Public Examinations 1936

BY permission of the Department of Education, further reports of the examiners in Science subjects in the Leaving Certificate and Intermediate Certificate examinations are published in this magazine, so as to make them available to teachers and students during the current year, prior to the publication of the official handbook of the Department.

In this issue the reports on the Elementary Physics and on the Botany papers are printed.

ELEMENTARY SCIENCE PHYSICS.

Question 1.—(*a*) Write a summary of your knowledge concerning **The Standards** in the c.g.s. system of units.

(*b*) What is meant by an error in measurement due to " parallax " ? Give an example from your own observations and state how the error was avoided.

This was not a very popular question. The attempts at the first part were better than in previous years, but there were still some children who gave lists of tables for the c.g.s. units of length and mass, and some who attempted to define all the c.g.s. derived units, but who made no mention at all of the Standards.

Part (*b*) was fairly well answered. The majority of the students who attempted it knew what was meant by a parallax error, though they had difficulty in expressing themselves ; some, however, confused a parallax error with a zero error.

Question 2.—Giving full details of the experiment, state clearly and fully how you would determine the relative density of an insoluble powder such as sand. Illustrate your reply by an example giving suitable numerical values to the various quantities measured.

Define density and relative density.

This question was attempted by a very large majority of the candidates, and was done well by a considerable number. Nearly all the students used the relative density bottle method, but some of them described the experiment in such a way that it was impossible to tell whether or not the method was correct ; in some cases this point was cleared up by the numerical example, but in others the numbers chosen were such that it was still impossible to decide whether the candidate was right or wrong ; the question was to state " clearly and fully " how the experiment would be performed, and accordingly these ambiguous answers were penalised heavily.

Question 3.—A glass U-tube has two cylindrical arms of different diameters, namely 2 cms. and 4 cms. Some mercury is poured into it, and then 50 cc. of water is poured into the wider arm ; what volume of liquid of relative density $0 \cdot 8$ must be poured into the other arm so that the mercury may be at the same level in both arms ?

This question was not attempted by as many candidates as has been the case with similar questions in previous years. Very few correct answers were obtained ; *the large majority of students did not appreciate the fact that the difference in cross-section of the arms has no effect on the pressure,* and accordingly they received practically no marks for the question.

Question 4.—(*a*) Describe simply any type of barometer, and explain *how* and *why* it can be used to read the atmospheric pressure.

(*b*) State briefly why floating bodies are an illustration of Archimedes' principle.

This question was a popular one. Part (*a*) was moderately well done by a fair number of students, though very few were able to explain why a barometer can be used to measure atmospheric pressure ; a few very good answers were given. (A few candidates described a thermometer instead of a barometer, and one described a micrometer screw gauge.)

Part (*b*) was not very well attempted. A large proportion of the candidates stated Archimedes' principle and talked about it without really dealing with the question at all.

Question 5.—(*a*) How is the boiling point of water affected by (i) a decrease in pressure, (ii) something dissolved in it ?

(*b*) A metal rod is one metre long, and is found to expand $1\cdot5$ mm. when heated through 100 centigrade degrees ; what is the coefficient of linear expansion of the metal ?

This question was attempted by a large proportion of the candidates. The majority of the students gave unnecessarily long answers to part (*a*) ; they were not required to describe experiments illustrating the effects, but merely to state what effects do occur. A considerable number of candidates answered part (i) correctly, but fewer answered part (ii) correctly, though some very good answers were obtained. For part (ii) all that was required was a statement that dissolved matter raised the boiling point ; a few candidates, however, gave a complete answer, including in their reply the case where the boiling point is lowered.

Part (*b*) was answered correctly by a large number of students ; but in nearly all cases the unit was omitted from the answer.

Question 6.—(*a*) Define the following : Specific heat, calorie, British thermal unit.

(*b*) Why does the temperature of a liquid standing in an open vessel usually fall below the temperature of the air ?

(*c*) What mass of dry steam at 100° C. must be condensed in a mixture of pure ice and water to melt 32 grms. of ice without raising the temperature of the mixture ? (The latent heats of vaporization and of fusion concerned are 540 cals./grm. and 80 cals./grm.)

