Script: Pre-recorded Event

Event Code:	**9PH0-19P1**
Event Title:	**Pearson Edexcel A level Physics: Feedback on Summer 2019 – Papers 1, 2 and 3**

Slide No.	Script (verbatim)
Slide 1	Welcome to this feedback presentation on Edexcel A level Physics Papers 1, 2 and 3 from summer 2019.
Slide 2	During this presentation we will consider examples of candidates' performance by reference to mark schemes and Examiners' Reports. We will also address some common issues.
Slide 3	Here is a breakdown of what we will cover in the presentation.
Slide 4	First of all we will consider the assessment model for this qualification.
Slide 5	There are 3 examination papers. Papers 1 and 2 focus on specific topics from the specification. These topics include AS material as specified. Paper 3 is a synoptic paper in which half of the total marks are awarded for questions relating to practical skills and techniques.
Slide 6	Let's begin by looking at some candidate responses to unstructured calculation questions.
Slide 7	Question 14b on Paper 1 tested candidates' ability to apply the principle of conservation of momentum to a situation involving a collision.
Slide 8	This response scores full marks for both parts of the question.
Slide 9	In this example the candidate has written their response to (i) clearly, and so even though the answer is incorrect, 3 "method" marks can still be awarded. Similarly in (ii) a mark is earned for the use of the KE equation, although components of velocity have been used and so the final answer is incorrect.
Slide 10	Question 17c in the same paper relied upon candidates being able to calculate an energy transition and show the direction in which the electron moves between atomic energy states. In this response the

	calculation is correct, but there are many arrows indicated on the diagram. Hence the response scores only 3 out of 4 marks.
Slide 11	In this example both the calculation and the diagram annotation are correct and so the response scores full marks.
Slide 12	In Paper 2, question 16a required candidates to “show that” the length of a pendulum was about 10 m. It is expected in such questions that the candidate will give a response to a greater number of significant figures than the value given in the question.
Slide 13	This response clearly shows all 3 stages and gives the correct answer. Note that it would not be enough to see a bald answer - we do need to see some of the steps in the working (e.g. the intermediate answer values and substitution in the equation).
Slide 14	MP1 can be awarded for the calculation top left. MP2 can be awarded for the substitution into the equation. Note that the solution to the equation has an incorrect value, but this is not important when considering the "use of " mark.
Slide 15	Question 8a in Paper 3 was an extended calculation problem based on a “stone” being propelled along an ice surface in a game of curling. The response shown here has all the parts of the calculation shown clearly, together with the correct answer for the power developed by the curler, so this scores full marks.
Slide 16	In this response the method is correct, but in the power calculation the candidate has used the wrong time (17.5 s instead of 1.25 s). Hence this scores 3 marks for MP1, MP2 and MP3 only.
Slide 17	Question 12 in the same paper required candidates to comment on data obtained when spheres made from modelling clay were dropped into a tray of sand.
Slide 18	In part (a) candidates were asked to determine the factor by which the KE of a sphere would increase when the diameter of the sphere was increased from 2 cm to 4 cm. In this response there is an attempt at a calculation of the volume of the sphere, but the formula used is incorrect. There is no link given between the change in gravitational PE and the increase in KE as the sphere falls, and so no marks can be awarded.

	It was surprisingly common for candidates to use an incorrect formula for the volume of a sphere.

Slide 19	This response uses the correct formula for the volume of a sphere and gives a correct calculation for the increase in KE of the sphere. However, the velocity of the sphere is cancelled without any justification when the KE ratio is calculated, and so MP2 is not awarded. Note that it was common for candidates to calculate the volume explicitly for each sphere, rather than just to find the ratio of the volumes.
Slide 20	This response includes some unnecessary calculations of the mass, but all the essential detail required is present and the final answer is correct. Hence this response scored full marks.
Slide 21	Now let's move on to questions in which candidates are required to make a deduction or come to some kind of judgement.
Slide 22	Question 12b in Paper 1 required candidates to deduce whether a cooling system for a superconductor electrical transmission system used less power than the ohmic losses in cables made from ordinary conducting wires.
Slide 23	MP1 is not given as an incorrect value from the graph is used. MP2 is not given as P = IV is not used MP3 is given, as the resistivity equation is used correctly. Note that if the length had been "1.05" and the area had been "145" this mark would still have been given, as these values are dimensionally correct. MP4 not given as $P=V^2 / R$ does not give the correct answer in this application, and MP5 can only be gained if the answer to the calculation is correct. So this response scores just 1 mark.
Slide 24	This response gains full marks. Note that the units of resistivity do not have to be shown for MP1 to be given; we just need to see a value that is within range. The "2.1" at the start of the calculation leads to slightly different values from those given in the mark scheme, but this is fine. If MP2,3,4 were given for a response, then MP5 could be given even if the candidates value from the graph was incorrect.
Slide 25	In the same paper, question 14a required candidates to discuss the validity of a suggestion made regarding a collision between two coins.

