Year 11 ATAR Physics 2020 Final Examination Marker Comments
Year Average = 67%

Note to all students:

1. After returning your examination papers you will be given an opportunity to read through your paper and the marks scheme.
2. Your teacher will go through the marks scheme and the information contained within these notes with you.
3. Your teacher will then be happy to discuss any concerns you may have about your individual paper.

Please note:

- It is expected that you will approach your teacher in a respectful manner. Please think carefully about how you will word your queries and the tone of voice you use.
- If there has been an oversight in the provision or summing of marks, it will be rectified, however, your teachers do not intend to haggle over marks with you.
- Please check the marking key and markers notes carefully. Important opportunities for improvement can be gained by carefully reading your response and assessing why you were not awarded full marks, rather than just assuming that what you had written was sufficient, but incorrectly marked. Your teacher will be happy to help you reach this understanding.
- Choice of words, particularly in definitions is important. One incorrect/inappropriate word can completely change the meaning of a definition or a statement and will mean full marks cannot be awarded.
- If a marker was unable to read handwriting or make sense of the logic the candidate has used in a question, marks will not be awarded upon further explanation.

All queries regarding marks must be finalised by:

Tuesday 1st December 4:00 pm

Please approach your teachers as soon as possible to address your concerns, but only approach if you have a valid concern. Throughout the paper;

- Make sure you read the questions carefully and ensure **your answer matches** the question asked. Be especially careful if the question asks for something specific to be shown in your answer.

- You must ensure that you work is well set out so that the examiner can follow your thinking/reasoning when answering questions. Poor setting out make it difficult to mark to see where you are entitled to marks.

- Your handwriting needs to be legible, if it can't be read it can't be marked - no excuses.

- Always check that you have included units with any calculation (including part calculations used in the next step).

- Remember that the fundamental units are metre (m) for length, kilogram (kg) for mass and seconds (s) for time. Other units should not be used unless you are asked for answers to be specified as such eg. How many hours….etc.

- Vector quantities should always have a direction unless you are asked only for the magnitude of the quantity.

- Be careful when rounding values, many mistakes made throughout the paper.

Section 1 – Short Answer

Q1 Mostly answered well.

Q2 Almost entirely answered correctly

3a Lots of students with 'magic' numbers – i.e just writing 4.75 – 3.25 = 1.5 - but not explaining where the 4.75 and 3.25 came from. Many students did not link the path difference to the wavelength, or did not write or include the wavelength in the calculation. This must still be done even if it is 1m.

3b Many students did not reference or show any working for λ. Even though $\lambda = 1$, this still needed to be shown explicitly.

4a Many students were incorrectly referring to the phenomena as resonant frequency. Students needed to explicitly make reference to the increase in amplitude of vibration of the object. Many students were discussing resonance in terms of constructive interference. Interference occurs when travelling waves are passing through each other. Resonance is when an object is made to vibrate due to being pused forards and back by pressure waves. The driving and drived object are oscillating 90 degrees out of phase, so for the resonance to be a form of constructive interference does not make sense.

5 Many students did not include $\Sigma F\Delta t$ in their equation, as there was no reference to momentum in the question, this needed to be included for the working to make sense. Students needed to reference the directions they were using.

6(a) Many students did not include in their working, the momentum of the cart before the spring extended. This either meant working did not make sense, or students, did not obtain the correct direction of the cart.

(b) Many students applied a direction to the kinetic energy – energy is a scalar quanity.

(c) Students needed to be explicit in their answer – making reference to conservation of momentum and the 1.00 ms^{-1}.

7(a) Many students did not draw the correct vector diagram – drawing u + v, not v- u. Students need to make sure they include all the arrows for vectors and draw vectors Head to Tail. As the question gave directions using N,S,E,W – answers must be given in this format also. Not in true bearings.

(b) Many students did not include a diagram in part (b). Students must read questions carefully – the requirement for diagrams was written in the main body of the question. Many students added the velocities together, rather than taking the hypotenuse.

