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PHYSICS

ORDINARY LEVEL

Paper 5050/1

PART I

Q.1 was well done and in general showed good understanding of the 'principle of moments'. However, some confusion arose concerning the masses and their weights.

Q.2 produced answers of a disappointing standard. Many candidates tried to deduce the resultant from a copy of the diagram given in the question. When either triangles of force or parallelograms were drawn it was rare for them to be labelled in any clear manner, either by arrows or some other means. It was often difficult to be clear whether the values appearing on the script were meant as the resultant of the forces or the value of W asked for. Some candidates gave the value of W as a mass.

Q.3 (a) Apart from weaker candidates who introduced the time, this question was generally well done.

Q.4 provided a wide variety of answers. A large proportion were able to account for the distinct shadows in *(a)*. Some appreciated that reflection could result in light reaching the area of shadow, but a much smaller proportion could indicate where this reflection arose. Hardly any at all referred to light coming from all parts of the 'sky'. The majority interpreted the question in terms of 'umbra' and 'penumbra' and many produced standard diagrams for this topic.

Q.5 most could identify X, Y and Z – X giving most trouble. Only a small minority indicated any refraction at the surface of the cornea.

Q.6 was surprisingly poorly answered – there were as many incorrectly marked critical angles as there were correct ones and a further considerable number where no angle was clearly marked. A significant number of candidates gave the critical angle a value of greater than 90°! Rather more candidates had a knowledge of how to calculate refractive index from the critical angle – around half the total number of candidates.

Q.7 About one-third of the candidates appreciated the part played by convection in producing a low temperature throughout the 'freezer', but very few candidates showed any real understanding of relative heat capacities in their answers to the second part.

Q.8 was one of the better answered questions on the paper. Common errors however were (i) to multiply the specific latent heat by 10, (ii) to ignore one of the two kilogrammes of water which needed to be heated from 0°C to 10°C.

Q.9 A number of candidates asserted that "distance = $\frac{\text{speed}}{\text{time}}$", but in general the calculations gave little difficulty. However, very few made a sensible statement of the basic assumption involved in the calculation.

Q.10 The first part was generally well answered, but there were hardly any candidates who appreciated that an equilibrium between forces was involved in *(b)*. In the final part, many answers contained the correct idea although it was often poorly expressed.

It was apparent that a significant number of candidates interpreted the 'charged sphere' as one in which 'charge separation' was brought about by the field.

Q.11 was well done although a significant number gave the answers to 'position 1' and 'position 2' reversed. In the final part there was a disappointingly large number who wrote in such a way as to suggest the current was reduced *after* passing through the 30 Ω resistor.

Q.12 (a) The deflection by an electric field was generally well answered but only a small minority of candidates gave the correct direction of deflection by the magnetic field.

Q.13 produced generally correct answers to *(b)*, but a significant number of candidates showed by their answers to *(a)* that they imagined there was an external power supply; references to 'commutators' and 'split-rings' were common.

Q.14 was very poorly answered; many were confused both between the two quantities of energy involved and also the use of W and mW. There was little clear evidence of understanding efficiency.

Q.15 There was evidence that many candidates understood the change taking place although the equations were often written in a confused form. A number identified the 'daughter' nucleus as being U (and not Th). A large number were able to answer the second part correctly.

PART II

Q.1 A was very much more popular than B. The improvement in drawing of graphs noticed recently continues, but there remain cases of large 'blobs' in plotting points and also thick lines. There were also cases where close examination showed that two straight lines of slightly different gradient had been drawn.

In A *(b)*, most could read a value for W_0, but very few could comment satisfactorily on the meaning of this value. In *(c)*, those who determined α by measurements rarely suggested that this would be done with a ruler. Others who used a protractor gave little indication of how it would be arranged. A larger number of candidates realised that ticker-tape and timer provided a convenient method of checking uniformity of speed. Many candidates did not provide any worthwhile answers to *(d)*; however some did say that less 'effort' was required with the slope and there were also rather vague statements concerning the greater length required.

Those who attempted the B alternative found marks readily scored. However a number of those who obtained a satisfactory gradient were unable to deduce which voltage sensitivity setting was used. There were not a large number of correct answers to *(c)*, and correct solutions to *(d)* even more rare. A considerable number did not progress beyond deducing that the cycle corresponded to 4.0 cm on the trace.

Q.2 Nearly all candidates attempted alternative A. The determination of the position of the centre of gravity was well known; the commonest omission was any clear indication that the sheet was suspended in such a manner that it swung freely.

Only a minority suggested using a micrometer screw gauge for measuring the thickness of the sheet, and few of those gave the detail of its use as required.

In *(c)* the principle of volume determination by a displacement method was realised, but very few appreciated the problems of applying the method in the case of a sheet of the stated size. In general the answers lacked real practical detail.

Few candidates attempted the alternative B. The circuit diagram was generally satisfactory but the procedure for calibration lacked detail. There was some idea of a counterbalancing action on the part of the brass mass. The reason for the non-linearity of the I–θ relation was beyond the candidates, although some did make valid points in the second part of *(c)*. The standard of answers to *(d)* was, however, rather better.