Slide 26	This response has only marginal relevance to the question asked, and it gains no credit. There is no reference to the appropriate equation of motion for MP1 or MP2. It is not clear whether this answer is referring to the "tap" force or to friction. If anything, the answer refers to an increase in velocity so looks to be about the "tap". Responses need to be referring to frictional (decelerating) forces to gain MP3 onwards.
Slide 27	This answer covers all six mark points in the alternative scheme. "Energy loss" was accepted in place of "work done" due to friction
Slide 28	Again from the alternative scheme, MP1 is given for "work done...frictional force" in line 3 and MP2, MP3 and MP4 are all present. MP5 and MP6 not awarded.
Slide 29	In Paper 2, question 11 required candidates to bring together a range of data to determine which of two processes has the greater rate of energy transfer. The question could be attempted in a number of ways. For example, candidates might calculate the two rates of energy transfer and then compare them. But they could calculate the time taken for the water to be evaporated and then compare this with the time given in the question. Because there is no clear steer as to what the candidate must do to answer the question, such questions test candidates' higher level thinking and problem solving skills.
Slide 30	In this response a temperature is being calculated from an energy transfer, but the question demands a consideration of the energy transfer including a temperature change. However, MP4 can be awarded for the calculation in the first line, and as the values of m and L have been correctly substituted MP3 can be awarded for the second calculation in line 4. MP1 and 2 cannot be awarded for the calculation in line 3 due to incorrect substitutions. MP5 could not be awarded as there is no comparison of values for power, energy or time.

Slide 31	MP1 can be awarded for calculation on the right-hand side, however this response does not use the correct temperature (82 ˚C) so MP2 is not awarded. Note that it would not be enough just see 82˚C. It must be in a specific heat capacity calculation for MP2 to be awarded. MP3 can be awarded for the calculation in the top left and MP4 can be awarded for the calculation in the bottom left. However, MP5 is not awarded as there is no comparison of correct values, with an appropriate conclusion statement
Slide 32	In this response two energies are calculated, and a correct deduction is made. Hence this response scores full marks.
Slide 33	In Question 4 on Paper 3 candidates were given a graph and a conclusion that a student had drawn from the graph. They were expected to use values from the graph to test out the validity of the student's conclusion.
Slide 34	This is an example of a neat way to interrogate the graphical data. The candidate has rearranged the lens equation and matched it to the equation of a straight line. From this the focal length of the lens can be determined from the y-intercept. This was a popular approach to this question and many candidates scored full marks for this method, just as in this example. Some candidates also calculated a value for the gradient of the graph (−1), although this didn't relate to the student's initial statement, and so wasted valuable exam time.
Slide 35	This is a more labour intensive approach, in which two pairs of values are read from the graph to calculate two values for the focal length. These should be similar and close to 15 cm, enabling the correct judgement to be made about the students' conclusion. In reading values from the graph some candidates forgot that these were reciprocals of *u* and *v*, hence their calculations didn't always yield a value close to 15 cm.

Slide 36	In question 5 on the same paper, candidates were again given some graphical information, this time relating to the absorption process as em-radiation is passed through the body. The tricky aspect of this question for many candidates was the use of log scales for the graph. It was clear that many candidates were unfamiliar with such scales, and so incorrect values read from the graph were common.
Slide 37	In question 5b candidates were asked to deduce whether the ratio of transmitted intensity to initial intensity was greater for red of infra-red light if the blood was de-oxygenated. Many candidates were confused, and thought that they were comparing the ratio for oxygenated blood with that for de-oxygenated blood, as in this example here which scored zero.
Slide 38	Despite the use of non-standard notation such as the up and down arrows, there is enough for full marks to be awarded here.
Slide 39	Part (c) of the same question required candidates to deduce whether the light from a specified lamp would have a significant effect on the oximeter readings. Not all candidates realised that a calculation **and** a judgement was required by this question. In this example the candidate carries out an appropriate calculation but draws an incorrect conclusion, so the response does not gain MP3.
Slide 40	This response scores full marks. Note that for MP3 to be awarded, the candidate had to relate the wavelength to the infrared radiation, as in this example.
Slide 41	Next, let's consider some examples of "linkage" questions. Such questions require candidates to structure their answer logically, showing how the points that they make are related or follow on from each other. These questions have up to 4 marks for candidates identifying appropriate physics, and up to 2 marks for the logical links made by the candidate in the answer. A candidate may make a number of indicative content points but still not be awarded linkage marks if their answer is jumbled or unclear.
Slide 42	The linkage question on Paper 1 was question 16biv. This question was slightly unusual, as it required candidates to perform a calculation as part of their response.