8(a) Students should round correctly, not round down.

(b) Many students neglected to include the milli for the 30.5 mW m^{-2} (-1 mark).

Section 2 – Problem Solving

Q9(a) Generally well done. Solutions needed to be realistic. (Using a quieter generator or "giving everyone earplugs) us not a suitable modification.

Q9(b) Last mark needs to be concise. "increasing the intensity" is simply restating outcome and not explaining the outcome. Sound "bouncing off walls" is also not a suitable explanation.

Q9(c) Generally well done.

Q9(d) The correct terminology must be used in the correct sentences. Objects do not have a resonant frequency: they have a natural frequency that can be increased when the driving frequency matches it to produce resonance.

Q10(ai) Many students only stated "out of phase", which is not the correct answer; need to be specific as to how much out of phase.

Q10(b) Generally well done. Some students opted to choose points far apart which was risky as some accidentally chose two points that were in phase.

Q10(c) Generally well done.

Q10(d) Anti-node is not explicit enough. Must mention particle or displacement.

Q10(e) Generally well done. Some students did not see that the effective length of the string was 240mm, reading the wrong length off the diagram instead.

Q10(f) Generally well done.

Q11(a) Poorly done. Students were commonly sketching the 2nd harmonic rather than the 3rd.
Q11(b) Students that got (a) wrong then made the same error in (b); setting n = 3 rather than n = 5. Achieving only 2 marks.

Q11(c) Done ok but many students did not get the 2nd mark. Full marks were paid for "equilibrium" or "mean position", half marks were paid for "original position"

Q11(d) Mixed achievement in this question. Students could get error carried forward from (a) if they dropped from n = 3 to n = 1. But dropping to n = 2 means nothing, as they do not understand that even harmonic n values cannot be established in a closed end tube.

Q11(e) Mixed result. Most were able to achieve the first mark but then went on to suggest the wavelength remained constant. The frequency remained constant (mentioned at the top of the page) so many students only achieved 1 or 2 marks.

Q12(a) Many students lost a mark for not expressing the bottom 3 rows to 4 sig fig. There were numerous students who forgot to divide the value by 10.
Q12(b) Generally well done. A few missing titles and even more students forcing their L.O.B.F through the origin. Do not do this!!! Even though the equation might imply no y-intercept, systematic errors can manifest through a y-intercept.

Q12(c) Generally well done. Some missing units.

Q12(d) Many students struggled to rearrange the linear form to determine what the gradient represented. Expressing the equation in the for y = mx + c an essential skill in the year

12 course and must be mastered. Many error carried forward but a lot of students neglected to include units, losing ½ marks in the process.

Q12(e) Generally well done but the line needs to be labelled if you are adding an addition data set to the graph.

Q12(f) Done well but the last mark was often missed. The Method needed to be mentioned: that students measured the period of 10 oscillations, hence the spring needed to be underdamped.

Q12(g) Poorly done. Please read the solutions.

Q12(h) There were interestingly numerous approaches to the solutions of this question. Many students managed to get the first 2 marks but could not show how kg s^{-2} was equal to kg m s^{-2} / m.

Q13(a) Surprisingly done poorly. Many students stating N = mg = 12.3 N. This gets nothing.

Q13(b) Many students had the normal force vertical the weight force tilted forward by 15.0 degrees. This gets nothing. The only way students could salvage this error would be to show their sign convention of a tilted x-y Cartesian, which no one did.

Q13(c) Generally done well.

Q13(d) Generally done well. A few errors carried forward from 14(c) and errors in calculating acceleration.

Section 3 – Comprehension

Overall, this section was plagued with significant figure errors. The cover clearly stated that all calculations should be completed to 3 s.f. and all estimates to 2 s.f.

