down to put cardiac or pulmonary artery.

(ii) Candidates were asked to provide clues for three answers that appeared in the crossword. Only a few candidates gave specific clues such as 'another term for a heart attack' for 6 across, 'a chest pain as a result of narrowed arteries' for 4 down and 'another term for a blood clot' for 5 down. Some candidates confused thrombus with thrombin and said that it caused blood clotting.
- (c) Able candidates who read this question carefully were able to describe in detail how a person with angina may go on to develop a myocardial infarction. They were able to mention that the atheroma narrows the lumen of the coronary artery, that it ruptures the endothelium and forms a blood clot which may break away and subsequently block the coronary artery. These candidates then went on to state that this deprives the heart muscle of oxygen and the heart muscle dies. Less able candidates did not read the question carefully and tended to describe in detail how the atheroma develops but not go on to explain how it may result in a myocardial infarction. A few candidates misread the question and described the symptoms a person would have during a myocardial infarction. Only more able candidates gained the QWC mark for the correct order of events leading to a myocardial infarction.
- (d) (i) This question was well answered and most candidates were able to state that a defibrillator is a machine which uses electric shocks to restart the heart.

(ii) Many candidates gained one mark for this by describing how the defibrillator saves lives because it can be used immediately without waiting for the emergency services. Some candidates also gained the second mark by describing how

exercise can increase their risk of a person having a cardiac arrest.

Q.6 An ultrasound scan of a 13 week fetus was given as stimulus material.

- (a)** Most candidates were able to describe the process of amniocentesis accurately by mentioning that a long hollow needle is inserted through the wall of the abdomen into the uterus to extract amniotic fluid. A few candidates lost marks by describing the process of karyotyping.
- (b)** (i) Many candidates gave two correct answers. The most common answers were an older mother, or a mother at risk from a genetic disease, or at risk from Down's syndrome and had received results from a scan which suggested there may be a problem.
- (ii) Many candidates correctly gave chorionic villus sampling as the alternative test but some incorrectly gave the advantage as less likely to cause miscarriage, which is not correct.
- (c)** (i) Almost all candidates were able to give a correct example of a condition detected by ultrasound scans.
- (ii) Almost all candidates were able to give Down's, Klinefelter's or Turner's syndrome as correct examples of a disorders detected by karyotypes.

F224 Energy, Reproduction and Populations

General Comments

It was agreed by examiners that this paper was slightly more accessible to candidates than the equivalent paper of last January. Candidates were able to complete all questions in the time available and very few blank sections were seen.

It was pleasing to see that more candidates are able to correctly identify the command word of a question. They are more aware of the important differences between the words describe, explain and suggest. In question 4, candidates were asked to compare the results of two athletes and it is important to note that this requires an answer linking statements relating to both athletes rather than a description of one athlete's results followed by a description of the other.

The overall performance of the candidates showed a relatively normal distribution of marks and there was a wide range of ability and attainment. More able candidates were able to display their knowledge and attained high marks. Candidates at the E/U boundary were able to display their knowledge more effectively, particularly in questions 1 and 4.

It was pleasing to note an improvement in the description of patterns or trends in graphs and the vast majority of candidates were able to accurately complete the calculation in question 6.

Comments on Individual Questions

Q.1 This question, about oogenesis and Graafian follicle structure, proved to be a very accessible start to the paper.

- (a)** Candidates were presented with a flow diagram outlining the stages of oogenesis.
- (i) Most candidates were able to state mitosis as the process that generates oogonia from oogonium, though the idea of multiplication of cells was accepted. Candidates who did not score a mark here tended to make general statements about cell division, mis-spelt mitosis or stated meiosis.
 - (ii) The majority of candidates were able to state that stage D or C were the stages at which meiosis occurred.
 - (iii) Candidates were asked to state what was happening to cells during the transition from oogonia to a primary oocyte. Many candidates answered this successfully with references to growth or meiosis I. A common error was to confuse this stage with mitosis, whilst some simply stated meiosis without qualification.
- (b)** This question asked candidates to study a photograph of a section through a Graafian follicle in a human ovary and to match statements with parts of the follicle. The majority of candidates were able to identify the nucleus as the structure that contained 23 chromosomes and the lumen of the follicle as the structure that contains protective fluid. There was some confusion regarding the site of oestrogen production and glycoprotein receptors.

Q.2 The female hormone, prolactin, was the basis of this question which included some synoptic elements relating to AS Human Biology.

