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General Certificate of Education (A-level)
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# Physics B: Physics in Context PHYB5

# (Specification 2455)

# Unit 5: Energy under the microscope

# *Report on the Examination*

## GCE Physics, Specification B: Physics in Context, PHYB5, Energy under the microscope

**General Comments**

There was a very small entry for this paper and so, in general, comments are of a very tenuous nature.

The more able candidates showed a good knowledge and understanding of the material. Approximately 50% of candidates were able to quote the three significant figure answer expected in question 3 (c) (ii) and most gave the correct units for entropy (question 2 (c) (ii) or (iii)) and activity (question 6 (c) (iii)).

Question 4 (a) required candidates to communicate their physics coherently with due care to spelling, punctuation and grammar. There was often confusion in answers relating to the role that the alternating potential difference played and the ways that the magnetic and electric field operated.

**Question 1**

For part (a), most candidates knew the definition of capacitance, but frequently omitted the 4.2 μC per V aspect.

There was a variety of techniques used in part (b) (i) but most answers were complete.

In part (b) (ii), nearly all candidates recognised that **B** had a smaller capacitance than **A** but most answers only gained a single mark for stating that the discharge happens faster in **B** without explaining why this meant that the capacitance was smaller.

Few candidates correctly calculated the change in energy in part (c) – most used ½ *QV* but did not calculate the values of *Q* **and** *V* before and afterwards.

**Question 2**

Most candidates gained the mark to part (a).

Part (b) was answered moderately well with most giving some indication of the ‘arrow of time’ type of ideas. There were occasional irrelevant references to the zeroth and third laws of thermodynamics.

The responses to part (c) (i) were poor, with few candidates being able to do the ‘method of mixtures’ type of calculation.

Most candidates had a go at part (c) (ii) but often the transferred, mean temperature or conversion to Kelvin, were incorrect.

Most candidates recognised that there was a fall in entropy of the lead and an increase for the water in part (c) (iv).

**Question 3**

In part (a) (i), most candidates knew the quantities, but some of the units were inconsistent, for example, $cm^3$ for volume. When *n* was defined as *the number of moles* either mol or no unit was credited.

For part (a) (ii), most candidates knew four postulates although several quoted were irrelevant.

Most candidates were able to describe what was happening in each stage of the cycle in their answers to part (b), but fewer were able to explain the thermodynamics relating to the stroke.

Surprisingly, few gained the mark in part (c) (i).

With error carried forwards from the previous part, part (c) (ii) was usually done well.

Those candidates understanding part (c) (iii) usually gained both marks, with few gaining just one, but several did not gain any marks.

**Question 4**

Part (b) (i) was done well with some very clear manipulations of the equations for magnetic force and centripetal force.

Most recognised that neither *v* nor *r* appeared in the equation in part (b) (ii).

Part (c) (i) was done well by many who gained all three marks, but several candidates appeared unsure how to attempt this and gained no credit.

Again a sizeable number of candidates did not attempt part (c) (ii). However, those who did so often gained both marks.

**Question 5**

Credit was not given for a statement that mass and energy are the same thing in answer to part (a) (i). The most common mark for this part was one out of the two available.

Only a limited number of candidates gained all five marks in part (a) (ii), but several gained two for finding a value of 4.78 MeV by converting the mass defect from values in terms of *u* to MeV.

Although the mark to part (a) (iii) was frequently gained, there was considerable benefit of doubt applied with candidates not saying that it was the deuterium-tritium reactions which supplied the neutrons needed for the lithium reactions.

Part (b) (i) was answered poorly. Most candidates did not use the electric potential energy equation – force or potential were more common.

A limited number of candidates used the $\frac{3}{2}kT$ equation in answer to part (b) (ii). A few candidates started with $4 \times 10^9$ K and worked backwards but rarely saw that this gave approximately half the ke in (b) (i) as would be expected.

Part (b) (iii) was generally answered well.

**Question 6**

For part (a), few candidates stated more than that the plutonium is very radioactive. Credit was given for implied description of dangers during production and very few commented on the potential hazard of explosions during launch or passing through the atmosphere.

In part (b), more candidates believed that being in a compound would affect the activity of the plutonium. Of those recognising that it would be unaffected, few mentioned the nuclear nature of the decay.

Part (c) (i) was almost invariably correct.

Part (c) (ii) discriminated well. Few gained full marks, but many performed different aspects of the calculation to gain some credit.

With error carried forwards several candidates gained full marks in part (c) (iii).

Nearly all candidates gave the correct nucleon and proton numbers for the uranium isotope and the alpha particle in answer to part (d) (i).

Very few candidates gained any credit for part (d) (ii), with several simply not attempting it.

## Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results statistics page of the AQA Website.