CO-ORDINATED SCIENCES (US) DOU AWARD

Paper 0442/04

Coursework

(a) Nature of tasks set by Centres.

All the tasks set were appropriate to the requirements of the syllabus and the competence of the candidates.

(b) Teacher's application of assessment criteria.

The assessment criteria are understood and generally applied well for all of their activities.

(c) Recording of marks and teacher's annotation.

Tick lists were used for some Centres for C1.

Some Centres write brief summaries on each candidate's script. Centres are reminded when annotating scripts, to annotate the script at the place where the marks are awarded.

(d) Good practice.

All Centres produced a booklet containing all practical tasks, the information given the candidate and the marking criteria specific to that skill being assessed.

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Paper 0442/13
Multiple Choice

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

General comments (Biology)

The questions fell well within the capabilities of the candidates. Some candidates found **Questions 2**, **5**, **6** and **11** challenging.

Comments on specific questions (Biology)

Question 2

There appeared to be a high degree of guesswork in this question due to confusion between the pulmonary artery and pulmonary vein. Candidates should be reminded that knowledge of the main blood vessels comprising the circulatory system is an essential requirement of the syllabus.

Question 4

Cell function can cause confusion, however the majority of candidates knew the correct functions bo blood cells and of root hair cells and chose the key **A**.

Question 5

There was clear evidence of uncertainty surrounding knowledge of food tests. A significant number of candidates appear to believe that a positive test with Benedict's solution (for reducing sugar) is a blue colouration and incorrectly chose option **C** or **D**.

Question 6

Candidates should be encouraged to read the questions carefully as a significant number of candidates incorrectly chose option **D** showing a large amount of water and fibre; while these are important in the diet, it is fat (and protein) that provide the energy and helps growth.

Question 9

Candidates showed a sound knowledge of the structures comprising the respiratory system and this question was generally well answered.

Question 11

A fundamental and quite serious misunderstanding was exposed, believing that the uterus lining is at its thickest in the week *following* the week of menstruation rather than in the week *preceding* it, as many candidates incorrectly chose option **C**.

Question 12

The majority of candidates have a good understanding of food chains and chose the correct response to this question.

General comments (Chemistry)

Candidates found **Questions 16**, **23**, **24** and **27** easy with most answering these questions correctly.

However, **Questions 19** and **22** were challenging to most candidates.

Comments on specific questions (Chemistry)

Question 14

Candidates should be able to use the Periodic Table to identify copper as a transition metal and know that it forms coloured ions.

Question 17

Some candidates incorrectly chose option **A**, but as this option stated the substance was **not** listed in the Periodic Table, it could **not** be an element.

Question 18

Candidates are reminded that powders react faster than lumps of solid or ribbon.

Question 19

Candidates found this question challenging with evidence of guessing. This question tests candidates recall that NaOH, an alkali, displaces ammonia gas from its salts, and that this gas is basic so will turn red litmus to blue.

Question 20

Candidates should recall that platinum is unreactive, and, as a transition metal, acts as a catalyst, in reaction rates. While many knew that ammonia is basic, they assumed that this question inv neutralisation.

Question 21

Candidates often confuse the signs of the anode (positive) and cathode (negative); this could explain why many incorrectly chose option **B**, (hydrogen) instead of the key **A**.

Question 22

Candidates may have incorrectly *either* thought that carbon oxidises the metal oxide *or* they misread the question and thought that they were being asked what happens to the carbon. Only the most able correctly chose the key **D**; 'reduction'.

Question 25

Half the candidates chose the key, **D**, however a significant number incorrectly chose option **C**. Had the question not specified that an 'acid is added to an alkali until the solution is **just** neutral', option **C** would have been a valid choice as excess acid would have cooled down the reaction mixture.

Question 26

Candidates should know that lime is a base, and as such it will neutralise acids in soil and raise the pH, rather than decrease the pH.

Question 27

Candidates should be reminded of the difference between a molecular formula, and an empirical formula.

General comments (Physics)

The best-answered question in the physics section was **Question 28**. Candidates had difficulty with **Questions 31**, and **32**. **Question 36** was particularly challenging.

Comments on specific questions (Physics)

Question 29

While nearly half of the candidates correctly linked the distance/time graph to the appropriate speed/time graph, the same number incorrectly chose option **D**. Candidates should be able to convert from one type of graph to another.

Question 31

Only the most able candidates knew that the temperature of a solid as it melts, and of a liquid as it boils would be constant. About half the candidates believed that the temperature would increase for both, incorrectly choosing option **A**.