- (a) Candidates were shown a diagram of a molecule of the hormone prolactin and asked to describe the bonds that hold the tertiary structure together. Unfortunately, some answers tended to concentrate on describing the primary and secondary structures in detail, with various references to peptide bonds, which were not relevant to the question. Most students were able to name hydrogen and disulphide bonds to gain marks, and this was often coupled with a description of the strength of these bonds for a further mark. The more highly scoring answers matched the names of the bonds to a description of the bond or that the bonds were between R groups.
- (b) This question asked candidates to state a target tissue for prolactin and the function of prolactin in this tissue. This question was very well answered, mostly with statements about breast tissue / mammary glands and the production of milk. A smaller number of candidates were able to gain the marks with an answer stating the ovary and that prolactin inhibits ovulation.

Q.3 This question, on the role of HCG in pregnancy and the pregnancy test kit, proved to be a good discriminator.

- (a) This question asked candidates to study a table of HCG concentrations at various stages of pregnancy and relate this to the role of HCG. Many candidates gained at least three marks in this question for stating that it maintains the corpus luteum, which secretes progesterone which in turn maintains the endometrium lining. Incorrect answers were generally confused and ambiguous and gave the impression that HCG that was directly responsible for the maintenance of the endometrium. Surprisingly few candidates commented on the inhibition of LH / FSH and the subsequent failure of ovulation to occur. Several good answers also made reference to HCG concentration falling after 12 weeks as the placenta was formed and started to produce progesterone.
- (b) This question asked candidates to study a diagram of a pregnancy test kit and relate this to what was happening on the strip when a coloured line appears in both windows. Many good answers were able to state that the HCG / urine moved up the strip, and that a HCG-colour complex was formed when it bound to antibody 1. There were correct references to antibody 2 being fixed or immobilised and that a coloured line indicated pregnancy at window L. Most candidates were able to gain a mark by stating that window K was there to show the test was working. However, there was often some confusion about the HCG-antibody 1 colour complex binding to antibody 3 rather than just antibody 1 alone with a common misunderstanding that HCG was needed to produce a coloured line in the control window. A small number of answers also confused a line appearing in the top window as showing that there was a pregnancy or that a line would appear in window L if the woman was pregnant and in window K if she was not pregnant. Several candidates were able to supply additional information about taking an early morning urine sample as HCG would be at its highest, or that the antibody 1 was bound to a coloured bead for further marks. There was a mark available for a reference to the specific nature of antibodies and good candidates were able to gain this with comments about complimentary shapes and binding. A significant minority confused antigen-antibody binding with enzyme-substrate binding and failed to

score this mark. Very few candidates were able to identify that HCG was the antigen.

A quality of written communication (QWC) mark was available here for making reference to three stages in the functioning of the test kit.

Q.4 This question proved to be accessible and enabled candidates of all abilities to display their knowledge.

(a) (i) Candidates were asked to identify a tissue containing cells where reactions given in the diagram occurred and most candidates correctly identified muscle or liver tissue.

(ii) The majority of candidates were able to state that glucose enters a cell by active transport or facilitated diffusion. A minority incorrectly gave diffusion.

(iii) The types of reaction occurring at P and Q on the diagram were largely incorrectly identified. Many candidates simply gave specific reactions, such as substrate level phosphorylation or glycolysis, whereas the question clearly asked for a type of reaction.

(iv) Candidates were asked to suggest one further metabolic pathway for glucose and this was answered correctly by the majority of candidates. Popular choices were the 'link' reaction, the Krebs cycle, glycolysis and respiration.

(b) (i) Candidates were asked to compare the glycogen concentrations of two athletes R and S to the days leading up to the competition. Most candidates were able to observe that the concentration for R rose at a steady rate compared to S whose concentration fell and then rose sharply and also gave accurate figures for glycogen concentrations on different days.

(ii) As a consequence of 4(b)(i), candidates were asked to explain the pattern shown by the graph for athlete S. A pleasing number of candidates appreciated that glycogen stores were depleted through reduction of carbohydrate intake and then rebuilt by a large carbohydrate intake, hence explaining the pattern rather than simply describing it.

(c) (i) This was a challenging question for which few candidates were able to score the marking point. Both the facts that the steroid molecule is non-polar and that it could therefore pass through a phospholipid bilayer were required.

(ii) This question was generally well answered with candidates correctly appreciating the uses of anabolic steroids in particular increasing muscle mass due to increased protein synthesis, features which gave the athlete the ability to train for longer.

(iii) Candidates were able to suggest a wide range of correct responses for long term disadvantages of using metabolic steroids, the most common being infertility and growth of breast tissue.

Q.5 This question, on chemiosmosis and the use of ATP in muscle contraction, was generally well answered by many candidates.

