

CO-ORDINATED SCIENCES (US) DOUBLE AWARD

Paper 0442/13
Multiple Choice

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

General Comments: Biology

Candidates generally performed well on the biology questions.

Comments on Specific Questions

Question 2

A significant number of candidates confused the terms respiration and breathing. Candidates should be reminded that respiration is the process in which energy is obtained from food.

Question 5

Only the most able candidates chose vasodilation – the result of muscular relaxation, a totally passive process. Many candidates incorrectly chose option A, which as an active process requires energy.

Question 7

Only the most able candidates knew the difference between the pulmonary artery and the pulmonary vein.

Question 9

Many candidates incorrectly chose option **B**, revealing a misunderstanding of the function of adrenaline. While it is correct that the blood would be pumped faster; and oxygen would be delivered faster to the respiratory surface, the *level* of oxygen in the blood remains similar. What does significantly increase is the concentration of blood sugar (as glucose is released from the converted glycogen in the liver).

Question 10

Candidates should be able to name and identify the parts of a flower.

Question 13

This proved to be the easiest of the biology questions, with the vast majority of the candidates selecting the correct answer.

General Comments: Chemistry

Questions 14, 18, 21, 20, 26 and 29 were the easiest for the candidates.

Comments on Specific Questions: Chemistry

Question 14

The use of chromatography in the separation of coloured compounds is specified and is generally well known.

Question 15

Some candidates would benefit from additional guidance for the deduction of formulae from information given.

Question 16

This question showed evidence of guessing, with similar numbers of candidates incorrectly choosing an incorrect option as those who chose the key **C**. Candidates had either confused the tests for oxygen and hydrogen gases, or, had confused the electrodes that oxygen and hydrogen are produced at.

Question 18

A tiny minority of candidates were confused over the effects of larger and smaller surface areas on the rate of reaction.

Question 23

Similar numbers of candidates incorrectly chose option **D** as those who chose the key **C**. Candidates knew the common names for calcium carbonate and calcium oxide, but were confused in their recollection of what lime is used to neutralise.

Question 24

A small number of candidates incorrectly thought that metallic oxides are acidic, rather than basic.

Question 25

While most candidates knew that potassium is more reactive than sodium, a significant minority were too unfamiliar with bromine or its position within Group VII to understand its reactivity in comparison to chlorine.

Question 26

This was an easy question for the majority of candidates.

General Comments: Physics

No questions on this paper were found particularly easy, but **Questions 31, 34, 38** and **39** caused problems.

Comments on Specific Questions: Physics

Question 28

Only a tiny minority of candidates divided the mass by the area of the base, instead of by the volume.

Question 31

This question concerned energy resources and whether they originally derived from the Sun's energy. Many candidates were unable to identify the **error** in the table as option **B** (hydroelectric energy), most choosing option **C** or **D** instead. Candidates should be made aware of the link between the water cycle and hydroelectric energy.

Question 33

A significant minority of candidates incorrectly chose option **B**, appearing to believe that convection would transfer thermal energy downwards to the toast.

Question 34

Many candidates forgot to halve the time taken for the sound to return to the source when calculating the distance to the building.

Question 35

This question required recall of the measurement representing the amplitude of a wave. Although a large majority of candidates could do this, a significant proportion of them used the 'peak to trough' value instead.

Question 36

A significant minority of candidates incorrectly chose option **A**. These candidates apparently were unaware that dispersion begins at the first air/glass boundary.

Question 37

Candidates are reminded that two different resistors in series across the same voltage (power) supply will divide that voltage up unequally. The potential drop across each resistor can be calculated from $V = IR$.

Question 38

Candidates should be aware that when **both** the current direction and the magnetic field direction are reversed, the direction of the force remains unchanged.

Question 39

There was evidence of widespread guessing in this question on a test for a magnet; only if repulsion occurs must both the objects be magnets.

CO-ORDINATED SCIENCES (US) DOUBLE AWARD

Paper 0442/23

Core Theory

Key Message

Candidates are reminded that if using the word 'it' or 'they' when answering questions it needs to be made clear what is being referred to. Credit cannot be awarded if Examiners are unable to work out what the 'it' or 'they' refers to.

General Comments

Most candidates were able to attempt most questions, gaining some credit for their answers. Sometimes it appeared that candidates knew the answers to the questions, but their answers were too vague to be awarded credit.

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 or 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.