Question 32

This question asked about the type of energy stored in water for use in a hydroelectric power station. Most candidates were unable to identify this as gravitational energy.

Question 35

This was generally well-answered. The most common mistake was to choose option **B** which was the 'peak to trough' value, rather than the key **A**, which was the amplitude.

Question 36

This question required knowledge that the angles of incidence and reflection are measured between and the normal, but the majority of the candidates did not know this; many chose the angle between th and the mirror instead.

Question 37

Specific examples of applications of electromagnetic waves are given in the syllabus, but almost one in three candidates thought that a television remote controller uses radio waves rather than infra-red.

CO-ORDINATED SCIENCES (US) DOU AWARD

Paper 0442/23
Core Theory

Key Message

Any formula quoted should be in a standard form and use recognisable symbols. Formulae consisting of units should be avoided. Similarly formulae consisting of a mixture of words, symbols and units should also be avoided. The idea of using the triangle consisting of three variables is a valuable tool to answering calculation questions but is not acceptable as a formula.

General comments

Most candidates attempted all questions, with only a few parts of some questions being inaccessible. Candidates generally gained credit in all questions.

Performance depends not only on scientific knowledge but on the ability of the candidates to both understand the question and to address their answer to the actual question asked.

There was little evidence of candidates running short of time to complete the examination.

Comments on specific questions

Question 1

This question was answered quite well. Some candidates found parts of the question challenging.

(a) Many candidates showed good data handling. Most candidates correctly identified at least two of the points.

(b) (i) Many candidates found the data provided difficult to understand. A number of candidates thought that the data was taken over two days. Full credit was awarded for a good description of how the energy output varied.

(ii) Many candidates repeated their answer to part **(i)** and did not give a reason why the energy output varied.

(c) Only a few candidates named a fossil fuel. Very few were able to describe how the energy is transferred from the fuel to the generator.

(d) This was fairly well answered.

(e) Many candidates seemed uncertain about the characteristics of a plane mirror and described why cars have mirrors, and were therefore unable to be awarded credit.

Question 2

This question was only well answered by the most able candidates. However, most candidates gained some credit.

(a) (i) This was not well answered. Many candidates gave vague answers referring to fuel for vehicles.

(ii) This was not well known. Many candidates incorrectly thought that hydrogen is a p... complete combustion of hydrocarbons.

(iii) Correct explanations about oxidation were rarely given.

(b) (i) Cracking was not known by most candidates. Many different incorrect responses were seen.

(ii) Few candidates realised that unsaturated hydrocarbons were produced during cracking and few knew the bromine test for unsaturated hydrocarbons.

Question 3

(a) Most candidates answered this part well showing a good understanding of the terms producer, consumer, carnivore and herbivore.

(b) Few candidates were able to answer this correctly. None of three possible answers were well known to the candidates.

(c) Most candidates gained partial credit, usually for suggesting muscle contraction or digestion.

Question 4

(a) (i) Gas being produced and a temperature change were well known observations.

(ii) That hydrogen gas was produced was quite well known.

(iii) Only the most able candidates knew that an increase in pH meant that the solution was becoming less acidic as the acid was used up. Many candidates thought that the acid concentration was increasing.

(b) (i) Many candidates gained partial credit for their answer.

(ii) Many candidates correctly identified at least one variable. This was usually the temperature of the acid or the acid concentration.

Question 5

(a) (i) Infra-red was well known.

(ii) Many candidates knew that the waves in the different regions of the electromagnetic spectrum had different wavelengths and frequencies.

(b) Most candidates showed a good knowledge of refraction and total internal reflection and gained credit.

(c) (i) Very few candidates were able to describe an α-particle.

(ii) Very few candidates were able to name a source of background radiation.

(d) Many candidates wrote down a correct statement. Many thoughtful and original creditworthy answers were given.

(e) Most candidates were able to identify one of the pieces of equipment that detected radiations, although very few candidates identified both.

(f) This was well answered by many candidates.

(g) This was well answered.

Question 6

(a) Many candidates were awarded some credit in this question. All of the correct respons equally accessible to the candidates.

(b) (i) Very few candidates were able to calculate the answer of 30 days from the graph.

(ii) Only the most able candidates used the data on the graph to answer this part of the question.

(c) (i) Very few candidates knew the term, Human immunodeficiency virus.

(ii) Most candidates were awarded some credit, usually for a reference to breastfeeding.

Question 7

(a) (i) Most candidates gained partial credit. Although references to corrosion gained credit, references to rusting are not creditworthy.

(ii) Transition metal was not well known. Many different incorrect responses were seen.

