

CO-ORDINATED SCIENCES

Paper 0442/13
Multiple Choice

<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
1	B	21	C
2	B	22	A
3	B	23	A
4	C	24	D
5	A	25	C
6	B	26	C
7	D	27	C
8	B	28	A
9	B	29	B
10	A	30	A
11	B	31	D
12	A	32	D
13	D	33	C
14	D	34	A
15	C	35	D
16	A	36	D
17	D	37	C
18	A	38	B
19	C	39	D
20	D	40	D

General comments

All questions fell well within the ability range of the candidates, and all questions were also effective at discriminating between the candidates of higher and lower abilities.

Comments on specific questions (Biology)

Question 2

Candidates answered this question very well thanks to the clear diagram provided.

Question 4

Although only calling for an item of specific knowledge, this question differentiated well between candidates of differing abilities. The best candidates performed well, but the most popular incorrect answer indicated a misunderstanding between photosynthesis and respiration.

Question 6

The part that has been exposed that was not exposed before is clearly the dentine. There may have been an element of insufficiently careful reading leading to incorrect responses by candidates.

Question 7

This question examined knowledge of the digestive system, this time, of features associated with the alimentary canal. Almost all candidates selected the correct response.

Question 8

The only real problem here for candidates was to decide on which neurone is involved in carrying impulses to the spinal cord. As a few candidates opted for motor neurone, this is an area for improvement.

Question 9

This question was answered correctly by few candidates. The majority appeared to believe that urea is made in the kidney, would indicate a serious misunderstanding. Candidates are reminded to carefully consider what the question as in this case the question was concerned with which organ makes urea and how is it then removed from that organ.

Question 10

There was a lack of accuracy surrounding knowledge of the functions of parts of the male reproductive system. Many candidates did not know the function of the prostate gland, or the function of the testes.

Comments on specific questions (Chemistry)

Question 14 A small number of candidates incorrectly chose option **C**. They had rejected the distractors **A** and **B** but chose the first 'likely' alternative without looking at option **D** which was a better solution.

Questions 16, 17, 21, 23 and 24 proved straightforward with most candidates selecting the correct answer.

Question 19 was the most difficult question with many candidates incorrectly choosing option **A**. Candidates had not fully read the question. They chose the first chloride available without taking into account that the solution was coloured. This answer was more popular than the correct answer.

Comments on specific questions (Physics)

Question 29

A common error was not to subtract the mass of the tank from that of the tank plus liquid. Had these candidates looked beyond option **A**, they might have realised their mistake.

Question 30

There was evidence of guessing in this question about energy resources and which of them received their energy originally from the Sun.

Question 32

Although this question about melting and boiling was reasonably well answered, a significant number of the candidates believed that both these processes involved an increase in temperature.

Question 34

There was a good deal of uncertainty over the image formed by a converging lens, with all three distractors proving popular.

Question 35

A significant number of candidates were unaware that all electromagnetic waves travel at the same speed in a vacuum.

Question 37

There was a lack of understanding of the effect of fitting an incorrectly-rated fuse in an electrical circuit.

Question 39

This question concerned the nature of alpha and beta radiation. Although the majority of candidates chose correctly, the rest were attracted almost equally by each distractor.

Question 40

Although a high number of candidates understood the meaning of the term isotope, there was some confusion for those who were not so well prepared.

CO-ORDINATED SCIENCES

Paper 0442/33
Extended Theory

Key messages

When answering questions, candidates should be guided by the amount of credit allocated to each question and use appropriate scientific language and terms. It is beneficial for candidates to check that they are answering the question that has been asked and that their meaning is clear.

Candidates are reminded that version of the Periodic Table as printed on the question paper should be the one used.

General comments

There were many accurate, concise answers to the questions requiring extended explanations. Those candidates were awarded credit for their use of correct scientific language and terminology. Candidates did not appear to have difficulty in completing the paper in the time allowed.

Generally, in calculations, formulae were written using standard symbols, mathematical operations were carried out accurately and working was well presented. A few candidates used too few significant figures and credit could not be awarded where units were omitted or confused.

