GCSE EXAMINERS' REPORTS

GCSE (NEW)
SCIENCE: PHYSICS

SUMMER 2017

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WJEC
SCIENCE (DOUBLE AWARD)

GCSE (NEW)

Summer 2017

UNIT 3 – FOUNDATION TIER

General comments:

The Pisa style questions which tested candidates' scientific literacy were problematic for almost all candidates with little evidence that they were able to access the information given to them.
The knowledge of experimental methods from the specified practical work was weak. Recall of facts was extremely poor. In particular, candidates demonstrated almost no knowledge of heat transfer on this paper. Poor expression and poor use of scientific vocabulary was evident throughout the paper.

Specific comments:

Q.1 (a) Many candidates gained a mark here for stating the amplitude of the wave but many could not identify the wavelength from the diagram.

(b) (i) The meaning of frequency was not well known and few candidates identified the correct value.

(ii) The calculation was well done by most candidates with most attaining marks via the error-carried-forward principle.

(c) This was done poorly despite the wave direction being given. Candidates drew their own reflections in a variety of directions. Where wavefronts were drawn they often did not have a consistent wavelength and were not parallel to the wave direction. Candidates should be aware of the requirement to take a ruler into the examination and for questions such as this the diagram must be completed with a ruler.

Q.2 The long question stem here provided candidates with useful information about em radiation which would help them to access marks. Candidates should be encouraged to read all of the information provided to them carefully.

(a) This is a familiar format and it was common for candidates to earn two marks here.

(b) Very few candidates could recall the definition of a transverse wave.

(c) This tick box question was testing both application of knowledge and the scientific literacy of the candidates as some of the options could have been ruled out through careful reading of the question stem. It was evident from the responses that both the knowledge of the topic and the ability to synthesise information from the stem was lacking for many.

(d) Many candidates were able to identify that gamma rays had a higher frequency and hence earned the first mark but very few were able to link the frequency with the ionising ability despite the prompt in the stem of the question.

Q.3 This question tested the candidates' knowledge of a specified practical, however most of the marks gained on this question were for graph plotting.

(a) (i) The ammeter and voltmeter symbols were reasonably well known however a large number of candidates connected a voltmeter in series in the circuit.

(ii) Some candidates earned two marks here for identifying the role of the ammeter and the voltmeter, although often poorly expressed, but it was rare to find candidates who understood the use of the variable resistor in this circuit even though all candidates should have carried out the experiment.

(b) Most candidates earned two marks here for correctly plotting the points. The quality of the curves seen was generally poor so few candidates earned all 3 marks. It was common to see straight lines drawn. A surprising number of candidates did not attempt to plot the graph.

(c) (i) This was generally well done with candidates able to read the current from their graph and use it in the calculation. It was however common for candidates to misinterpret the graph and identify the current to be 64 A rather than 0.64 A.

(ii) Many candidates were able to identify that the current increased as the voltage increased but very few were able to identify the trend that indicated the increasing resistance. A significant number described the link between voltage and resistance without referring to the current, wrongly assuming that the graph was of voltage against resistance.

Q.4 (a) (i) This was well done by the majority of candidates.

(ii) It was pleasing to see many candidates earning both marks here as the calculation was quite open-ended.

(b) (i) Many candidates were able to identify an advantage of the National Grid.

(ii) Almost all candidates could identify the step-up transformer.

(iii) Many candidates were able to identify that step-up transformers increase the voltage and earned one mark but making the link with energy loss eluded many.

Q.5 (a) The vast majority of candidates were limited to the lower band on this question and it was most common to award 0 or 1 mark. The knowledge of heat transfer was very limited as was the standard of written communication. Many accounts were incoherent and contained no credit worthy response.

(b) (i) The idea of payback time was generally well understood and many candidates completed this correctly.

(ii) Typical responses to this question lacked clarity and often it was not evident in the responses what cost the candidates were referring to. Few candidates were able to gain both, if any, marks.

Q.6 (a) (i) This was a multi-stage calculation which required candidates to select the correct information from the table to determine the number of units of electricity used and then to proceed to calculate the cost of the electricity. Many candidates were able to select the correct power and time although it was unusual to see correct, if indeed any, unit conversions so they gained one mark. Many candidates did not know how to go any further than this to calculate the cost. Those who did calculate a cost usually gained marks via error carried forward. It was not uncommon to see candidates multiplying a temperature by the cost per unit.