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

Performance depended not only on scientific knowledge but on the ability of the candidates to understand the question and express themselves clearly.

Comments on Specific Questions

Question 1

(a) (i) and (ii) Most candidates gained partial credit for knowing either an advantage or a disadvantage.

(iii) Kinetic (energy) was not well known. Many candidates wrote down wind energy.

(b) Few candidates were able to do this. Many candidates had a single energy transfer from thermal to electrical, with no mention of water, steam, turbines or generators.

(c) Very few candidates realised that this question was about expansion and contraction. Many wrote about wind damage.

(d) (i) and (ii) A few candidates answered these parts well.

(iii) Most candidates successfully completed the calculation, showing good data handling skills. A few did not quote a formula or show their working. The unit for resistance was not well known.

Question 2

(a) Photosynthesis was quite well known.

(b) The term for tissue X, *mesophyll* was only known by the most able candidates.

(c) Full credit was gained by drawing a rectangular cell and correctly labelling four structures of the cell. Candidates were not awarded credit for incorrect labelling or where the structures were placed in an impossible position.

- (d) (i) The vascular bundles were usually correctly identified.
- (ii) Xylem and phloem were well known.
- (iii) Only the most able candidates could describe two functions of a vascular bundle.

Question 3

- (a) (i) Some candidates were able to describe an alloy as a mixture of metals.
 - (ii) The term *malleability* was not well known.
 - (iii) Many incorrect substances were suggested.
- (b) Few candidates were able to do this. Full credit was given for discussing the gain and loss of electrons or the resulting charges on the ions.
- (c) (i) A significant number of candidates managed this, however many candidates did not use the information given in the question.
- (ii) Only the most able candidates knew that a non-metal oxide would be acidic, and give a correct colour change or explanation.

Question 4

- (a) Most candidates gained partial credit for this part. However a common error was to replace artificial with natural in the first gap.
- (b) (i) Many candidates correctly identified the two sheep breeds suitable for crossing.
- (ii) Most candidates were able to give at least one suitable characteristic.
- (c) Few candidates were able to explain that the sheep would use their food for making meat/muscle rather than being used in making wool.
- (d) Many candidates explained correctly that the female sheep are kept for breeding and/or milk production. A number of candidates suggested that male sheep were bigger, which was not accepted.

Question 5

- (a) (i) Few candidates used the term *pole* in their answer. Instead they used terms such as 'side' which is too vague to be awarded credit. A significant number of candidates confused poles with charges.
- (ii) Gravity was the only force commonly mentioned. A few candidates attempted to explain about the Earth's magnetic field, without suggesting that it was the Earth's magnetic field referring vaguely to a 'magnetic pull'.
- (b) (i) In this part it was essential that candidates referred to charges.
- (ii) A few candidates knew about electron transfer, but very few explained why there was electron transfer.
- (c) Many candidates successfully completed the calculation, showing good data handling skills. A few did not quote a formula or show their working.

Question 6

- (a) (i) A number of candidates knew that the number of electrons was six but few could explain why.

- (ii) Although most candidates suggested covalent bonding, candidates needed to explain why a substance had to be covalent to be awarded credit. Few managed to do this. Many stated that it was because the atoms were sharing electrons, while this in itself is a perfectly accurate description of covalent bonding it does not explain why these structures are covalently bonded. This was all to do with both atoms being non-metals.
 - (iii) Only a few candidates could correctly explain why molecule **P** was carbon dioxide.
 - (iv) Burning a carbon fuel was not well known. Responses such as 'driving' were considered too vague to be awarded credit.
- (b)(i) The limewater test was not well known.
- (ii) A number of candidates correctly suggested that the mass would decrease. Very few could explain why.

Question 7

- (a)(i) and (ii) Some candidates were able to use the information in the question and their knowledge to answer these parts correctly.
- (b)(i) and (ii) some candidates showed a good knowledge of wave property terms.
- (c) A number of candidates gained some credit but few were able to fully describe what was happening to the particles.
- (d) Some candidates successfully completed the calculation, showing good data handling skills. A few did not quote a formula or show their working. A small number forgot to divide the distance by two.

Question 8

- (a)(i) The term *gamete* was known better than the term *genotype*.
- (ii) Most candidates deduced that the dominant allele was **G**/green.
- (b) Few candidates were able to explain that yellow was recessive or that there was no green allele present.
- (c) Many candidates were able to work through this part, gaining credit.
- (d) Chlorophyll was quite well known as the substance which gave the green seeds their colour.

