Vicphysics Teachers' Network
Revision Lectures: The Q&A from the Zoom Webinars 2021 - 2023

General Comments

Revision Advice

1. How much should we practice physics in a week
   Do a bit every night. Create a study program, with all your subjects blocked in.
2. Will we get the links to these applets?
   Yes, see the list at the end of this document.

Exam Advice

Calculation

3. If you don't round up your decimal point will you lose a mark?
   Typically, if you don't round off correctly, your answer is incorrect.
4. When answering questions is it best to substitute the numbers in before or after rearranging?
   I always advise my students to substitute first. My rationale is that often the first mark is for correct substitution into an appropriate formula. This shoiuld be fairly simple. If your transposition is incorrect, then you won't get the marks for the substitution.
5. Instead of writing the speed of light in full for example, can you simply just write c? Same with charge of an electron
   To be safe, write in the values.
6. What if you have to rewrite your answer but there is no room in the box? is it ok to write next to the box?
   Yes, beside it or below it. Just make sure it's very clear what your final answer is.

Cheatsheet

7. Does the A3 cheatsheet that we bring into the exam have to be handwritten?
   No, can be a print out.
8. Is the A3 sheet single sided or double sided?
   The A3 sheet can be doubled sided if you need it
9. Can you print out things and stick them into the A3 formular sheet?
   As long as it is stuck down flat and doesn't go beyond the edge of the A3 sheet. You could compile screenshots, do the cut n paste on your computer then print out the completed pages of your cheat sheet.
10. Is it recommended to use two A4 cheat sheets or one A3 (from experience what works practically)
    you are only permitted to bring in one piece of paper as a cheat sheet. It can be 2 x A4, but they must be taped together so it's the same as an A3 sheet.

Derivation

11. Recently there have been questions to derive an expression, does that mean that derivation of formulae needs to be a section of the Study design?
    The derivation refers to equations based on the relationships in the study design, not the relationships themselves. Check examples in the NHT exam paper

Graphs

12. Do we need to know how to use a logarithmic scale?
    Logarithmic scales are not required in the new study design. They were used in Sound, but no longer. IF they did sneak in, you would only be expected to read exact values.
13. Do you have to draw a line of best fit even if the question doesn't ask you to?
    If you're not asked to draw a line of best fit there may not be any marks specifically allocated to it. That said, if you're presented with data plotted on a graph and the analysis involves finding the gradient, you'll need to use a line of best fit. The assessor will be looking to see how you calculated the gradient of a line of best fit.
14. Investigation questions: Marks for title?
    The decision will by the chief assessor, but the focus will be on scales, labels on the axes, correct plotting and line of best fit, so a title would be very low on the criteria.
15. In calculating the area under a graph, would counting squares still work?
    Yes , counting squares does work, but you may need to count half squares. If there are a lot of squares, using triangles and trapeziums may be quicker.

16. When counting squares for the graph what's the rule for doing so do you count the square if it's over 50% of the square?
    You should be approximating a partial square to the nearest half square, so its value is either 0, 1/2 or 1. Also consider dividing the area under the graph using a rectangle and triangle method, particularly if there are lots of squares to count. There is a range of acceptable answers when calculating areas, so be clear to demonstrate how you arrived at your answer.

Pen or pencil?

17. Do we have to use pen?
    It is best to use a pen. The papers are scanned and are marked by assessors from the scanned version on their screens. So pencil can be problematic.