This question also was answered by a considerable number of students. The definitions of specific heat and calorie were given correctly in many cases, that of the British thermal unit in fewer.

Part (*b*) was well answered by a large proportion of the candidates who understood it ; the others were mainly quite wrong in their ideas.

Part (*c*) was not well answered, a large number of the students omitting one of the two terms in the expression for the heat lost by the steam.

Question 7.—(*a*) (i) What difference is there in the statements that a body is moving with " uniform speed " or " uniform velocity " ? (ii) Why is it correct to say that bodies fall to the ground, in a vacuum, with " a uniform acceleration of 980 cms./sec.^{2} " ? How is this altered when they fall in air ?

(*b*) Define a dyne, and calculate the weight of 1 pound in dynes (1 pd. = 454 grms.).

This was a fairly popular question, and was very badly answered. Very few candidates understood the difference between speed and velocity. The answers to part (*a*) (ii) and (iii) were very poor. A common statement was that " the acceleration of a falling body is 980 cm./sec.^{2} *in vacuo* and 32 ft./sec.^{2} in air ".

Part (*b*) was omitted by a large number of candidates, but was done correctly by a considerable proportion of those who attempted it.

Question 8.—(*a*) State Newton's laws of motion.

(*b*) Two men of the same height carry between them on their shoulders a uniform beam 20 ft. long and weighing 50 pounds. One man (" A ") supports it 2 ft. from an end, and the other man (" B ") 15 ft. from that end ; what load does each take ?

What extra weight must be hung from the end nearer " B " so that " A " will have no load ?

This was a popular question, but was not very well answered. Newton's laws of motion were stated correctly by many candidates, but some of them had attempted to memorize the words without understanding them, and so wrote some very curious statements.

The first part of (*b*) was answered correctly by a large number of candidates, but some of them merely wrote down the answers without showing any working, and others succeeded in getting the correct answers by wrong methods. Very few candidates were able to do the second part of the question

Question 9.—(*a*) Define (i) an erg, (ii) a watt.
(*b*) A body of mass 2 Kg. is travelling with a velocity of 3 Km./sec. ; what is its kinetic energy, and what force applied to it will just stop it in 5 sec. ?
(*c*) A load of 20 Kg. is raised vertically 3 metres in 5 sec. ; what is the average power exerted ?

This question was not answered by many students, and very few of those who attempted it were able to solve the problems correctly.

(For students in the technical schools ; one question may be attempted from this section.)
Question 10.—State Ohm's law.
An electric lamp is employed across a 110 volt circuit and takes 0·80 ampere. What is its resistance? What is meant by the statement that the difference in potential is 110 volts ?

Ohm's law was stated correctly by a fair proportion of the candidates who attempted this question, and the numerical problem was solved correctly in many cases, but only a very small number of candidates were able to give the meaning of the statement " that the difference in potential is 110 volts ". The answer required was " that the work done in taking 1 coulomb from one point to the other is 110 joules ".

Question 11.—Write an essay on the subject of magnetism, employing and defining the terms equal poles, unit north pole, gauss, and magnetic declination.

This question was very badly answered. The majority of candidates wrote very vaguely and at great length on the subject of magnetism, but very few made any attempt to define the quantities mentioned in the question.

LEAVING CERTIFICATE BOTANY.

PASS PAPER.

Question 1.—The drawings provided for the first part of this question were seldom good ; they were too small as a rule, or had some defect, such as (*a*) guard cells larger than other epidermal cells (*b*) guard cells without chloroplasts, (*c*) all walls of guard cells shown either uniformly thin or thick.

In consequence of defective drawings (thus suggesting deficient knowledge of stomatal structure), the explanations of the opening and closing mechanisms were frequently very poor. A common answer was along these lines :

" The guard cells contain chloroplasts, and can therefore carry on photosynthesis ; as the concentration of the carbohydrates in the guard cells increases, they withdraw water from the epidermal cells and expand ", or

" Stomates open when the guard cells are turgid, and close when the guard cells become flaccid."

Some candidates unnecessarily made drawings of a leaf in transverse section, but gave very little detail of the lower epidermis and its stomates.

These answers are almost valueless, and candidates must be expected to get down to the fundamental explanation of plant processes.