Question 9

- (a)(i) Very few candidates identified nitrogen as the main gas in air and state its percentage.
- (ii) Only a few candidates correctly named a gas that causes air pollution, however, very few could describe a harmful effect of that gas.
- (b)(i) The test for hydrogen gas was not well known.
- (ii) Only the most able candidates deduced the name of the product for the reaction as magnesium chloride.
- (c)(i) The term *exothermic* was not well known.
- (ii) A number of candidates correctly stated that reaction had stopped.

Question 10

- (a) Many candidates gained partial credit. The commonest correct connection was between *ultraviolet* and airport security scanners.
- (b) Candidates are reminded to take greater care with their labelling. Candidates need to be very accurate with the measurement for showing the wavelength. A double headed arrow placed between two waves and pointing to both waves was usually not sufficient. The arrowheads need to point to *identical* points on two consecutive waves.
- (c) (i) Very few candidates knew this.
- (ii) and (iii) These parts were not well answered. Many candidates put the radiations in reverse order.
- (iv) Very few candidates were able to describe radioactive decay.

Question 11

- a) (i) and (ii) A significant number of candidates were able to identify the gases. A common incorrect answer for part (ii) was oxygen.
- (b) Diffusion was not well known.
- (c) (i) Red blood cell was well known.
- (ii) and (iii) These parts were not well known. There were no common wrong answers.
- (d) This was very poorly answered. Very few candidates identified where the oxygen concentration was the lowest or went on to explain why this was important in terms of oxygen diffusion.

Question 12

- (a) (i) Most candidates correctly gave the answer 3.
- (ii) Many candidates correctly identified the compound molecule.
- (b) (i) and (iii) The term transition metal was not well known, and only a few candidates were able to suggest any properties of transition metals.
- (iii) Many candidates gained some credit, usually for a correct use of aluminium. However, many uses listed were very vague and only few candidates could explain why aluminium had the use they had stated.
- (c) (i) and (ii) These were quite well known.

CO-ORDINATED SCIENCES (US) DOUBLE AWARD

Paper 0442/33
Extended Theory

Key Message

The most successful candidates were able to apply the fundamental principles to explain phenomena in all branches of the subject. Candidates should be reminded to use key words provided in the question, e.g. *energy* for energy transfer, and *particle* in collision theory.

Many candidates tailored their answers to the requirements of the questions, discriminating between terms such as *state*, *describe* and *explain*. Candidates should be able to quote definitions as stated in each area of the syllabus.

General Comments

Successful candidates demonstrated their knowledge by presenting their answers with care, ensuring their meaning was unambiguous and showing the steps in their calculations. They quoted the formula they were using and where necessary showed how they rearranged it. They used units consistent with the data supplied.

Some responses could have been improved by making reference, as directed, to the data in tables, graphs and diagrams to support explanations. Candidates were often able to apply their knowledge to unfamiliar contexts.

Common misconceptions included confusion between global warming and depletion of the ozone layer. For this syllabus, carbon dioxide and methane are the greenhouse gases having the greatest contribution to global warming.

Comments on Specific Questions

Question 1

- (a) (i) Successful responses suggested advantages of wind power such as being a renewable resource rather than reusable, a free energy source rather than just citing cost and lack of pollution. Good suggestions for disadvantages were high capital cost rather than just cost and the need for space rather than repeating the information about the amount of power achievable. Vague statements about being good for the environment needed explanation.
- (ii) Some candidates correctly calculated the efficiency while not quoting the formula. A significant number used an inverted formula.
- (b) (i) This question referred to energy transfer so the thermal to kinetic energy change should have been included in the description of the process occurring in a power station. Reference to heat energy or thermal energy rather than just heat was required in the response. Few candidates could describe the process as heat energy being used to produce steam which turned a turbine and generator.
- (ii) There was a wide range of suggestions for the nuclear process occurring in the Sun.
- (c) Candidates who knew the relationship between current and power usually calculated a correct value for the current.

- (d) Few responses recognised that power cables would contract in cold weather leading to a common misconception was that they were hung loosely as they contracted at high temperatures. Some candidates also referred to tension affecting resistance causing heating of the cable.
- (e) (i) Candidates who knew the relationship between cross-sectional area and resistance chose the correct wire.
- (ii) Those who knew that resistance was dependent on cross-sectional area, length and the material from which it was made chose the correct wire.
- (iii) When the Ohm's Law formula was correctly arranged the right value for current was usually obtained.