(ii) Very few candidates were able to access this question with few attempts to calculate the percentage reduction in energy use at 30 ^{o}C. Typically candidates made vague statements about lower temperatures using less energy.

(iii) Statements here were often poorly expressed and not specific enough to earn credit. Common responses referred to reducing pollution or saving money. Clumsy wording by candidates was most evident with references to stopping global warming or no CO_2 emissions not gaining credit.

(b) (i) Most candidates were able to identify the live wire.

(ii) The function of the earth wire was not known by most candidates, this was poorly answered with very few obtaining marks. Again poor use of language let candidates down with references to electricity rather than current being taken to ground, or to the casing becoming ‘electrified’.

(c) This was poorly done. Very few candidates attempted a calculation and hence could not access any marks in this question.

WJEC
SCIENCE (DOUBLE AWARD)

GCSE (NEW)

Summer 2017

UNIT 3 – HIGHER TIER

General comments:

Most candidates appeared to be correctly entered. However there was a group of candidates who found the demands of the paper too difficult and hence scored low total marks. These would have been better suited to the foundation tier paper. The vast majority of candidates attempted every question. It was pleasing to see how candidates coped with the open ended calculations and the different methods they adopted in their answers. The marking scheme was adapted to include credit for these different routes e.g. Q1(a)(ii), 1(c), 6(b)(i). Two topics were not applied very well in the context given in the paper. These were the transfer of heat and reflection of wavefronts.

There is more information provided on the exam paper compared to the legacy versions but there is an additional 15 minutes allowed for reading time. There is plenty of evidence to suggest that not all candidates used this to their advantage. Schools need to further develop the scientific literacy of their learners. They need to be able to evaluate which information is required for a question part. There was careless reading of questions and in some instances responses were irrelevant and earned no credit. Some candidates do not consider units when substituting values into an equation e.g. 5 s refers to time and yet it was sometimes substituted as a value for wavelength into an equation. Some questions required evaluation of information e.g. Q1(a)(ii), 1(c), 3(b)(ii). These required calculations and a concluding remark, but too often, one or the other was missing. Candidates made errors in converting quantities between different SI multipliers. Page 2 of the exam should be constantly available to candidates as they study this unit.

Specific comments:

Q.1 (a) (i) The two equations required to answer this question are helpfully grouped together within one cell of the table on page 2. Most candidates earned some credit for using them to calculate a cost. The first mark was available for making the correct conversions for power and time. This mark was only awarded to a minority of candidates. However multiplying power by the correct time without conversion or with an incorrect conversion earned a mark. An ecf for the number of units was allowed into the second part of the calculation to find the cost. Most candidates gained the remaining two marks. Some candidates converted 16 p into £0.16 but lost the answer mark because their answer in £ was written on the answer line where the pence unit was given. If candidates wish to do this then they need to write in the £ sign and delete the given p unit. In the equation to calculate the units used there is no quantity that has units of temperature and yet some candidates substituted 40 ^{o}C into it. Also it is surprising how many candidates thought that 90 minutes was equivalent to 1.3 hours.

(ii) There was no hint in the stem as to how this question should be answered. However the previous calculation should have provided some guidance. Since the mean power was constant then the energy used was proportional to the time. How to use equations in this way is an example of scientific literacy that needs development. Washing clothes at 30 °C saves 50% compared with 50 °C and 33% compared with 40 °C so the claim was not always valid. This would have earned three marks. Few candidates chose this method. Some used combinations of the data correctly to arrive at percentage values e.g. by calculating units used for each wash temperature or by calculating a cost for each one. Others just made a comparison between 30 °C and one of the other temperatures so limiting their maximum mark to two. Many candidates opted to use all the data in the table sometimes finding the product of all the three values on each line e.g. $50 \times 500 \times 120$. Occasionally candidates made calculations but did not add a final statement so their maximum mark was two. There were some that commented on the validity of the claim without any calculations so they earned zero.

(iii) Surprisingly only a minority of candidates earned any credit here and even fewer gained both marks. The question referred to saving energy so answers stating 'less energy is used' just repeated the question. The question required benefits to the environment so saving money was not a credit worthy statement.

(b) (i) Mostly correct answers here.

(ii) Most candidates could state that the earth wire is a safety feature but unless qualified further (e.g. protects users from electric shock or takes electric current to ground) no mark was awarded. A minority of candidates knew the particular fault associated with earth protection. A common misconception was that 'extra electricity' flows through the earth wire.