Question 2.—Most candidates knew the ten elements essential for plant nutrition, but quite a number stated that carbon dioxide, water, inorganic salts and light are the essential elements.

Most understood that these necessities of plant nutrition are absorbed into the plant cells in the form of compounds and in solution. Although CO_2 and O_2 diffuse into the intercellular spaces of a leaf through the stomates in the gaseous condition, they enter the cells of the plant in solution in water.

Quite a considerable number of candidates do not seem to have carried out, or studied a demonstration of water-cultures designed to show the effect of the deficiency of the elements, particularly those absorbed from the soil, upon plant growth and development. Even in the case of many who described such water-cultures, technical errors were evident, such as the following :

(1) The root systems of the water culture plants were not protected from light.

(2) Pieces of *woody twigs* were used instead of seedlings such as wheat, barley, buckwheat, etc., which are known to react well in water culture solutions.

(3) The effects of deficiency of individual elements were not carefully studied and compared. Too frequently the reaction of the plants in all the cultures (except the complete solution) was simply stated to be poor, and they died.

(4) Provision does not seem to have been made for renewing the culture solution as required, and aerating it regularly.

The importance of the atmospheric carbon dioxide can be demonstrated by depriving the plant of CO_2 by absorption with soda lime.

Question 3.—The importance of saprophytic plants was generally appreciated, although quite a number simply stated that saprophytes rid the earth of waste organic matter and did not seem to realize that in so doing they secure their own food requirements, and energy, and at the same time reduce waste substances, such as starch, sugar, cellulose, protein, fats, etc., of plant and animal residues to simpler substances such as carbon dioxide, nitrogen, ammonia, sulphuretted hydrogen, etc., which are the raw materials for green plant nutrition. In other words, saprophytes cause decay, and also bring carbon and nitrogen of waste organic matter into circulation again. The methods employed for the preservation of foodstuffs from saprophytic invasion appear to be known by most candidates, although many do not seem to understand the precise effect of such treatment upon the saprophyte. For example, sugar and salt preserve foodstuffs, because they provide a substrate whose osmotic pressure plasmolyses saprophytic cells, prevents their development and finally kills them.

Question 4.—This question was very poorly answered. The drawings of a mature seed of a flowering plant were lamentable. Most candidates attempted to draw the broad bean seed, but with very unsatisfactory results. The hilum and micropyle were not closely associated in the drawings (as they are in the seed), while the radicle frequently showed no relation to the micropyle. Few candidates appreciated the differences between a seed and a spore ; the usual answer was that a seed was formed by a sexual process, while the spore was formed asexually. Of course, there are asexual and sexual spores ; for example, in Mucor the asexual spores are formed in the sporangium, while the sexual spore (zygospore) is formed by the fusion of plus and minus gametes. Again it was stated that spores are formed in the lower plants, while seeds are produced in the Gymnosperms and Angiosperms. It was not realized, apparently, that in the seed plants microspores (pollen grains) and megaspores (embryo sacs) are formed.

In this part of the question the examiners expected candidates to state that spores are unicellular, bicellular or multicellular reproductive units, formed sexually or asexually, surrounded by a wall which may be thin or thick, containing one or more nuclei, cytoplasm and little reserve food material. The seed is a complex reproductive unit, formed from the ovule by a sexual process, consisting of representations of three distinct generations of the plant, possessing considerable food reserves (carbohydrate and nitrogenous), capable of dispersal and of germination to produce a similar plant in virtue of its contained embryo.

Question 5.—Many good answers were provided to the first part of this question, but some answers were too general, while others were confined to dispersal of seeds and spores of land plants. Few described the fresh-water marsh vegetation, and most of those who did so confined their answers to a brief list of the plants found in such a habitat without indicating their essential characteristics, which show how they react to the superabundance of water.

The best answers were given in regard to the sand dune vegetation, and many candidates appear quite familiar (through field study) with the sand dune habitat and its vegetation. Here again, however, many candidates did not display a critical faculty of coordinating the characters of the plants of the dunes with the environmental factors to which the plants react. For example, they do not seem to realize why Spinifex and Festuca are the pioneers in the colonization of this habitat. Their success is due chiefly to the fact that they can tolerate sand-burial without injury. As some very prolix and disjointed answers were provided to this question, candidates ought to be encouraged to systematize their data and present it in a relevant and reasoned manner. They do not seem to ask themselves " why is this so ? " frequently enough, and depend too much upon memory.