Comments on specific questions

Question 1

- (a) (i) Most candidates knew the formula for kinetic energy, and gained full credit if they used the total mass of the train in their calculation.
- (ii) The formula for work done was well known. A few candidates converted the distance from kilometres to metres in the calculation to obtain the correct answer.
- (iii) Many of those who knew the formula for power did not convert the time into seconds. The work done in gaining the kinetic energy was sometimes used in the calculation, rather than the work done in applying the driving force to maintain a constant speed.
- (b) (i) In general, candidates appreciated that the maximum kinetic energy of water at the foot of the waterfall was equal to the gravitational potential energy at the top. To gain credit, they needed to explain that energy was conserved during conversion from potential to kinetic energy.
- (ii) Many candidates knew the relationship between heat energy transfer and temperature change. Difficulty was experienced in rearranging the formula, to make temperature change the subject.

Question 2

- (a) (i) A correct bonding diagram was drawn when it was appreciated that a nitrogen molecule contained a triple bond.
- (ii) Most knew that the nitride ion had an octet of electrons in the outer shell, but some failed to notice that they were required to show the arrangement of *all* the electrons.

- (iii) Many answers simply restated the question, rather than showing that they knew the charges on electrons and protons, and that the charge on the ion was due to there being three more electrons than protons. Those who stated that three more electrons had been *added* also needed to show that the neutral atom initially contained the same number of electrons as protons.
 - (iv) The correct formula for magnesium nitride was usually given. The explanation had to be shown as a comparison of the total charges provided by the magnesium ions and by the nitride ions in the formula, or a statement of the need for charge balance. A diagram showing crossed arrows from the ionic charges, though a useful tool, was not an adequate explanation.
- (b) (i) Chlorine was usually correctly identified as the gaseous element formed at the anode. Hydrogen and carbon dioxide were other suggestions.
- (ii) Hydrogen was usually suggested as the gas forming at the cathode with aqueous magnesium chloride as the electrolyte. simply stating 'pop test' was not sufficient to gain credit; a description of the hydrogen test was required.

Question 3

- (a) The root cell was usually labelled correctly.
- (b) (i) Most candidates explained that root hair cells absorbed water by osmosis and some mentioned the partially permeable membrane. Answers involving movement from a region with high concentration to one with low concentration were ambiguous if they did not specify *water* concentration.
- (ii) There was misunderstanding between the functions of roots and of root hairs. 'To anchor the plant' was a common response, rather than to absorb ions or minerals. The absorption of nutrients was not sufficient to gain credit.
- (iii) Many candidates described the adaptation of root hair cells by noting their large surface area but some did not go on to explain that this maximised absorption.
- (c) (i) The xylem was usually identified as the tissue which transported the coloured water.
- (ii) The central region of the root was not always labelled as the xylem.
- (iii) Most candidates attempted to answer this question in terms of biological processes rather than recognising it as a particle model question. Some did state that the water evaporated but the dye did not, while few recognised that molecules of each behaved independently as separate molecules and were not combined.

Question 4

- (a) (i) Relatively few candidates knew concise, useful definitions of both frequency and wavelength. Candidates who labelled the distance from peak to peak or trough to trough generally gained credit. Candidates are reminded that carefully drawn (and labelled) diagrams can gain all of the available credit.
- (ii) Most candidates knew the formula for the speed of a wave.
- Those who could not recall the standard symbol for wavelength, λ , sometimes wrote the formula in words: speed = frequency \times wavelength; rather than choosing a symbol that could have an ambiguous meaning. The question tested whether the candidate knew that the system of units requires the conversion of kilohertz to hertz.
- (iii) Successful candidates interpreted this question as requiring a description of the meaning of the terms compression and rarefaction as regions of particles packed close together under higher pressure and of particles further apart under lower pressure. Others described the propagation of sound waves or simply the nature of air particles.

- (b)(i)(ii) Candidates gaining credit in these parts appreciated the need to measure the angle between each ray and the normal to the surface.
- (iii) Many candidates gained partial credit by suggesting a device such as an optical fibre. Full credit required a description of its use, such as data transfer or seeing inside the body, rather than, say, just being connected to a telephone. There was some confusion with simple reflection in mirrors, and devices which may or may not use total internal reflection, such a periscope. In this case ambiguity could have been avoided by identifying the optics performing the total internal reflection.