Paper 5050/2

General Comments

1. Whilst the questions clearly direct the candidate, the examiners do expect to see words or symbols defining the left hand side in equations. Too frequently only the right hand side is set down and explained.
2. Candidates continue to be guilty of 'continuous equating' (exemplified by the working of calculations in *Q.10*). Equality signs are inserted at step after step so that the same 'extended equation' may, for example, begin with $1/R$ and, through a series of steps linked with equality signs, end up equalling R.

Comments on questions

PART I

Q.1 Candidates' attempts at reading off values from the graph were disappointing. Attempts at explaining why in *(b)* the speed was steady were lacking in detail; too often the candidates merely referred to terminal velocity. In part *(c)* the ability to **apply** $F = ma$ was very limited.

Q.2 (a) Far too many candidates worked in °C, were happy to write down 80/0 in an equation, treat it as 80/1 and get hopelessly wrong answers.

(b) The answers did not show that the candidates had picked out the idea of equilibrium and part (iii) particularly showed a regrettable tendency merely to restate the question.

(c) appeared on the whole to be too demanding and discriminated less well between the candidates.

Q.3 (a) the outstanding feature was how few candidates were able to continue the paths of the 'given' rays correctly. Too often the size of the image was merely stated.

(b) The subject matter in *(b)* is standard, yet there was a surprising number of inaccurate answers, e.g. no dispersion at first surface, wrong refractions etc.

(c) It was rare to have unequivocal statements of similarity and/or difference – perhaps only 20% of the answers were explicit.

Q.4 This was probably the most difficult question in Part I. The whole idea of 'pulses' seemed to throw the candidates, but nevertheless the knowledge the candidates exhibited of electromagnetic induction was very limited. The answers to *(a)* (ii) and (iii) were poorly expressed; *(a)* (ii) too often being dismissed as 'a.c.'. *(b)* The examiners remain convinced of the validity of the either/or type of question; here again however the candidates did not really focus on the central issues, e.g. the 'device' in *(b)* (ii).

Q.5 (a) There was a surprising number of candidates who identified the decay as other than β. They found it difficult to *apply* their knowledge when faced with non-standard conditions.

(b) Too many candidates simply re-iterated the "some get through" notion, very few had the insight to involve directions, and far too many implied or stated that the atmosphere contains radioactivity.

(c) was difficult for the candidates to express, though they gave the impression of knowing. In drawing the graph far too many candidates failed to make the plotted points clear, and a surprising number used unconventional axes.

Q.6 This question discriminated excellently between the candidates. The average score was high, and the range of electrical units was well tested.

PART II

Q.7 Candidates found it difficult to 'explain what is meant by', writing a lot but saying very little. The variation in atmospheric pressure was rarely related to molecular movement and the answers in this section were poor. The diagrams of the barometer were of a reasonable standard, but the independence of height from area was badly done. The calculation showed 'mass confusion', and the confusion of units and the use/misuse of 'g' was widespread.

Q.8 Over recent years experimental descriptions have become increasingly schematic, and far less an account of what is *done*. The examiners expect details of procedure, a statement of the measurements to be made (and with what) and the use to which the measurements are put. The practical points in *(b)* were understood but in the calculation, the heat capacity of the beaker was surprisingly difficult to cope with and the idea of 'rate' continues to evade most candidates, far too many of whom ignored *kilo*joules in the units and ended up quoting a time anyway.

The examiners would wish it to be known that it is a direct electrical heating method which is preferred for the determination of specific heat capacity.

Q.9 (a) The accounts of the ripple tank were poor by comparison with previous years. The candidates simply did not answer the 'effects observed' section. Are they becoming increasingly less good observers?

(b) The indices gave trouble, as always; many candidates quoted no unit for wavelength.

(c) The answers were poor; the candidates tried to quote appropriate experiments but the question was clearly on the edge of their field of knowledge.

Q.10 The initial part was poorly answered, perhaps in part due to unfamiliar wording, but the candidates' awareness was clearly very limited. The answers to the experiment too were disappointing. The candidates clearly found it difficult to answer the question posed, many of them omitting the 5 Ω resistor from their answers. As indicated above, the calculations were as well answered as usual but 'continuous equating' was far too frequent.

There seemed to be an astonishing lack of knowledge of the diode, and consequently the conclusions scored more heavily than the properties.

Q.11 This was a popular, high scoring question; the experimental description was well done which maybe indicates the restricted practical experience of the candidates – this was, perhaps, an experiment they had actually done, and this reinforces the misgivings expressed elsewhere. On the other hand, the magnetic field patterns were very poorly drawn; the action of the bell was understood and the candidates applied their knowledge very well in the last, unfamiliar, section.

Q.12 The diagrams of the nuclide were disappointingly poor, and the candidates awareness of the relative sizes of nucleus and atom seemed very uncertain. They answered *(b)* (i) and (ii) competently enough but their ability to discern the facts and the associated ideas in the foil experiment was very limited.

There were too many 'inverted' calculations showing a clear failure to comprehend the principles involved.