Question 2

- (a) (i) Most candidates were able to name the cilia.
- (ii) Some candidates showed that they understood the role of the mucus secreted by goblet cells in trapping pathogens and being pushed away from the lungs by the cilia.
- (b) (i) Tar was the best example of a damaging component of tobacco smoke. Some candidates may not have understood the word *component*.
- (ii) The most able candidates showed how the smoke component given in (b) (i) disrupted the process described in (a) (ii). A common misconception was that tobacco smoke reduced mucus production.

Question 3

- (a) (i) Some candidates knew the definition of an alloy.
- (ii) A significant number knew that the physical property was malleability. There was evidence that the term *physical property* was not well understood.
- (iii) Candidates needed to use the information about the composition of Dutch metal at the beginning of the question in order to name the compounds formed with chlorine.
- (b) Some candidates answered this question by drawing good diagrams showing electron transfers between atoms, however a significant number of these omitted the formula from their conclusion.
- (c) A correct equation was the result of deducing the formula of phosphorus oxide from the data and showing the subscript number of atoms per molecule.

Question 4

- (a) Most candidates knew the key constituent elements of fertilisers, and some named the ion present.
- (b) Run-off or the wind was often suggested as the mechanism by which mineral ions reached the river. Movement of soil was quoted as a less likely method.
- (c) (i) to (iv) Good answers stated that fertiliser increased the growth of algae. Others suggested that fertiliser acted as a toxin or reduced water transparency to sunlight.

The most able stated that fertiliser reduced photosynthesis by submerged plants due to shading by those at the surface leading to their death. Others suggested that fertiliser acted as a toxin, reduced water transparency to sunlight or encouraged more than initially strong growth.

Many stated that fertiliser increased the growth of bacteria as they fed on dead plants. Others suggested that fertiliser acted as a toxin or increased their growth.

Most stated that fish died due to lack of oxygen. A few suggested that fertiliser acted as a toxin or caused a reduction in available food.

- (d) Some candidates suggested using less fertiliser to reduce the effect on the river. Some of the most able mentioned the timing of its application. Many suggested less practical measures such as building a barrier or not farming near the river.

Question 5

- (a) (i) Most candidates described the repulsion of the magnets. Only a few gave an explanation in terms of the general rule that like poles repel.
- (ii) Many candidates appreciated that the iron would become magnetised, sometimes then describing attraction. Some thought that magnetism could not be induced in unmagnetised iron.
- (b) (i) Most candidates described the attraction of the charged balls. Electric and magnetic fields were sometimes confused.
- (ii) Some candidates explained the electron transfer occurring when the ball was rubbed by a cloth.
- (iii) The concept of electric field was not generally understood. Only the most able knew that the charge experienced a force moving it towards the ball with the opposite charge.
- (c) Those who knew the formula for density, often correctly substituted the data, although a significant number did not state the correct units.

Question 6

- (a) (i) The correct number of electrons in a carbon atom was usually given. Only a few gave the equivalence of the numbers of protons and electrons as the reason. Some applied a rule which would not generally work, such as subtracting the atomic number from the mass number.
- (ii) A minority of candidates identified the ethane molecule and fewer explained their choice in terms of the numbers of carbon and hydrogen atoms.
- (iii) Many candidates knew that covalent bonding was found in the molecules, and a few explained it in terms of the bonding between non-metals. Others just described the covalent bond.
- (b) (i) Many candidates correctly calculated the mass of water by multiplying the relative molecular mass by the number of moles. Some were distracted by the molecular mass of methane.
- (ii) The best responses to this part of the paper showed the calculation of the mass of methane hydrate obtained by adding the molar mass of methane to the mass of water obtained in part (i).
- (iii) Some candidates began their explanation of how the breakdown of methane hydrate might affect global warming by stating that methane was a greenhouse gas. Very few went on to predict the further melting and release of methane which would increase the rate of global warming. There were several irrelevant references to depletion of the ozone layer.

Question 7

- (a) Many candidates described how air pumped into a tyre caused it to inflate by stating that the number of moving particles in the tyre increased causing the pressure to increase. Some explained this in terms of the increased rate of collision with the tyre wall. Others thought that there was a significant increase in volume of the tyre, or made vague statements about particles 'wanting' to get out.
- (b) The principles involved in the working of an electric motor were not well known. The most able candidates included the forces on the sides of the coil acting in opposite directions, and reversing of the current to keep the coil rotating in the same direction. Rather than explaining in terms of the interaction of the magnetic field produced by the current with the permanent magnetic field, many candidates postulated a force of attraction between poles and the coil.