Question 5

- (a) The explanation of how mammals use food to keep body temperature constant needed to include the statement that glucose combines with oxygen in the respiration process, releasing energy as heat. Some answers used ideas from the rest of the question, for example, suggesting that fat in food supplies insulation. Others showed a misunderstanding of the respiration process by stating that energy was used in order to respire.
- (b)(i) Many candidates suggested that marmots need to eat a lot in order to build up fat stores. Most went on to state incorrectly, that they should eat fat which is then stored, rather than excess carbohydrate being converted to fat. The fact that marmots were herbivorous was sometimes ignored and some answers suggested that they had control over the amount of exercise they took.
- (ii) Most candidates correctly described the relationship between a marmot's body mass and its chances of survival. The use of the term 'proportional' was not appropriate for this non-linear relationship. Some compared two sets of data selected from the graph to support their description and a minority observed that the rise in survival rate reached a limit at higher mass.
- (iii) Candidates awarded credit recognised that fat was an insulator or a poor conductor of heat.
- (c) Most candidates could suggest deforestation as a human activity that contributed to global warming and many explained this as being due to the reduction in the removal of carbon dioxide through photosynthesis. Those who had first stated that global warming was caused by the *addition* of carbon dioxide to the atmosphere avoided subsequently making the contradiction that deforestation caused this increase in carbon dioxide. Some knew that methane was a greenhouse gas and that cattle rearing was an important source of this gas. Those who successfully attempted an explanation of the greenhouse effect often used arguments based on trapping heat, rather than radiation. A considerable number of candidates confused depletion of the ozone layer with the greenhouse effect.
- (d)(i) The majority of candidates correctly described the trend as that of increasing body mass rather than commenting on the fluctuations.
- (ii) Rather than merely stating that the earlier arrival of spring caused the increase in mass, successful candidates suggested that this occurred because marmots had more time to feed on plants that were more easily available, or used less of their fat store during winter.

Question 6

- (a) To gain credit, candidates needed to identify both surface area of magnesium and temperature as variables that should be kept constant for a fair test. Ambiguous statements about the 'amounts' of materials to be used, or inclusion of factors related to the choice of equipment were not creditworthy
- (b)(i) Most candidates correctly identified experiment **B** as using acid with the higher concentration.
- (ii) Many candidates gained credit by reading the maximum volume of gas and time taken from the graph and substituting their values into the formula. To gain full credit, they needed to state the units of these measurements and the consistent derived unit of the calculated rate of reaction.
- (c)(i) The (aq) symbol was usually interpreted as standing for aqueous or in water solution.
- (ii) The majority of candidates could find the relative atomic mass of magnesium or could show how to calculate the number of moles present to gain credit.

Question 7

- (a) Candidates who stated that nuclei *split* during fission gained credit.
- (b)(i) The nature of a beta particle as an electron was not well known.
- (ii) Only those who knew that an electron was emitted from the Strontium-90 atom could predict the composition of the Yttrium nucleus. A common misconception was that the nucleus was split in half during the decay.
- (iii) Very few candidates realised that beta was ionising radiation and so changed the neutral atom into an ion by causing the loss of an electron. Some described the capture of the beta particle while others suggested a nuclear process.
- (c)(i) The majority of candidates interpreted the scale accurately and read off the correct count rate after 10 hours.
- (ii) Most understood the effect of half-life on the shape of the decay curve and chose the correct source.

Question 8

- (a)(i) Many candidates knew that they could identify the Periodic Table group number from the number of electrons in the outer shell. Candidates should be reminded that the Group Number for the noble gases is '0' rather than '8'.
- (ii) Most identified **Q** as least reactive because it had a full outer shell.
- (iii) Most identified **P** as a good conductor of electricity because it was a metal.
- (b)(i) The use of limestone in the modern blast furnace was not well known.
- (ii) Only some candidates could name a gaseous oxide of carbon other than carbon dioxide, and could identify iron oxide as the constituent of iron ore from the information given in the question. Rather more could name the products of the reaction in a word equation. Others attempted a symbol equation instead of the word equation required.
- (c)(ii) There were few scientific explanations of sacrificial protection. Successful candidates avoided the pitfalls of referring to the reaction of steel rather than iron, and to the rusting of zinc rather than its corrosion, by explaining the action of a more reactive metal coating a less reactive metal in general terms.