Q14a Very poorly done with many students forgetting the basics of ray diagrams. You must use a ruler, include arrow heads on your rays and draw in the normal line to the surface. It was specified in the text that the rays speed up, hence we need to see refraction AWAY from the normal line. 1 mark awarded for showing refraction AWAY from normal line on entry to hot air, and towards on exit. 1 mark was awarded for showing relatively minimal or no refraction for the bottom ray, as the angle of incidence was approximately 0 at this point.

Q14b Also poorly done considering this is a basic definition. Most students were able to get the mark for "bending" or "deflection" but explaining that this was due to a change in speed was missed by many. The most common error was attributing this to density and not speed. Density is only one factor affecting wave speed and did not earn the mark.

Q14c Many students failed to measure or calculate the angle and simply stated a guessed number here. A good strategy when you don't know what to do, however calculating an angle from a triangle should be a skill all Year 11 Physics students are well capable of. 1 mark was assigned to stating the angle, hence several students lost this mark by only calculating the sin of the angle and not actually stating α. This statement needed to be to 2.s.f. as it was an estimate.

Q14d Well done other than lots of s.f. errors. It was disappointing to see some students not providing full working. For a simple 2 mark question, full and complete working needed to be shown.

Q14e Generally well done. Multiple s.f. errors throughout lead to a number of different angle calculations. One error that many students made which was not penalised (THIS time), was writing down a figure, Ma = 1.32, and then using the figure in their calculator to calculate α, not the figure they have written down. This is incorrect technique and answers do not follow through. Always use the rounded figure you have written down. On the diagram, this either needed to be drawn accurately with a protractor, or labelled with the calculated angle to receive full marks.

Q14f Mostly well done but several students lost a mark by stating an incorrect proportionality. If Ma is indirectly proportional to sin(α), then it is not correct to say that Ma is indirectly proportional to α, although it is true to say that as Ma decreases, α increases. You must state the proportionality correctly to receive the mark for justification.

Q15a Many students did not get full marks here when they really should have. Common mistakes were not drawing a LOBF on the graph, not identifying points used clearly with a triangle, selecting points that were not on the linear section of the graph, and not showing full working for gradient (i.e. a subtraction of two points). A margin of error was accepted here and there was no need to falsify your readings to get exactly 1.9 m/s. Students who did this inevitably lost marks as their working did not match their working on the graph.

Q15b A similar error came up here as in 14f. If one variable increases as another increases, it is not correct to say that these two things are proportional, unless there is a *linear* relationship. Which in this case, there clearly was not.

Q15c Many students rearranged the equation to solve for v, which earned them 2 marks. However relatively few realised that this does not actually address what was asked. For this, you had to specify V_t in terms of mass, which was the variable plotted. Many students were misunderstanding entirely and providing non-sensical answers.

Q15d Fairly well answered, all things considered. For students who had failed to solve part c) correctly, they were still able to gain marks for this section by stating that they would plot F_D vs v^2. However, a little thought needs to go into this, as F_D would be a near impossible value to actually measure, and hence it is not a practical solution. Others provided answers that included plotting constants on either the y or x axis but this would provide either a zero or undefined gradient and hence would not allow you to solve for C_D. Be careful to address all parts of the question for full marks.

Q15e A relatively easy question that was overcomplicated by many as this was a very simple principle. The most common error was either not referring to an equation to justify your response, or misinterpreting the question altogether, and providing an analysis method rather than a change in the actual experiment as was requested. This resulted in students trying to repeat what had been said on the previous page.

Q15f This was also very easy and so many silly mistakes were made, by far the most common being not reading the question. The first diagram was before the cupcake was dropped, hence forces should be equal and there is no friction. Applied force or Normal Force was the appropriate label for this. The second diagram was during the fall, but as specified in the text, terminal velocity was never reached, hence not in equilibrium. Forces should be drawn from a central dot on the shape and correctly labelled. Not showing the dot means that in some cases it was impossible to tell whether arrows were supposed to equal in length or not. Many silly or incorrect labels were provided such as a normal force when falling or a friction force when stationary.