Slide 43	This grid shows how the marks for “linkage” questions may be awarded. Refer to the mark scheme for the specific indicative content points relevant to this question.
Slide 44	This answer contains IC1 (use of v=d/t). However the student converts the prefix micro incorrectly and omits 0.99 so does not get IC2. IC3 can still be awarded if 0.99 omitted as it still makes good sense but here the value leads to a reversed statement. There is no further reference to relativistic effects so no further indicative content points. The response was awarded 1 mark for indicative content. As there is only one indicative content point there can be no linkage marks, and so the response is given just 1 mark.
Slide 45	In this response, IC1, IC2 and IC3 are clearly seen. IC4 can be awarded for "relativistic" and IC5 for the reference to time dilation. There is nothing in the response that clearly states IC6, and so this response scores 3 marks for indicative content. The response is logically ordered with good linkage, as so 2 linkage marks are awarded, giving a total of 5 marks.
Slide 46	There is evidence of all six indicative content points in this response, and there is a logical line of reasoning and so this scores full marks. Note that poor spelling, such as "relistic" for “relativistic” and "delation" for “dilation” seen in some responses, was not penalised in this question.
Slide 47	The linkage question on Paper 2 was question 13. This question was a more standard question in which candidates were required to apply some standard physics knowledge to a novel context.
Slide 48	This response outlines a range of physics knowledge, but there is much repetition and some of the language lacks precision. For example “external frequencies” is not “driving frequency”, so IC5 is not credited. In fact this response has IC 4 only (in lines 2 to 5) and so there is just 1 mark for this question.

Slide 49	This is a better response, IC1 and IC5 are seen in the phrase “when the signal generator applies 720 Hz, the bowl's natural frequency…” “The signal generator provides a driving frequency to the bowl” is sufficient to suggest “causing forced oscillations” so IC2 is met, and loudness and resonance are linked at the end for IC4. Note that 'it will resonate' was accepted for “resonance occurs” in this context. The response was awarded 3 marks for indicative content and 1 mark for linkage giving a total of 4 marks.
Slide 50	On Paper 3 question 8b was one of the linkage questions. The context was two curling stones making a collision on ice and the physics content should have been familiar to most candidates.
Slide 51	IC2, IC3, IC4, and IC6 are all stated in this response, and so 3 marks are gained for indicative content. There is a logical flow to the explanation, and so 1 linkage mark brings the total for this response to 4 marks.
Slide 52	All six indicative content points are made in this response, and there is good linkage between the points and so 2 marks are awarded for linkage giving this response full marks.
Slide 53	Finally, let’s consider some questions that targeted candidates’ knowledge of experimental skills.
Slide 54	Although not a direct experimental skill, graph sketching is an important way in which experimental data can be represented in outline. This question required candidates to apply knowledge of diodes to sketch how an input waveform would be modified by a circuit.
Slide 55	This is a well-drawn graph which scored 2 marks. MP1 was given for the half sine waves, but MP2 was not. For MP1 the half sine waves can be negative or positive and they should peak at just over 3 V. MP3 was given for horizontal lines at 0.7 V.
Slide 56	This graph is a little ragged looking, but is nonetheless worth 2 marks. Again MP2 is not given. MP3 is given for the "spaces" which are clearly marked at 0.7 V.
Slide 57	This response is worth all 3 marks.
Slide 59	Candidates should know that when using a micrometer to measure the diameter of something with a circular cross section they should vary

	both the position along the object and the orientation at different positions to calculate a mean value for the diameter. In this example, the candidate only refers to different positions. In addition, there is not mention of calculating a mean, and so this response is worth just 1 mark.
Slide 60	The top response is worth 2 marks, as there is reference to taking multiple reading along the length of the tube and then calculating a mean value. The bottom response scores full marks as it is clear that both position and orientation must be varied in order to obtain an accurate mean value for the diameter.
Slide 61	This response was only awarded 1 mark, as the calculated percentage uncertainty is clearly not approximately equal to 1%.
Slide 62	This response is worth all 3 marks. The candidate has identified the uncertainty in a single reading from the meter rule and then doubled it as the diameter is calculated from a difference between two readings.
Slide 63	In (ii) the candidate has taken the range rather than the half range when calculating the uncertainty. For this reason, (ii) was only given 1 mark, although (iii) scored all three marks as error carried forward was applied.
Slide 64	Both parts of this response scored full marks. Note that it is expected that, as percentage uncertainties are estimates, no more than 1 decimal place is justified in such a value.
Slide 65	This question tested candidates' knowledge of experimental procedures to be used when timing an oscillating system. It is an explain question, so justifications as well as descriptions are required for a complete answer, something that was missed by the vast majority of candidates.
Slide 66	This response comes close to scoring, but misses out important information from each of the marking points. For example there is reference to a mark being made at the equilibrium position, but no indication that this is used in the timing of the oscillations.
Slide 67	This is an example of a good response in which all the marking points except for MP6 are seen.

Slide 68	Now let's briefly look at some common features seen across all the papers.
Slide 69	Perhaps its worth making particular mention that: Centres are making good use of past question papers and mark schemes. Questions that involved straightforward calculations produced significantly better marks than questions requiring discussion or explanation.
Slide 70	Multi-step calculations can be a challenge. Conclusions were not always made sufficiently explicit. Command words are not always being followed. Some of the processes of quantifying uncertainties in practical work is poorly understood by candidates.
Slide 71	And finally some common issues.
Slide 72	Here are some handy places for clarification of issues associated with teaching the specification.
Slide 73	Edexcel provides a full statistical service for centres entering candidates for its examinations.
Slide 74	Thank you for attending this online presentation. I hope that the information has been useful.