(c) Those candidates that successfully answered the question chose one of three different routes. Some calculated the power (690 W) when the current was 3 A which was lower than the 2 400 W required so the fuse was unsuitable. Others calculated the current to be 10.4 A so the 3 A fuse would blow so it was unsuitable. The last method was a calculation showing that the voltage required to produce a power of 2 400 W at 3 A would be 800 V so the fuse was unsuitable since the voltage was only 230 V. Each of these methods earned full credit. Candidates needed to add a final correct statement to earn the third mark. This was not always the case. Some candidates ignored the space for calculations and just gave a comment so were awarded zero.

Q.2 For most candidates, credit was only earned for (a)(i).

(a) (i) The majority of candidates found the correct value of X. For those that were unsuccessful an ecf for wavelength was allowed into part (ii).

(ii) This was another example where values were substituted into an equation regardless of their units. It was common to see the wave equation being used with 40 cm and 5 s being substituted as the wave speed (m/s) and wavelength (m) respectively. The answer of 8 Hz was then written on the answer line. Incorrect substitution never receives credit. Candidates were expected to find the wave speed using the equation:

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

This is where the substitution of 40 and 5 should have occurred to give an answer of 8 cm/s. Then the wave equation should have been used using 8 and the answer for X in part (i). This was only seen in a minority of instances.

(b) Responses were very poor. Many examples of refraction were seen even though 'reflect' was stated in the question. Even when reflection was shown, the reflected angle did not approximate to the incident angle. Other errors included wavefronts not being parallel or having a constant separation, which was equal to the separation of the incident wavefronts. It was a requirement that for two marks to be awarded, a ruler should have been used.

Q.3 This was the best answered question on the paper. However, most credit was given for part (b).

(a) The circuit diagrams were poor. It was rare to award more than one mark and this was usually for adding an ammeter in series.

Common errors were:

- not including a cell or variable resistor;
- joining cells together with incorrect polarity;
- not including a lamp;
- using square symbols for ammeters and voltmeters;
- adding a voltmeter in series;
- adding a voltmeter in parallel across something other than the lamp;
- using a thermistor symbol instead of a variable resistor symbol;
- omitting the arrow head from the variable resistor symbol.

(b) (i) Most candidates gained two marks for their graph. The third mark was lost for one of the following reasons:

- incorrect scale on x-axis due to the omission of the value of 8;
- one or more incorrect plots;
- not joining points with a smooth curve;
- not joining points at all.

(ii) Most candidates earned credit for two correct calculations although not all gave a concluding statement. A surprising number manipulated incorrectly and calculated resistance by using $R = V \times I$.

Q.4 Candidates always have difficulty with answering questions related to heat transfer. This year was no exception and this was the least well answered question on the paper.

(a) (i) The only difference between the windows was the material they were made from i.e. aluminium/metal and uPVC. All other features were the same. Therefore the only heat transfer method of concern was

conduction. However candidates described an air gap between the panes of glass in the uPVC window, ignoring the fact that there was also an air gap in the aluminium windows. There were also descriptions of white uPVC reflecting sunlight 'back out' and of no gaps for air to pass through. If a mark was awarded it was either for stating aluminium is a good conductor or that uPVC is an insulator. There were few references to particles and usually it was described that 'when heated, particles begin to vibrate' rather than vibrate more vigorously. There were even fewer references to free electrons transferring energy.

(ii) The heat transfer methods of interest here were conduction and convection. These methods were often confused and statements such as 'hot air convects through the ceiling' were seen.

(b) Most candidates earned credit for stating one benefit to the environment of reducing energy losses. Some linked this with less need for heating of the home. There is a common misconception that the heat escaping from homes is a cause of global warming.

Q.5 (a) Many candidates obtained three marks here. A common error was reversing the two wavelength values. It is doubtful whether all candidates know the significance of the symbols > and < in front of a number.

(b) Probably half of the candidates knew which end of the spectrum has more energy so were able to complete the column correctly.

Q.6 (a) Candidates are placed in a band based on the accuracy and completeness of the science. The quality of the structure of the response, spelling and punctuation determine whether the mark awarded is the top or bottom of the band. There were three aspects that needed inclusion in the descriptions. These were the structure of the National Grid, how it provides reliability and also efficiency. There was no need to include a separate paragraph on the structure since it was acceptable for details to be intermingled with other content. Candidates tended to focus on the reliability aspect or the efficiency and not both. This obviously limited the marks available. It was clear from responses that centres have provided past paper questions on this topic since the usual answer consisted of a description of step-up transformers increasing voltage to reduce energy losses in the cables (which was relevant) and then step-down transformers reducing voltage for safety reasons (which was irrelevant).