Question 8

- (a) A minority of candidates gave an explanation of continuous variation, rather than discrete variation as asked by the question.
- (b)(i) Most counted the number of coloured grains correctly, although some counted the grains in the whole cob.
- (ii) The whole number ratio was usually correct if 'cancelled down'.
- (c)(i) Almost all candidates stated that the sweetcorn grain with genotype **Gg** was purple.
- (ii) Most candidates correctly used the ratio to deduce the genotypes of the parents.
- (d) There were a many excellent genetic diagrams. The most common error was in completing the gamete line.

Question 9

- (a)(i) While some knew that nitrogen was the major constituent of air, very few gave the percentage as 78. There was a wide range of other suggestions for both the constituent and the percentage.
- (ii) Where sulfur dioxide was given as a polluting gas from car exhausts, an effect of acid rain had to be mentioned to gain full credit. Only a few candidates suggested nitrogen dioxide, along with the effect of damage to respiratory systems. The greenhouse effect was often incorrectly cited.
- (b)(i) Most candidates knew the test for hydrogen but some thought that just seeing bubbles would suffice. Candidates should understand the scientific meaning of the term *test*.
- (ii) Very few candidates described the reaction in the form of a word equation.
- (c)(i) Although the question asked for an explanation in terms of energy, only the most able stated that thermal energy was released and the increase in kinetic energy of the particles. Some candidates correctly described the reaction as exothermic.
- (ii) The shape of the graph was sometimes correctly explained by realisation that the acid had been used up, although some candidates had difficulty in explaining that the magnesium was in excess. It was not always made clear that the reaction had stopped so that no more heat was being released. Some responses just described the temperature change over the course of the reaction.

Question 10

- (a) Most candidates matched the electromagnetic waves to their uses.
- (b) Frequency and wavelength were defined correctly by a minority of candidates. Diagrams were often inaccurate.
- (c)(i) Many candidates placed the radiations in the correct order of ionising ability.
- (ii) Only a few candidates gave a good explanation for the deflection of radiations in a magnetic field. Credit was awarded by candidates showing a link between deflection and charge. The most common misconception was that charged particles were attracted to the poles of a magnet.

Question 11

- (a) Most candidates knew that osmosis involved the transfer of molecules, and many provided a full definition.
- (b)(i) A few responses referred to the reduction in size of the vacuole or the withdrawal of the cell membrane from the cell wall.
- (ii) Some suggested that water moved out of the cell from high to low water concentration. Others wrote that sugar entered the cell.

(iii) Many diagrams of the cells in water were carefully drawn.

(c) (i)(ii) Only the most able described structural features such a shape or permeability of the cell wall and went on to relate them to the function. A few confused the function of root hairs cells with that of roots.

Question 12

(a) (i) The number of gases was usually counted correctly.

(ii) and (iii) Where the compound was correctly identified, a good definition of a compound was stated.

(b) Some candidates knew that cobalt was a transition metal.

(c) (i) Many candidates did not seem familiar with the industrial extraction of aluminium.

(ii) Oxygen or carbon dioxide were most often correctly named as the gas appearing at the anode, however a wide range of other gases was seen.

(iii) In describing what happened at the cathode when Al^{3+} ions were converted to atoms, most candidates just repeated information in the question and were unable to be awarded credit.

CO-ORDINATED SCIENCES (US) DOUBLE AWARD

Paper 0442/04

Coursework

- (a) Nature of tasks set by centres.

Several Centres provided a very comprehensive portfolio of practical exercises. In most Centres all the tasks set were appropriate to the requirements of the syllabus and the competence of the candidates. Centres are reminded to select tasks that meet the requirements of the syllabus.

- (b) Teacher's application of assessment criteria.

In most 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. Centres are reminded that it can be difficult to assess candidates for following instructions and planning in the same assignment.

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

Tick lists remain popular with particularly skill C1.

Many Centres write brief summaries on each candidate's script. The use of annotations to indicate where and/or to justify how credit has been awarded, continues to be helpful.

- (d) Good practice.

Many Centres have developed a booklet of tasks and dedicated assessment criteria.