Question 6.—This question was not very popular ; few rarely good answers were provided. Some candidates gave the particulars of a pentamerous type of Rutaceæ (Eriostemon) although a tetramorous type (Boronia) was asked for. In writing the floral formula, the symbol for hypogyny was omitted by some.

Question 7.—The answers to this question were most variable in quality. While the terms were generally defined correctly, the explanations given were frequently inaccurate, particularly in regard to anaerobic respiration. Many understood (and described the mercury and pea experiment well) that anaerobic respiration does not involve free oxygen, and that alcohol and carbon dioxide are produced, but they seemed to think that energy is obtained from the alcohol formed during the process. In the demonstration of respiration in green leaves many inaccuracies were apparent in experimental technique :

(1) The apparatus containing the green leaves was left exposed to light (or at any rate it was not specifically stated that it was placed in the dark or covered to exclude light). Now carbon dioxide is not given off by green leaves exposed to light, because the respiratory carbon dioxide does not escape from the cells owing to photosynthesis.

(2) The leaves were sometimes *immersed in lime water* and placed in darkness. This is not a satisfactory method for various reasons.

(3) When testing the atmosphere of the apparatus containing the green leaves, at the end of the experiment the fact that a glowing splinter was extinguished was *stated to prove that carbon dioxide was present.* Surely this is not so.

(4) Blue litmus paper was inserted in the apparatus and the fact that it turned red was taken as proof that carbon dioxide was present.

Question 8.—The drawings of Spirogyra cells were of variable quality and accuracy. Many, however, were excellent. In a few, the distinction between the chloroplasts (" green chromatophores bearing chlorophyll ") and the pyrenoids was not understood ; for example, the pyrenoids were sometimes labelled chloroplasts, and the chloroplasts proper, the chromatophores. The pyrenoids were frequently shown in groups of three to five. The direction of the spiral chloroplasts in relation to the long axis of the cell was sometimes *reversed.* The second part was frequently answered in a rather scrappy fashion, e.g. some candidates simply stated that as Spirogyra is immersed in water, " it is an easy matter for it to absorb water through the membranes of the cell ". The examiners expected candidates to say that water enters the cell by osmosis, and that the inorganic salts in solution enter by diffusion, each independently of the others, and irrespective of the turgor of the cell. The water is a medium for their diffusion, and the salts and their ions will continue to diffuse inwards although the cell has taken up osmotically, at any moment, its maximum supply of water.

HONOURS PAPER.

Question 1.—On the whole this question was very well done. My chief criticism applies to the smallness of some of the drawings, in which it was very difficult to see exactly the position of the larger leaves, and the point of insertion of the rhizophores. In some drawings it was almost impossible to be certain whether the small dorsal scale leaves were present or not. Some candidates still refer to the micro- and macro-sporangia as male and female. This is terminologically inexact, as they are asexual spore-producing organs, although they give rise to spores which on germination develop the male and female gametophytes or sexual plants.

Question 2.—Many did not realize that in a deciduous tree starch is stored in certain living cells of the stem and root. This starch is secondary starch, and is formed from sugar brought into the tissues from the leaves. Most candidates indicated that starch (primary) is formed in the green leaves and young stems only.

Many provided a rather detailed account of photosynthesis. This was not necessary. Starch is not formed by photosynthesis. It is formed from sugar (*a*) in the chloroplasts of green cells, and (*b*) in the leucoplasts of starch-storing cells. Photosynthesis is not essential for starch formation even in a green leaf ; e.g., experiment with green leaves floating on sugar solution in the dark. Leaves, although free from starch at the start, give the typical starch reaction at the end of the experiment.

Question 3.—Some of the answers to this question were poor. Most candidates understood that anaerobic respiration takes place in the absence of free oxygen, and demonstrated this in the case of green pea seeds by the mercury experiment. In order to demonstrate respiration in the pea seeds in the absence of oxygen, it would be better to use pyrogallate of potash to absorb the free oxygen. In the absence of oxygen, germination of seeds does not take place, although many stated that it does.