(b) There was a lot of information given in the question. Some of it was relevant to the questions that followed. It was up to candidates to decide what was required for each part of the question.

(i) It was very interesting to see how candidates coped with the amount of information available in this question. It was pleasing to see how many used the data and there were a couple of acceptable unexpected methods that were added to the marking scheme. This is to be welcomed and candidates to be congratulated on their thinking. Candidates had to decide on a value for useful power transferred and for the power supplied. The rider was at maximum demand. Some candidates used the maximum demand value from the written information and others read the maximum demand from either of the graphs. Most regarded this as the power supplied. They then subtracted the total power loss to find useful output power and then

completed the calculation. Others regarded the maximum demand values as useful output power and added the total power loss to find the power supplied. Both routes were equally acceptable. Some candidates found the percentage power loss and then subtracted this from 100 to find the efficiency. Again this was an acceptable method. Some candidates found the percentage value of the maximum demand compared with the output capacity. This did not answer the question and scored zero.
In all the acceptable methods described above, candidates were required to substitute values with consistent units. This was not always successfully achieved so at least one mark was lost.

(ii) Candidates were required to select the only energy value from the information provided. This was not always successfully achieved. Then there needed to be a conversion from TWh to GWh, or from TWh to Wh and back to GW at the end. Many candidates failed in their conversion. However only one mark was lost and an answer of 4.1×10^{n} earned two marks.

(iii) As expected, a full range of marks was awarded for identifying the correct statements.

WJEC
PHYSICS

GCSE (NEW)

Summer 2017

UNIT 1 – FOUNDATION TIER

General comments:

This was the first examination of the new specification. The foundation paper attracted an entry of just under 20% of the total entry for Physics Unit 1. Traditionally high ability candidates would have opted for this separate award in physics, however, it was clear that candidates of varying ability had elected to study this qualification. The statistics show that most of the questions were attempted by a high percentage of candidates. The performance varied from question to question but the performance of candidates on the 6 mark QER was very poor. The time allocation of 1 hour 45 minutes for the paper seemed to be used productively and effectively by many candidates. There wasn't any evidence to suggest that candidates struggled to finish the examination paper in the time available. Centres may wish to remind or promote to their candidates that some "reading time" is built into the paper. It was evident from candidates' answers that many had not read the information contained in the question or instructions carefully enough.

Specific comments:

Q.1 (a) Some candidates failed to follow the instruction of "**draw one line** from each letter to the correct label". There was some confusion between which coil was the primary and which was the secondary.

(b) Some candidates missed out this part of the question altogether. Although the instruction was to **underline** the correct word or phrase, candidates were not penalised if they indicated their answer by other methods. No marks were awarded if two or more had been selected from the same line. Some candidates chose to underline whole sentences.

(c) (i) Generally well answered by candidates.

(ii) The emphasis was on "no greenhouse gases emitted" or equivalent. Many candidates, incorrectly, suggested that there would be less greenhouse gases emitted or global warming would be reduced.

Q.2 (a) Many candidates earned the one mark available on this part.

(b) Many candidates identified correctly the amplitude. However, some did miss this part out.

(c) (i) Frequency was identified correctly by most candidates.

(ii) Interestingly, many candidates who had correctly identified the amplitude of the wave in part (b) could not link this to the amplitude definition given in the stem of this part of the question. A common mistake of recording wavelength was made by candidates.

(d) (i) Most candidates earned full marks here. They substituted the speed and time correctly into the equation. Only a few candidates seemed not to possess a calculator as they missed out recording an answer.

(ii) The majority of candidates had been able to correctly count the number of waves in part (a) but could not apply this principle to the question. Correct calculation of the wavelength was rarely seen. Many tried, unsuccessfully, to use the wave equation.

(e) (i) A well answered question. Candidates knew a variety of transverse wave examples. If the term “heat” was used by candidates it had to be qualified as “heat radiation” to earn credit.

(ii) Recall of the correct term was rare. Phonetic spelling was accepted.

Q.3 (a) Candidates showed a good knowledge of the main circuit symbols. The variable resistor was the symbol that was correctly identified the least. Ampmeter and voltagemeter were frequently seen but not credited.