- (a) Candidates were given a description of the different stages of chemiosmosis and were asked to place them in the correct sequence. Candidates were told the first stage in the sequence and many were able to complete the subsequent stages leading to the formation of the proton gradient, which they were also given, in the correct order. This was also followed by the stages in the right order that drive ATP production. This question produced a full range of marks and proved to be a good discriminator. It was pleasing to note that many had a good understanding of this sequence of events.
- (b) An explanation of the precise role of ATP was asked for in this question. There were some excellent answers, which encompassed both understanding and clarity of expression. The role of ATP particularly in the detachment of the myosin head from actin was largely appreciated. A proportion of answers, however, lacked focus on the role of ATP and gave accounts of the whole sliding filament theory starting with the binding of calcium ions to troponin and much of this was irrelevant to the question.
A quality of written communication (QWC) mark was available and was awarded when at least two specialist words were correctly spelt and used appropriately in the answer.

Q.6 This question tackled aspects of the populations section of the specification and had some synoptic elements.

- (a) (i) In this question, candidates were asked to outline the main features of intensive farming.
Most appreciated a high yield in a small area, but only the more perceptive candidates obtained further marking points. Many mentioned the use of fertilisers and pesticides but failed to state that they would need to be in large quantities or that the fertilisers would be inorganic. The concept of providing cheap food was fairly well appreciated.
- (ii) Pollution or eutrophication and reduction in biodiversity were popular responses to the disadvantages of intensive farming. It was also pleasing to note that many candidates realised that there were moral and ethical issues involved in intensive farming such as poor animal welfare.
- (b) (i) Candidates were asked to suggest reasons for the decrease in percentage of carbon dioxide in the atmosphere over a stated time period. A large proportion linked this with increase in plant life and the increased uptake of carbon dioxide for photosynthesis. More able candidates understood the concept of carbon sinks developing over millions of years in fossils and rocks.
- (ii) The link between increased levels of carbon dioxide and its role in stopping heat from escaping was made, in a response to an explanation for 1998 to 2007 being the warmest decade on record. Many candidates were able to state that there has been an increase in atmospheric carbon dioxide due to an increase in the burning of fuels. Unfortunately many incorrectly linked carbon dioxide increase with the ozone layer which has a minimal, if any, effect on the greenhouse effect.
- (iii) Candidates were asked to give reasons why an increase in environmental temperature could lead to an increase in crop production. Few answers were analytical enough in terms of the fundamental reasons at cellular level, namely the

involvement of enzymes in photosynthesis and that the rate of enzyme activity, and hence the rate of photosynthesis, would be increased by an increase in temperature leading greater production of organic molecules.

(iv) It was very pleasing to note that the vast majority of candidates were able to successfully calculate the average yearly increase in sea levels between 1961 and 2003.

F225 Genetics, Control and Ageing

General Comments

Although this was only the second time this paper has been taken, it was agreed by examiners that it was of appropriate level of demand and comparable to the June 2010 paper. The entry for this session was low and comprised mainly of candidates who were re-sitting from June 2010. It was pleasing to see some excellent scripts, although a number of candidates omitted several questions on the paper.

The examiners noted that the more able candidates were confident with the synoptic material and teachers should note this and build opportunities for re-visiting core material from AS and F224 into their teaching.

There was evidence of 'skim reading' of the stem in certain questions with key words being overlooked (in particular, Q1(b) and Q4 (b)). It is essential that candidates read the question carefully before attempting their answer.

It was clear that some key words were not well understood by candidates including *aquaporins* (Q3), *phenotype* and *genotype* (Q4). While genotype and phenotype would have been met at KS4, it should not be assumed that candidates necessarily have a good understanding of their meaning.

Candidate performance on data response questions was pleasing but, as on previous papers, calculations such as that of a percentage increase still prove to be very difficult for the majority of candidates.

Comments on Individual Questions

- Q.1** This question was based largely on module 2 (5.2.2, Treating Central Nervous System Injuries). Synoptic links to cardiovascular disease in F222 and links to scanning techniques were expected in the response. This resulted in good discrimination across candidates.
- (a)** The commonest response referred to cells being starved of oxygen with only better students referring to glucose or that aerobic respiration would be affected. The need for high levels of ATP to support active transport of sodium and potassium ions in the nervous system is a clear synoptic link between this unit and F224.
 - (b)** Most candidates were able to complete the calculation in part (b)(i). Those who did not answer the question well tended to omit one of the risk factors from the description of the subject in the stem of the question. In part (b)(ii), the development of atheromatous plaques was well described although it was not uncommon for candidates to 'stray' into myocardial infarction – again possibly losing site of the stem of the question.
 - (c)** This question was generally well answered with candidates correctly identifying the right group and justifying their choice. It was pleasing to see good candidates referring back to the components of the FSRF score and referring to the 'risk factors' which would contribute to a score linked with a 20% risk.