The essential points in this question were (*a*) the complete breakdown of sugar to carbon dioxide and water, with the liberation of 677·000 calories of energy, which may be used for various endothermic reactions in the protoplasm, and for other purposes, e.g. as heat to promote transpiration. In anaerobic respiration much less energy is released, approximately 9·700 calories ; so that latter process is more wasteful of the carbohydrate reserves of a plant. Anaerobic respiration can be carried on for a long time in yeast and results in the production of alcohol.

A long account of photosynthesis, etc., was not necessary in this question, although many wasted time providing this. Certain candidates erroneously stated that respiration " continually oxidises the tissues of a plant which are broken down ".

Question 4.—In this question too much unnecessary cell detail was given, and many of the cells were badly drawn. Outline diagrams, carefully labelled, were sufficient to indicate the candidate's knowledge to the examiners. It was noticeable that certain candidates confused phellogen with " bark ". Phellogen is the meristematic layer of cells which produces the cork and phelloderm (secondary cortex) in stems (and roots) which undergo secondary growth.

Question 5.—Essential differences between mitosis and meiosis not clearly understood. Few know much about meiosis. Detailed accounts, frequently inaccurate, were given, while the fundamental points in either process were not clearly indicated. Mitosis occurs at growing points of shoot and roots where active cell division proceeds. It also occurs in cambium and phellogen, although this was frequently overlooked.

The following statements were fairly common :

(*a*) " Meiosis occurs in all higher plants from liver-worts upwards."

This shows that the candidates think that meiosis is confined to organisms which form spores in spore mother-cells ; of course it also occurs in the algæ and fungi where gametes fuse, and the chrosome complement is doubled. In fact meiosis occurs somewhere in the life-cycle of all plants and animals which reproduce by a sexual process involving the union of gametes.

(*b*) " The object of mitosis is to produce new cells."

What about the character of these cells, how do they compare with the parent cell ? Mitosis is not to be confused with *cell division*. Cell division follows the nuclear division (mitosis) in meristematic cells. It was apparent that some candidates confused genes with chromosomes. The chromosomes are the gene carriers. The examiner's impression of this question is that a lot of badly digested matter was presented without the essentials being clearly understood. Some teachers seem to stick too closely to the schedule of instruction at the University, although the candidates are not really ready to assimilate it.

Question 6.—The question was frequently poorly answered, and many statements were written down which clearly revealed the muddled nature of the candidates' knowledge on this part of the syllabus. For example, a megaspore was defined (*a*) as a female ovule of a plant, (*b*) as a female gametophyte. (*It is the initial cell of the female gametophyte, but is not the female gametophyte itself.*)

Drawings of the entire ovule of Macrozamia and an angiosperm were given, although quite unnecessary. In these drawings the actual megaspore and its products were not clearly labelled, and the examiner was left in a state of suspense as to whether the candidate really knew or not.

Question 7.—Evolutionary trends in floral morphology were rather poorly answered, but a number of candidates traced the evolution of the angiosperm from an algal ancestry ; this was quite irrelevant. On the whole, the question was well answered by many.

Question 8.—" *Before Mendel's experiments no thought of inheritance.*" This statement is not true ; it was realized that parental characters were inherited, but the exact nature of the inheritance was not understood because many characters were examined at the same time. Mendel discovered the laws of inheritance because he examined the inheritance of one pair of contrasting characters at a time.

3 : 1 ratio experiment, roundness and wrinkledness of seed coat, yellow colour *v.* green colour and tall *v.* dwarf were referred to, but many candidates did not understand the results completely.

Many missed out the F_1 generation which consists of dominants only, e.g., $T \times d \rightarrow Td$ in F_1 ; the F_2 generation in which the 3 : 1 ratio appears is consequently referred to as the F_1 generation. Many experiments were attributed to Mendel which he did not perform. Furthermore, when Mendel was working, meiosis had not been discovered.

INTERMEDIATE CERTIFICATE BOTANY.