(b) (i) Many candidates displayed a secure understanding of fuses by correctly selecting 100 mA.

(ii) I. Many selected the correct current from the table. Only a minority of candidates could correctly do the conversion from mA.

II. This part was generally well answered. The current needed to be selected from the previous question part and substituted successfully into the equation. The ecf principle allowed some candidates to earn marks on this part.

(iii) The points were generally plotted well. The curve of best fit was often poorly drawn. This is a skill that teachers may see as in need of developing with their candidates.

(iv) Most candidates correctly read the current value from their graph. It was encouraging to see construction lines added by some. This proved to be helpful to both candidates and markers.

(v) Many correctly recognised the basic relationship between current and voltage. Very few included “at an increasing rate” to earn a second mark.

(vi) Very few identified the component correctly. Candidates failed to link the graph characteristics to a diode/LED.

Q.4 This was a poorly answered question. Knowledge and application of the motor effect was displayed by few candidates.

(a) (i) Few identified that the current carrying copper rod would produce a magnetic field.

(ii) Only a minority of candidates realised that Fleming's left hand motor rule was needed.

(iii) Generally, most candidates gained one of the marks on this part. However, some answers were unclear and vague. For example, “bigger magnet” was not credit worthy.

(b) Many good examples of everyday devices that contained an electric motor or loudspeaker were recorded by candidates.

Q.5 Many candidates scored highly on this question. Most seemed confident with the aspects examined from this part of the specification.

(a) Both parts of this were answered well by most candidates.

(b) Usually well answered by candidates. However, there were a considerable number of candidates who failed to follow the instruction of identifying two statements. Sometimes there were more than two ticked, sometimes less.

(c) (i) Usually correctly read from the graph.

(ii) Generally, most identified the time taken correctly. An incorrect answer of 5 100 s was frequently recorded by some candidates.

(d) (i) Substitution into the equation was generally good. Occasionally a zero was neglected which had a knock-on effect on their answer. Correct conversions into kW was rarely seen. Many candidates did not even attempt to convert. This may indicate that the stem of the question had not been read carefully enough.

(ii) Substitution into the equation was reasonably good. Candidates who noticed and used brackets on their calculators were more likely to achieve the correct answer.

(iii) This required a straight forward substitution into the given latent heat equation. Many candidates neglected to notice that the mass had been given in the stem of the question instead they used their calculated mass from (d)(ii).

Q.6 This was the least well answered question on the paper.

(a) Secure knowledge of conduction, convection and radiation was rarely seen. Linking these processes to the labelled features was poorly carried out by candidates. There were few answers that reached middle band, even fewer were worthy of top band.

(b) Many candidates attempted this question and gained some credit. Many displayed good numerical skills and could discuss the validity of the claim based on their workings.

Q.7 (a) (i) Generally well answered. Some candidates missed the question and failed to draw a cross on the map.

(ii) Not many candidates attained full marks on this question as they neglected the need for a third station. The circles on the map were meant to guide or help candidates with their explanation.

(b) Many correct responses and explanations were recorded by candidates.

(c) The arrival time at T1 was usually correct. However, many candidates struggled with the arrival time at T2. Many candidates were unable to link the change in distance/diameter and its effect on the time of travel.

Q.8 (a) Candidates interacted with Figure 1 successfully and generally showed their workings. This was important for the award of an ecf mark linked to their conclusion about the validity of the claim.

(b) (i) Many candidates failed to describe the three main features on the graph. The increase and decrease were frequently listed but the constant values from May to July were neglected.

(ii) This was generally well answered by candidates. False advertising was frequently recorded.

(c) (i) Candidates did well on this part of the question and were not deterred by the quantity of information they needed to interact with. Frequently full marks were awarded. Some candidates ticked more than three statements and were penalised. The stem of the question clearly stated **three**.

(ii) Frequently a correct calculation was carried out by candidates. There were three methods possible. The award of a second mark could not be made unless they linked their answer to the claim.

(d) (i) Some good attempts were made by candidates. Some tried an unnecessary conversion between pounds and pence. Occasionally the pound sign and pence symbol were used together in the final answer. Candidates were not credited for mixed units.

(ii) Most recognised that the payback time would be quicker.