(b) (i) The term alloy was not known. Again, many different incorrect responses were seen.

(ii) Although the candidates did not know what an alloy was, many knew an advantage of an alloy compared to a pure metal. Many candidates answered either harder or stronger.

(c) (i) Electrolysis was fairly well known.

(ii) To be awarded credit the label for the cathode had to be drawn to the carbon electrode and not to the wire or power pack.

(iii) Very few candidates were able to identify copper chloride as the compound or give an explanation.

Question 8

(a) The majority of candidates were able to describe the energy transfers involved in the washing machine.

(b) (i) The idea of the random arrangement of both liquids and gases was well known and many candidates gained credit for their drawings. Candidates should be reminded to draw their particles with similar sizes, as drawing where the particle size differed too much were unable to gain full credit.

(ii) Many candidates explained that evaporation had something to do with the faster moving molecules breaking free and leaving the liquid, but were unable to develop this further to gain full credit.

(c) This was quite well answered, although many candidates were not awarded full credit, as an incorrect symbol for current was used. The accepted symbol is **I** not A.

Question 9

(a) (i) This was well answered, and most candidates gained some credit.

(ii) A significant number of candidates tried to write the word equation with a mixture of words and symbols. Candidates should be reminded that a word equation should not contain symbols.

(b) (i) To be awarded credit, candidates had to do more than just identify the features that help trap insects. They needed to state that the pitchers had spines so that the insects could not crawl out or that the pitchers had a slippery rim so the insects fall in.

(ii) The definition of digestion was not well known. Candidates needed to explain that large molecules are broken down so that they could be absorbed.

(iii) Only a few candidates suggested that enzymes must be present in the solution. Mo incorrectly suggested acid.

(c) (i) The idea that water was placed on both sides of some dishes as a control was not well unders

(ii) A number of candidates correctly suggested that the results did support the scientist's hypothesis because insects moved towards the piece of rim. The most able candidates used data from the table to support their answer.

Question 10

(a) (i) This was not well answered by most candidates. Only the most able candidates knew that calcium carbonate is used to reduce acidity in the soil and potassium compounds increase plant nutrient levels.

(ii) The chemical test for carbonate ions was not well known. When a carbonate is mixed with a dilute acid, carbon dioxide is produced.

(b) (i) Many candidates correctly determined the total number of atoms as 15.

(ii) Few candidates realised that to form ammonium sulfate, sulfuric acid would be required for the neutralisation reaction.

(iii) The idea that the solution needed to be warmed gently to allow some of the water to evaporate was not understood.

Question 11

(a) Most candidates gained some credit. There seemed to a reasonable understanding of how enzyme activity is affected by temperature.

(b) (i) Most candidates gained credit for a reference to sweating. A number of candidates thought that the sweat gland was blocked in environmental condition **2**.

(ii) The idea that environmental condition **2** was hotter was well known.

(iii) The idea that muscle contraction would release heat was not well known.

CO-ORDINATED SCIENCES (US) DOU AWARD

Paper 0442/33
Extended Theory

Key Messages

Candidates are reminded to show their calculations to numerical questions. Credit is awarded for both the working and the result of the calculation. This means some credit can be given for the process, even though the final answer may have been incorrect.

Where a formula is used, it should be quoted either in words or using the conventional symbols as listed in the syllabus. A combination of words and symbols will generally not be awarded credit.

General comments

The most successful candidates arranged their answer to address all the points required by the question, mindful of the number of marks available and the space allowed for their response. They checked their work to avoid contradictions, and that they were not simply rearranging the information in the question.

Candidates should use the units as listed in the syllabus, using the correct case.

Comments on specific questions

Question 1

(a) (i) Most candidates correctly labelled the part of the graph when the car was accelerating.

(ii) The total distance travelled by the car was usually calculated by measuring the area under the graph. Some candidate tried to estimate the average speed, those that explained this method gained partial credit for the process even when the answer was incorrect.

(b) (i) The best answers explained the varying energy output from the solar panels in terms of the varying light energy input. Those who made statements such as 'the Sun moves or goes in' were unable to be awarded credit.

(ii) Many candidates correctly measured the time for which the solar cells could run the car.

(iii) Some candidates rearranged the efficiency formula usually obtained the correct numerical value for energy input, however the unit J / s needed to be used to be consistent with the stated value of the output.

(iv) Many candidates quoted the formula for kinetic energy and correctly substituted the data gaining full credit.

(c) (i) To measure the voltage across the cell, candidates placed the voltmeter in parallel and in series in roughly equal numbers. A non-standard symbol was sometimes used.