Sig figs

18. For questions where the required significant figures is not stated, how many sig figs do I give my answer to?
    If you aren't asked for a specific number of significant figures, generally your answer should be to the least number of significant figures provided in the question. Eg, if you were given values with 2, 3 and 5 significant figures, give your answer to two significant figures.
19. Do sig figs matter in questions where not specified?
    Where it's not specified, there probably won't be a mark allocated to significant figures. Even if sig fig not specified, be careful not to round too heavily during the working process, just round the final answer.
20. When using the lowest sig figs in the questions and for example there is 42,600 does that mean your answer for example would have to be 0.12945
    The least number of sig figs provided in the question is what to look for. I don't remember seeing any questions where the least sig figs given is 5 or 6. Generally data provided is two or three sig fig.
21. Do we always answer with 3 sig figs?
    You look at the least number of sig figs in the question. That identifies how many sig figs you can quote in the answer. e.g. if the question is 3.22533 x 2.1 = 6.773193, which you write as 6.8. (2 sig figs). Additionally, if the question specifies a required number of significant figures, you must use that in your final answer.
22. How would we treat significant figure questions if the lowest sig fig option is for example 2 minutes, however that is also 120 seconds. Would we do 1 sig fig or 3?
    2 minutes has 1 sig fig. If the question states 2 minutes, then it is saying that the time was closest to 2 mins than 1 min or 3 mins. Therefore only 1 sig fig in your answer. This type of question is not very common at all. If a question had a data value of 2 min, it would be considered a poorly designed question. The SI unit for time is seconds and you would expect data values in seconds.

Units

23. Is there a preference for units when you have multiple options
    The answer box in the exam paper will specify the units for the answer, you must use that unit.

Written response

24. Would you advise responding to explain questions in dot points rather that paragraphs?
    Yes, Dot points are best. They are also much easier to mark, so it keeps the markers happy.
25. Can we answer theory-based short answer questions with dot points?
    Yes, the most important part is to ensure that you actually answer the question being asked, not just 'data dumping' from your cheat sheet. A logical well thought answer usually scores more than a random selection of facts. Most certainly. It is to be encouraged. It makes your logic clear to the marker and to yourself and it means you avoid contradicting yourself.

Colin Hopkins' Presentation

26. In Colin Hopkins' presentation when he shows an exam question, the bottom has a percentage with a number in brackets after it, what does this number mean?
    The percentage is the percentage of students who got the question correct. The number in brackets is the number of extra questions in Colin's notes that test the same idea.

Unit 3 Fields

Gravitational Field

1. Strength of gravitational field at the centre of the Earth. Is it that net force is 0?
   The net force at the centre of the earth is zero. Surrounded by mass so the gravitational attraction is in all directions, giving a net force of zero
2. Using the area under Force or Field vs Dist graph to determine the change in potential energy. How can we know when we approximate the squares under the curve of the graph correctly? Is there an acceptable range?
   A wide tolerance in the answers is accepted, for example +/- 1 square. You can also break up the area into a rectangle and one or two triangles
3. Derived Gravitational equations, e.g. R^3/T^2. Can we use the derived formula in the exam straight away or do we have to derive it on the spot?
   You can use the derived formula in the exam straight away. You don't need to derive it for the calculation.

Electric Field

4. Do we have to label the null point in the middle of like-charges?
   No, you are not required to identify the null point. The question will ask for the field.
5. What is the radius for point charges?
   There is no radius for a point charge. Don't worry about the fact that at r=0, the field is infinite. That equation breaks down, but how to deal with that is outside the course.
6. Why do the field lines curve outwards on the ends of parallel plates?
   Between the plates the field at any point is from all parts of the plates. At the edge of the plates, the associated field is only due to the charges on the ends of each plate. This gives a curved field. You are not required to draw them on the exam. The simplest way is to draw a uniform field by having parralel lines equally spaced. I would not draw any right on the edge of the plates, just to avoid having to draw the curved lines
7. Why do the field lines go through a solenoid but not through a bar magnet?
   With the solenoid the direction of field is determined by the direction current flowing through the wire / loops. The question would be asking you to demonstrate that knowledge. For a bar magnet only show field lines to/from the ends. Magnetic field lines form closed loops, so there are field lines inside a bar magnet. Outside the magnet the direction of the field lines is North end to South end. So inside the bar magnet, the field lines must go from South end to North end.
8. Do you need to put mass of an electron and proton on your formula sheet or is it given in the question
   Mass of electron is on the formula sheet. If you are required to use the mass of any other particle, it will be given in the question stem. You are not expected to know the mass of particles.

Unit 3 motion

Circular motion

9. Under what circumstances does the circular motion occur and why?
   Circular motion happens when there is a constant force at right angles to the velocity. This means that the object is continually being acceleration towards the centre of a circle, but the tangential speed is constant.