- (d) This was answered well with most candidates giving several examples of the various techniques used. Where marks were lost, it was generally because candidates wrote at length about one technique.
 - (e) Responses to this question were disappointing. The question was synoptic to F222 (2.1.2(c)) but many candidates confused PET scans with MRI and CT scans. Again there was evidence of 'skim reading'. Many candidates failed to address the aim of the question which was to use a PET scan to investigate memory. Only the better candidates referred to carrying out some sort of memory test while scanning the patient.
 - (f) Part (f)(i) allowed candidates an 'error carried forward' mark if they recognised that heart rate and blood pressure were controlled by the same region of the brain. In (f)(ii), examiners were looking for changes in brain tissue rather than more general descriptions of changes. While some candidates referred to tangles and plaques, correct references to tau protein or beta amyloid protein were not common.
- Q.2** This question was accessible to most candidates and use of data to support answers was good. This suggests that this skill has been well taught by centres.
- (a) This question asked candidates to identify the changes during and after menopause. Candidates were very proficient in describing changes but the QWC mark required them to include changes in hormones. The commonest mistake by candidates was to omit progesterone or to suggest that FSH levels also fall. A few candidates went on to describe the role of HRT, which was not a requirement of the question.
 - (b) Candidates were asked to consider herbal remedies and impending new regulations in part (b)(i). While a few good candidates suggested the need for clinical trials into how effective herbal remedies are, most simply referred to the need to check for harmful side effects or that they did not contain illegal substances. In (b)(ii), weaker candidates assumed that they would contain synthetic oestrogen or progesterone – suggesting some confusion regarding the concept of a herbal medicine.
 - (c) Most candidates noted the overall increase and supported this well with data quotes but failed to notice or comment on the fact that the increase in survival at 5 years was less. The tendency was to repeatedly use data quotes without any qualification, such as 'whereas after 5 years, the rise was only.....'. Several candidates went on to explain their observations. They were not penalised but this suggests that, as in previous sessions, candidates do not give sufficient regard to the command word in the stem of the question.
 - (d) Part (i) was in part a 'stretch and challenge' question with candidates expected to notice that there was little change in survival at 1 year and 5 year for breast cancer. Examiners noted that, while data quotes were used well in part (c), fewer candidates used data in part (d). Part (d)(ii) was done well but some unexpected responses were seen in part (iii), including 'vasectomy' suggesting that candidates had lost sight of the original question.

- Q.3** This question was on kidney structure and the role of ADH. The stimulus material was a labelled diagram. A considerable number of candidates omitted part (b).
- (a)** This question had some aspects of 'stretch and challenge' in that, to identify the correct letter, two 'thinking steps' were required. For example, 'filtration slits' should have triggered the idea of the Bowman's capsule which then needed to be identified in the diagram. Most candidates attempted this entire question but only around 50% of candidates scored more than 1 mark.
 - (b)** Detailed accurate descriptions of the mechanism of ADH release and subsequent action was given by many students. The QWC mark required this to be linked to the experimental evidence provided and approximately a fifth of candidates did this successfully. However, there were several common errors and misconceptions including cyclic AMP and aquaporins circulating in the plasma and water being reabsorbed *into* the kidney tubule. As ever, explanations of the role of osmosis were confused with several incorrect references to water potential.
 - (c)** In part (i), many weaker candidates simply re-stated the question and suggested that ADH would be released when it was not meant to be or that it affected the reabsorption or secretion of sodium ions in some way. Changing concentrations of solutes by changing the volume of solvent is key to understanding the changes in concentration seen in blood plasma and glomerular filtrate. This was a stretch and challenge question and the responses indicated that it was appropriately targeted. In part (c)(ii), weaker candidates ignored the question stem which referred to Class A drugs and answered in terms of the affects of MDMA as already described in the question.
- Q.4** This question addressed the genetics of Huntington's Disease and the ethical issues that are raised by testing for the disease. Neurone structure was tested and the question was also synoptic with both F221 (cell structure) and F224 (protein synthesis).
- (a)** Candidates were given an outline of a genetic diagram with sufficient information in the stem of the question to complete this correctly. Common mistakes were to assign allele symbols incorrectly such that 'Normal' was shown as the dominant allele, or to use inappropriate symbols suggesting that the alleles were co-dominant. Marks were allowed for 'error carried forward' if correct genotypes and gametes were identified but several candidates could not give symbols for gametes correctly with several writing X and Y. While it was good to see many candidates using a Punnett square, all but a handful of candidates failed to recognise that a 'lethal' combination of alleles would result in that genotype not being viable and hence only three possible genotypes would appear in the children, two of which would result in them developing Huntington's Disease.
 - (b)** A common mistake was to misread the question and answer in terms of a couple deciding whether to have children or not. The stem described a couple who have children and candidates were being asked to discuss the ethics of testing these children. Where candidates failed to score, they tended to list 'issues' without any real consideration of the 'pros and cons' arising from either a positive test result or a negative test result.
 - (c)** (i) The idea that the resultant protein would be longer or larger and hence build up quicker was a difficult concept and this question was targeted as a stretch and challenge question and certainly performed at this level. Part (c)(ii) was synoptic with both F221 and F224 but examiners were disappointed that only about a quarter of candidates could correctly identify ribosomes or RER as the site of protein synthesis and again, in (c)(iii), describe the formation of a peptide bond.