(ii) The formula for electrical power was well known and most candidates correctly calculated the answer, gaining credit.

Question 2

(a) Many candidates correctly gave the full name of the separation process as fractional distilla

(b) (i) The formula of the alkane was usually quoted correctly as C_8H_{18}. The explanation given o involved balancing the equation, however in to gain full credit, a statement about the need fo atoms of each element to be the same on each side of the equation was required.

(ii) Many diagrams of the bonding of ethene showed the correct element symbols, a shared electron pair at each C–H single bond and two shared pairs at the C=C double bond.

(c) (i) To calculate the number of moles in 480 cm^3 of carbon dioxide, some divided by the molar volume but few candidates remembered to convert this to cm^3.

(ii) The molecular mass of ethene was often calculated correctly. Few candidates found the number of moles of ethene used from the equation and their answer to part **(i)** or to calculate the mass used from this data. It was rare to see a strategy for the calculation written in the answer space.

Question 3

(a) (i) A number of candidates knew that producers transfer chemical energy to herbivores. Some incorrectly wrote about the material which stored the energy.

(ii) The percentage of energy transferred from producers to carnivores was often correctly calculated as 1%. A common incorrect answer was 10%, suggesting that the question had been misread.

(iii) Many candidates gave at least one way in which energy was lost from the food chain. Some answers were too general, such as 'through life processes' to gain credit. The term *excrete* appeared to be misunderstood.

(b) Many candidates knew that the removal of trees would cause less carbon dioxide to be removed from the atmosphere. This was not always explained by referring to the fact that there would be less photosynthesis. The best responses made the link between the addition of carbon dioxide by human activity and its removal by photosynthesis.
Alternatively a description of photosynthesis would be given with an inaccurate statement that this would lead to an increase in the carbon dioxide concentration. The link between increased carbon dioxide content and global warming was not always made.

Question 4

(a) (i) The formulae for magnesium and hydrochloric acid were well known. A significant number of candidates used 'MgC*l*' in their equation, thus preventing completion of the equation and therefore candidates were unable to be awarded full credit.

(ii) Some candidates described the reaction as exothermic. The terminology used for the transfer of heat energy into the mixture was often inaccurate. Heat energy needed to be specified and terms such as 'given off' are not creditworthy. The transformation from chemical to heat energy was not often discussed.

(b) (i) Where an attempt was made at calculating the average rate of gas production at 40 °C, the correct result was usually obtained. Other responses involved the calculation of the average of the rates or the average time taken.

(ii) The most able candidates gave accurate and concise explanations of the effect of temperature on rate of reaction. Credit was sometimes lost by candidates referring to the 'decrease in motion of particles' rather than in their 'speed or kinetic energy'. The requirement for collision to bring about reaction was seldom stated. The importance of collision frequency was recognised by some. Reference to collision energy or its link to chance of reaction was not often seen.

Question 5

(a) (i) Only a minority of candidates knew the speed of light and were able to convert the units.

(ii) As well as infra-red, the most common suggestions for the radiation used in remote control devi were radio and microwave.

(iii) Wavelength or frequency was often correctly suggested as a differing property of waves in the electromagnetic spectrum, with amplitude also being common.

(b) This was generally done well.

(c) Most candidates showed their working and many obtained a good estimate for the half-life. Some had difficulty reading the scales or when they apparently attempted to compensate for background radiation.

(d) (i) Many correctly chose the polonium isotope as having the highest count rate due to its longer half-life.

(ii) Fewer selected the polonium and radon isotopes as being the most ionising because they both emitted alpha radiation. Some candidates thought that gamma radiation was the most ionising.

(e) The medical tracer was most often chosen to require an isotope with half-life of six hours, however many candidates were unable to give a creditworthy explanation.

Question 6

(a) Most candidates knew the direction of flow in at least one pair of blood vessels, usually the maternal artery and vein or the umbilical artery and vein.

(b) (i) Carbon dioxide was often suggested as a substance that passed from the fetus's blood to the mother. General terms like 'waste' were sometimes used.

(ii) Water was occasionally chosen as the substance that passed from the mother's blood to the fetus's blood. Examples were often chosen from materials that had not been digested such as protein.

(c) (i) Most candidates knew that oxygen was carried in red blood cells, often associated with haemoglobin. Only the most able candidates implied that this is a chemical combination.

(ii) Most candidates could select at least one or two reasons why the rate of absorption across the lungs was more than that across the placenta. The term diffusion was not often used.

Question 7

Very few candidates showed confidence in discussing the structure of metals and electrolytic processes.