WJEC
PHYSICS

GCSE (NEW)

Summer 2017

UNIT 1 – HIGHER TIER

General comments:

The fourth question proved to be the least popular on the paper with one aspect of the question dealing with heat transfer, it is not surprising as this topic has proved to be problematic for candidates in the past. Handling numbers in equations, manipulating them and using numbers in standard form were all well done on the whole but candidates' abilities to explain aspects of physics theory and apply them to new situations is in need of improvement.

Specific comments:

Q.1 (a) (i) The intersection of the three circles identified the epicentre of the earthquake.

(ii) The candidates could apply their knowledge but had difficulty in explaining why three monitoring stations were required to actually locate it.

(b) The majority of entrants could state that monitoring station C would be the first to detect the earthquake because of its proximity to the intersection of the three circles.

(c) This was not answered at all well with just one mark being earned on average. The interval between the instant that the earthquake struck and the timing of the P and S waves at station A could not be explained as being halved to give their times of arrival at B. Of those who did find the times successfully, the explanation often omitted the "time **interval**" aspect of the answer.

Q.2 (a) In this Pisa style question only one mark could be awarded to candidates who simply totalled the energy values given by the bars on the chart without stating that the claim was valid, based on their calculation.

(b) (i) The general shape of the curves needed to be compared in some detail to earn the mark.

(ii) The unfairness of misleading advertising was the key to the answer.

(c) (i) Nearly all candidates could take information accurately from the bar chart.

(ii) This was answered well but a comment was demanded to validate the claim for both marks to be awarded.

(d) (i)-(ii) Only about 50% of candidates could correctly subtract the two figures and multiply by 29 p to give the answer in pence. Many confused themselves by trying to work in £ and then convert back to pence (or not).

Q.3 (a) Just how a transformer works is a mystery to most candidates.

(b) (i) The meaning of 100% efficiency was well answered.

(ii) Candidates are well advised to substitute the numbers into the transformer equation before trying to manipulate it. By attempting to do otherwise often resulted in the loss of both marks. Answers of thousands of volts applied to the toothbrush were not unusual!

(iii) Given that the answer from the previous part was now brought into this part, the need to convert 100 mA into amps produced a loss of one mark for failure to convert correctly (despite the conversion factors being given inside the front page). There were some interesting calculations arising from a compounded error in the previous part coupled with 100 mA being converted to 100×10^3 A which resulted in a toothbrush having a power that compared well to the output of a small power station.

Q.4 (a) (i) The function of the earth wire was not well understood. Teachers should refer to the teacher guide for clear statements on this point.

(ii) The same can be said of the advantages of an mcb, these were not well known and again please refer to the teacher guide.

(iii) The candidates had to apply their knowledge by realising that the total current drawn by the three appliances was 24 A but there existed two routes for the current to get to and away from each socket. This meant that neither cable should pass a current as large as anything approaching 21 A (in this simplified approach to the ring main).

(b) Questions on heat transfer continue to be answered badly. However some very good answers were seen.

Q.5 (a) (i) A number of candidates failed to answer this part at all (they may not have seen it at the beginning of the question?)

(ii) The answers seen were usually at foundation tier candidate level. The fact that the current increases **at a decreasing rate as the voltage increases** was not noted.

(b) (i)-(iii) The calculations were either well done or marks were earned on the error-carried-forward principle. It was interesting to see how many candidates chose the more demanding route to find the total circuit resistance using the reciprocals of resistance relationship. Often they failed to invert the result of their calculation to get the final answer.

(iv)-(vi) These parts were poorly answered.

Q.6 (a) Answers to the QER question were very poor on the whole. Many failed to even recognise that latent heat is associated with change of state, let alone show any knowledge of bond breaking being involved in the processes.

(b) (i)-(ii) Many candidates could apply numbers to the equations to get answers of 200 million J and 288 million J but then they subtracted the two values. Very few knew how to relate the total energy to the power of the heater to come up with a time. There were very few complete, successful answers.

Q.7 (a) Some candidates entered for this paper could not name the two missing parts of the em spectrum.

(b) (i)-(ii) The light passing into the prism was incident on the side AB at 45^{o}. This simple geometrical fact was lost on many candidates who could state correct answers to part (b)(ii). If they knew what constitutes total internal reflection, why could they not apply it to the diagram? It goes without saying that (b)(i) was answered poorly whereas (b)(ii) was answered well.

(iii) The rather complex two stage calculation required in this part was done very well – except for failing to halve the final answer in many cases. Three marks out of the four were often awarded.

(iv) Most candidates failed to relate the pulse interval to the return time of 2.5626 s.

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