Question 9

- (a) A minority of candidates could recall the full syllabus definition of a hormone. Some responses often described the action of specific hormones using non-scientific terminology, or showed confusion with enzymes.
- (b)(i) About half of candidates knew that insulin was formed by the pancreas, with the liver often being suggested by others.
- (ii) There were some succinct answers stating that insulin causes the liver to remove glucose from the blood and to store it as glycogen. These candidates wrote or implied that glucose was removed from the blood rather than restating the information that the concentration was lowered, or making similar statements about lowering the glucose *level*.
- (c) Some candidates could state at least one effect of adrenaline on the body. The primary effects could have been 'increased blood glucose concentration causing increased respiration and energy provision in the muscles' and 'increased pulse rate causing more glucose and oxygen to be delivered to the muscles'. Answers often stated secondary effects such as sweating, or less scientific descriptions such as 'the body getting more energy' or 'the brain working faster'.

Question 10

- (a) (i) Most candidates could draw a suitable circuit diagram including an ammeter and voltmeter, correctly connected. The symbol for a variable resistance was often drawn incorrectly or the means of varying the potential difference was omitted.
- (ii) The resistance of the lamp was usually calculated correctly from the Ohm's Law formula.
- (b) (i) Most chose **D** as having a greater resistance than **B** because of its greater length.
- (ii) Fewer chose **A** as having a greater resistance than **E** because of its smaller cross-section.
- (iii) A quantitative explanation was required for the values of the resistances of **C** and **E**. The resistance of **C** was 20Ω , twice the resistance of **A**, because the wire had twice the length. The resistance of **E** was 5Ω , half the resistance of **A**, because the wire had twice the cross-sectional area. Some candidates seemed unaware that this was not the same as twice the thickness.

Question 11

- (a) Some candidates could recall that meiosis produced four cells rather than two, halved the chromosome number and produced genetic variation. Credit was awarded to candidates specifying *genetic* variation. Others described mitosis without implying the differences between mitosis and meiosis.
- (b) (i)(ii) Most candidates could draw a genetic diagram to find the probability that the first child would have cystic fibrosis. Where candidates had omitted the parents' genotypes or did not highlight the offspring genotype responsible for appearance of the disease, credit could not be awarded. Ambiguity can be avoided if candidates write the upper and lower case 'f' in such a way as to emphasise the difference.
- (c) It was quite well known that diffusion was the mechanism for the exchange of gases in and out of the alveoli. Relatively few candidates used the idea of the mucus increasing the distance between the alveoli and the blood. They tended not to mention the greater time taken to diffuse over this distance. Many responses mentioned the reduction in surface area for absorption, or the blockage of air passages, which did not answer the question referring to mucus collecting on the inner surface of the alveoli.

Question 12

- (a) (i) Most candidates could match the molecules to their families of carbon compounds.
- (ii) Many candidates correctly draw the structure of a butene molecule gaining full credit. Others drew butane or assigned incorrect valencies to carbon atoms.
- (b) It was common to suggest that the introduction of electric vehicles would not achieve the predicted reduction in carbon dioxide because carbon dioxide would still be produced by other sources. Better answers recognised that electricity for charging the vehicle battery would come from a power station that was likely to burn a fuel that would produce carbon dioxide.
- (c) (i) Some candidates knew that ethanol was made by a reaction between ethene and water at elevated temperature in the presence of a catalyst. Several candidates incorrectly mentioned processes such as cracking and fractional distillation, while others attempted to explain a mechanism of addition of individual atoms to the ethene molecule.
- (ii) Some candidates were able to give a use for ethanol (other than fuel).

CO-ORDINATED SCIENCES

Paper 0442/04
Coursework

(a) Nature of the tasks set by Centres.

Most Centres have provided coursework in previous years and have acted on advice given.

Several Centres, including new ones, provided a very comprehensive portfolio of practical exercises. In most Centres, all the tasks set were appropriate to the requirements of the syllabus and to the competence of the candidates. Candidates' work was of a similar standard to previous years.

(b) Teacher's application of assessment criteria.

In the majority of Centres, the assessment criteria were understood and applied well for all of their activities. There has been a steady improvement in the Centres' application of assessment criteria.

(c) Recording of credit and Teacher's annotation.

Following suggestions made encouraging the use of annotation on candidates' scripts, many more Centres are using this technique to indicate or justify credit awarded. There is still scope for further improvement with some Centres writing comprehensive summaries, but not indicating the point at which the credit was awarded. Tick lists remain popular, particularly with skill C1.

(d) Good practice.

Some Centres make very useful comments about individual candidate's performance on a summary sheet. Many Centres have developed a booklet of tasks and dedicated assessment criteria.