Question 1.—The early stages of germination showing the effect of the absorption of water were frequently omitted by candidates, and the drawings did not clearly indicate the position of the micropyle and its relation to the emergence of the radicle. Many of the drawings were very poor, the method of emergence of the coiled plumule was not clearly shown, and many candidates did not show the soil-level in relation to the cotyledons, so that the examiners were left to assume that the candidates knew the difference between epigeal and hypogeal germination. It is surprising to find candidates stating that the gas given off by germinating seeds is oxygen. In describing tests for CO_2, many candidates simply used the lighted taper as proof that this gas is present in the apparatus containing germinating seeds. Such a test indicates the absence of O_2, which supports combustion. The lime-water test indicates the presence of CO_2.

Question 2.—Quite well done by majority. Many candidates termed the rose and blackberry prickles " *thorns* ", while the curvature of the prickles was not correctly shown in drawings. The drawings of tendrils were frequently inaccurate, or they did not show clearly the morphology of these organs in the quoted examples ; *such inaccuracies also appeared in the note-books from certain schools.*

Question 3.—The sections of this question were, on the whole, answered inaccurately.

(*a*) The *capsule* was frequently termed an *indehiscent* fruit ; the number of carpels was seldom mentioned, while the fruit of Hakea, Lambertia, etc., was referred to as a " woody capsule ". *This error also appeared in many note-books.*

(*b*) The *root cap* was frequently referred to as *hard*. Candidates from some centres seem to have the idea that as the cap is worn away, it is replaced by a new one. They do not seem to have understood the method of replacement by the formation of new cells on the inner surface of the cap.

(*c*) *Rhizome.* Generally quite well described, but the drawings were not always accurate. Inaccuracies also appeared in the note-books, particularly in regard to the position of the scale leaves.

(*d*) *Inferior Ovary.* Description often poor. Rose frequently given as an example. The fusion of the ovary wall and receptacle was seldom mentioned.

(*e*) *Cambium.* Answers most variable from different centres, and many gave very inadequate description. Some candidates stated that the cambium is situated between the cork and the " bark ".

(*f*) *True Fruit.* Generally badly answered. Few candidates really understand the morphology of a *true fruit,* as is indicated by the common answer " a fruit in which the *main* part is made up of carpellary tissue ". Such a definition also applies to a false fruit.

(*g*) The *stomate* was generally understood and described in general terms. Very few candidates can draw a stomate accurately.

(*h*) *Adventitious Root.* This was badly done on the whole. Few definitions were accurate, and many candidates were content to quote examples of such roots without understanding their morphology. A common definition was " a root which grows out of its natural order ", or " a root which grows where it shouldn't ".

Question 4.—Probably the most poorly answered question in the paper, although widely attempted. The poorness of the answers was explained partly by the inaccurate drawings in the note-books.

In the bulb, axillary buds were frequently omitted, while the short stem was generally not shown or not labelled. In the drawings of the tuber (potato) the spiral arrangement of the " eyes " and the leaf-scale scars in association with the buds were frequently not shown. Other candidates indicated them, but showed the buds on the wrong side of the scale leaves in relation to the apex of the tuber. Remarkably few candidates noted the crowding of the buds near the apex, and the shortening of the internodes.

Few candidates realized that the tuber and bulb are not only food-storage organs, but organs of perennation and vegetative propagation.

Question 5.—The definition of a parasite was commonly incomplete, the semi-parasitic or holo-parasitic type being omitted. The description of Loranthus (mistletoe) was frequently good, in some cases excellent, but many candidates still speak generally of the absorption of *food,* rather than water and mineral salts from the host. *Cassytha* and *Dodder* are still regarded by some students as synonymous. Others realize there is some difference, but do not make this clear in their descriptions. Drawings of the parasites do not show clearly the haustorial cushion and the connection with the host. Scale leaves were not seen on Cassytha apparently, as drawings did not indicate their presence. Exocarpus was described by a few candidates, but the drawings were usually poor, and did not indicate careful study.

Question 6.—The vertical sections provided to this question were frequently not *median.* Some very good drawings were provided, however. Many candidates do not seem to understand the terms they are using, as they describe the gynoecium of the Myrtaceæ as G_1, when their drawings clearly show a syncarpous ovary with several carpels and loculi.