(a) Many candidates knew that copper was less reactive than sodium and magnesium. Examples of reactions between metals and water or oxygen were less common than descriptions of changes in electronic configuration, sometimes involving covalent bonding.

(b) (i) Very few candidates knew that bronze was an alloy.

(ii) The very few candidates who realised that the tin atoms disrupted the metallic structure of copper were more likely to describe the extra energy required to make atoms move past each other than was required to make **layers** of atoms slip.

(iii) Some answers suggested that an alloy was a compound because its different elements were bonded, rather than because **atoms** of different elements were bonded.

(c) (i) There were a few good answers describing the attraction between copper ions ... cathode. Of these only the most able were able to explain the discharge of the io... gaining two electrons.
Many candidates confused the roles of atoms, ions and electrons in the electrolysis process.

(ii) Candidates were most likely to suggest carbon dioxide for the gas produced at the carbon anode.

(iii) Ideas for obtaining evidence for the electrode dissolving often included weighing. Other methods were more likely to opt for measuring length than a more precise thickness measurement. It was rare that the expected result of the measurement was stated.

Question 8

(a) (i) Of the candidates who knew the formula for power and could rearrange it, only a few converted the power to watts before multiplying by time. Fewer converted the time to seconds.

(ii) Some candidates correctly argued that reducing energy consumption in the machine would reduce carbon dioxide emissions because electricity could be produced by burning fossil fuels. They stated that this released carbon dioxide. They made the link between reduction of demand for electricity and fossil fuels, and the reduction of carbon dioxide emissions. Other candidates suggested that washing machines emit carbon dioxide directly.

(b) (i) Many candidates used Ohm's law to calculate the resistance. Some candidates were unable to be awarded full credit as the units were not given in their answer.

(ii) The formula for charge was not well known, and when it was used the time was not always converted to seconds.

(c) (i) Most candidates correctly drew a diagram representing the arrangement of particles in a gas, thereby gaining partial credit. The representation of a liquid often did not show the particles in contact.

(ii) Most responses only mentioned the change of state of a liquid to a gas. Explanations often stated that heat caused particles to move faster but did not make it clear that it was the faster particles that left the liquid. Few responses made reference to the work done against attractive forces or the heat energy transferred from the surroundings.

Question 9

(a) (i) Many descriptions of how leaves obtained carbon dioxide mentioned the role of the stomata. It was often assumed, but not stated, that the gas came from the air. A diffusion mechanism was seldom included.

(ii) The best responses specified that water was obtained from the soil, and was absorbed by 'root hairs' rather than just 'roots'. The mechanism of transfer was given as osmosis rather than just absorption. Movement up the stem was said to be via the xylem and not the phloem. Transpiration was rarely mentioned.

(b) (i) To gain full credit candidates definitions of digestion had to make it clear that molecules were broken down chemically for absorption rather than food particles being broken down mechanically.

(ii) Some candidates correctly suggested an enzyme that would digest proteins. Others suggested that an acidic solution would be sufficient.

(c) (i) Some candidates understood that the experiment was a control.

(ii) Those who gained credit in this question understood that they had to use the data to describe how responses to a stimulus provided protection.

(iii) The features of the plants that helped them catch insects were often described in full. Features were sometimes assumed without evidence from either the figure or the data.

Question 10

This question covered some fundamental chemistry topics which many candidates found challenging.

(a) (i) The use of calcium carbonate in reducing soil acidity was not well known. Potassium was generally recognised as a plant nutrient but its role in supporting plant growth was not always made clear.

(ii) A number of candidates who derived the charge on the carbonate ion by considering charge balance with the K^+ ion sometimes did not show the formula as CO_3^{2-} as required by the question.

(b) (i) The catalyst used in the Contact Process was not well known.

(ii) Most candidates correctly stated that catalysts increased the speed of the reaction. Some knew that, in the case of the Contact Process, the catalyst did in practice allow the reaction to occur.

(iii) Very few could suggest an acid that would produce a nitrate in a neutralisation reaction.

Question 11

(a) Most graphs of enzyme activity showed an increase and decrease over a suitable temperature range. Some made a sensible suggestion for the temperature at which maximum activity would occur.

(b) (i) There were many good suggestions for the location of temperature receptors in the body.

(ii) Many wrote that the contraction of muscles or shivering would cause body temperature to return to normal. It was more appropriate to describe heat energy being released rather than created. Reference to friction was common but not acceptable.

(iii) There were a few successful attempts to explain the meaning of negative feedback using a specific example of homeostasis. They correctly described how the system responded to a 'sensed change' to return it to normal.