The examiners were disappointed at the low numbers of candidates who could distinguish between axons and dendrons in (d)(i), suggesting that these terms are not used in the context of the transmission of a nerve impulse. Most candidates correctly identified the cell body in (ii) but many went on to confuse transcription with DNA replication in part (iii) and answered in terms of cells failing to divide.

(ii) It was pleasing to see that many were able to accurately outline anaerobic respiration in muscle cells. Good answers noted that the pyruvate produced by glycolysis would, in the absence of oxygen, be reduced to lactate in order to regenerate NAD, producing a net gain of two molecules of ATP. Some candidates tended to be imprecise by using the word "convert" to describe when one compound is changed into another rather than use the accurate words like "oxidised" or "reduced". This was also true in some answers to question 4(b)(iii).

(iii) Although some mistakenly thought that EPOC could be used to break lactate down to form pyruvate, many were able to state that the extra oxygen could replenish oxymyoglobin, oxyhaemoglobin and creatine phosphate. This question did refer back to question 2 and it was pleasing to see how some candidates were able to make that link.

Q.5 This question tested the structure of the eye with a photograph of the external features in the stimulus material (Fig. 5.1). A calculation was required. The overall candidate performance was disappointing suggesting that, while candidates are accustomed to diagrams of eye sections, they have difficulty in relating this to actual appearance of the eye.

- (a) The calculation required the candidates to notice several points – namely that the eye photograph had a magnification and that the question required a percentage increase to be calculated. Most candidates noticed the magnification but failed to calculate a percentage *increase* with some reversing the 'start' and 'end' points – assuming that the pupil started large and became smaller. This type of calculation has always proved challenging for candidates suggesting that this is a skill which needs lots of practice.
- (b) Just over half of candidates successfully identified the sclera and were able to give a function suggesting that too many are not able to relate a diagram of the eye section with the outward appearance of the eye.
- (c) Although most candidates could identify that light would pass through the cornea, many then assumed it would pass through the lens, suggesting again that the relationship between the pupil and the rest of the eye is not well understood.

- Q.6** The stimulus material for this question was a diagram representing the production of a recombinant plasmid and the take up of the plasmid by a bacterial cell. The question was also synoptic with F222 and F221 (prokaryotic and eukaryotic cell structure and organelle functions).
- (a)** It was apparent that most candidates were familiar with the enzymes used in genetic engineering with many achieving full marks on this question. Where marks were lost, it tended to be for confusing restriction enzymes with DNA ligase or for providing two alternative answers such as 'sticky ends or blunt ends' for response two.
 - (b)** There was some evidence again of candidates misreading the question in part (b)(i) and attempting to describe the role of EPO. The examiners were disappointed in the low number of candidates who could successfully identify two clear differences. The use of genetically modified bacteria is an opportunity to re-visit F222 module 3, where both prokaryotic cell structure and virus structure are covered in learning outcomes. Retroviruses are an important tool as vectors in genetically modifying human cells. Part (b)(ii) was a stretch and challenge question and only a small number of candidates related the formation of glycoproteins to the role of the Golgi and went on to correctly state that this organelle would not be present in bacterial cells. Most candidates answered in terms of glycoproteins not being needed in bacterial cells.
 - (c)** Most candidates linked the role of EPO to the problems experienced by people who required kidney dialysis. Most candidates answered in terms of the failure to produce enough EPO and the risk of anaemia. Candidates did not pick up on the 'genetically modified' prompt and the examiners did not see any scripts which discussed the advantage of RhEPO.

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