The differences between the two families were poorly indicated. Many candidates observed differences between the two types of flowers they mentioned, but in most cases these did not hold generally for the families. The oil glands of the Myrtaceæ were rarely referred to, but the stipulate leaves of the Rosaceæ were frequently noted.

Question 7.—This question was very well answered by candidates from some centres, but very poorly by others.

(*a*) Inadequate apparatus for the gravitational experiment was often described, the roots were not allowed to turn in any direction (if they wanted), while proper provision for keeping the roots moist was not made. Most students failed to realize the importance of performing this experiment in darkness (or excluding light from the apparatus). In this experiment *one* seed was commonly used, while some candidates employed a potted plant which was apparently dug up and replanted from time to time during the course of the experiment. Hydrotropic and heliotropic experiments were erroneously described by some candidates.

Controls were seldom mentioned.

(*b*) Many candidates did not state that the leaf was placed in sunlight for a time before testing for starch, while, according to some, the green leaf was placed directly in iodine and gave the starch reaction. The proper method of chlorophyll extraction by immersion in boiling water to kill the tissues and then in alcohol to extract the chlorophyll was seldom described carefully. The experiment to demonstrate the presence of starch in the leaf was often confused with an experiment to prove that light was essential for starch formation.

Question 8.—This question was rarely attempted, and most answers were poor. Some candidates considered an " aerial stem " to be such a type as a stolon or runner ; others described experiments to show that transpiration does take place, without demonstrating the path of the " transpiration stream ". Some candidates used a complete plant with root system instead of a stem bearing leaves only. Many failed entirely to realize that the stem should be cut under water to prevent the entrance of air into the system. This experiment to demonstrate the path of the transpiration current is not properly carried out in many schools.

Question 9.—Many good answers were provided to this question. Some candidates appear to have the curious idea that the sun's rays enter through the stomates only, some that mineral salts take a direct part in photosynthesis. Many candidates do not know how and why CO_2 enters (*a*) the intercellular spaces of a leaf from the atmosphere, and (*b*) into the green cells.

The final products of the process were stated to include oil, fat, etc. A few candidates do not realize that sugar is formed before starch, while one group of candidates, who obviously did not understand the process, stated that nitrogen is given off during photosynthesis. Many gave the formula of the photosynthetic reactions, but did not show that oxygen is given off as a by-product.

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ELEMENTARY ANATOMY

Lectures and Demonstrations by A. A. ABBIE, M.D., B.S., B.Sc., Ph.D.

LECTURE I.—The body as a whole; the skeleton; muscles and their actions.

LECTURE II.—Blood lymph; blood vascular and lymph vascular systems; heart, lungs and respiratory system.

LECTURE III.—Alimentary system, teeth, digestive tube, digestive glands, liver and pancreas.

LECTURE IV.—Nervous system, special senses (nose, ear and eye), ductless glands.

LECTURE V.—Uro-genital system: kidneys, ureters, bladder, urethra (male and female); genital systems—male and female; brief description of development of embryo; skin and its appendages.

ELEMENTARY PHYSIOLOGY

Lectures and Demonstrations by F. S. COTTON, D.Sc.

LECTURE VI.—The physiology of the cell. Physiology of the blood. The circulation of the blood. Muscles and reflex action. Respiration.

LECTURE VII.—Foods and foodstuffs. Their different varieties: proteins, fats, carbohydrates. Their functions in the body. Digestion and absorption of foods. Metabolism.

LECTURE VIII.—Other foodstuffs. Vitamins, inorganic salts and water. Calorific value of foodstuffs. Calculation of calorific value of a typical meal. Illustrations of different kinds of foods that go to make up a suitable meal. Objects of cooking food. Its advantages and disadvantages.

LECTURE IX.—The general nature of excretion. Removal of carbon dioxide from the lungs. The secretion of perspiration. Elimination of waste matter in solution from the kidneys. Elimination of solid waste matter from the bowel. Functions of the skin. Regulation of body temperature. The nervous system.

LECTURE X.—The endocrine organs: Pituitary body, suprarenal gland, thyreoid gland, islet tissue of the pancreas, testis and ovary. Relation of the latter two to reproduction.

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(A) COMMENCING TUESDAY, 14th SEPTEMBER, 1937

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