Special relativity

10. Would a person travelling at the speed of light in one direction measure light travelling in the same direction as them as having zero velocity or 3.0×10^8 m/s?
    The speed of light is the same for all observers. Take the speed of light as 3×10^8 m/s for all inertial frames of reference
11. Does the observer always measure the dilated time?
    No. If the observer is stationary relative to the event, they will measure the proper time.
12. Is the t always greater than the t_0?
    The proper time will be the smallest measurement of an event taken as observed from various frames of reference, because proper time is taken in the rest frame of the event. 't' is always either greater than or equal to t_0, because gamma is greater than or equal to 1
13. Do exam questions ever combine special relativity with other concepts, i.e, how do we know when to take into consideration time dilation if the question is asking about something else?

Special relativity concepts are generally confined to special relativity questions.

14. Why is the speed of the pion in the pion's frame of reference 0?
    Because the pion doesn't recognise that it is moving. Think about your movement at this instant. Do you think that you are stationary. If I was observing you from space, I would see you moving. So it is all about your frame of reference. You think that you are stationary. just like the pion.
15. Is it reasonable to consider what the light clock or a beam of light does in each frame to work it out.
    Yes, you need to consider each frame of reference.
16. How would you explain the pion seeing its own speed as 0 m/s if it was asked to explain?
    Everything else can be considered to be moving relative to the pion / from the pion's frame of reference.
17. What happens to length if the object moving at speed of light?
    Mathematically the observed length reduces to zero, but what does that mean physically?

Springs

18. With F=-kx, sometimes the negative is just ignored in questions, can I just write F=kx in that case? also when is the negative relevant?
    The negative is designed to show the vector nature of the force. The force is in the opposite direction to the change in length. For calculations you can ignore the negative sign.
19. If it is beyond its elastic limit is there a different formula to calculate?
    Beyond the elastic limit we would need more information. Potentially could read f and x values or calculate the work done by finding the area only if an accurate graph is provided, but this would be outside the scope of VCE Physics. You only need to worry about springs that obey Hooke's law
20. Will the spring be its natural length at the top of its oscillation?
    No. The spring is compressed at the top in the example being considered.
21. Does a spring's unstretched position lie between its mg=kx equilibrium point and its maximum height while oscillating?
    Not always, it depends on how far the mass is pulled down (or raised) before release.
22. If an object is deformed by a force, why is momentum then conserved.
    We deal with fairly simplified ideal situations in VCE Physics. Collisions we take as having conserved momentum, then check if the collision is elastic or inelastic.
    In a collision when a force by one object compresses the other object work is done by the force acting over a distance transferring kinetic energy into potential energy. As the two objects come apart, the force at the same compression is usually less than before so less energy is returned to kinetic energy. The collision is inelastic because Force vs Compression graph has two lines, one for the objects approaching and another below it when they are separating. The area in between the two lines is the energy lost in the collision. In the case of momentum, the force on one object acting on the other over a short time interval is the impulse. This impulse causes a change of momentum. But because of Newton's 3rd Law, the force by object A on object B is equal and opposite to the force by object B on object A. This means that in the small time interval, the impulse by A on B is equal and opposite to the impulse by B on A, with the consequence that the two changes in the momenta are also equal and opposite, so total momentum is conserved, and not only before and after every collision but also during the collision.

Projectile motion

23. Do we have to state which direction of velocity is positive?
    No. You just need to be consistent in your working. You are not going to be required to identify positive or negative for velocity. You might need to specify a direction in your answer.
24. Horizontally: Why is a=0?
    When the object is in the air, if ignoring air resistance the only force acting is due to gravity. Therefore there is no force acting horizontally, so the acceleration in the horizontal direction is zero.
25. Is time the only variable that can be used to link vertical and horizontal aspects?
    With projectiles, after launch the only force acting is gravity, so the time it takes to hit the ground is a critical piece of information. There are several equations (relationships) available, and not all use t, but as t is so critical it is usually the link between horizontal and vertical. If you didn't have t, then you'd probably need to solve some complex simultaneous equations. Examiners would be unlikely to ask a question with that level of complexity.

Unit 3 Electric power

Magnetic flux and EMI

26. Is it bad to say that flux has a direction or should you say that the field has the direction and the flux is increasing/decreasing?
    Technically magnetic flux is a scalar, but it is acceptable in VCE to say it has a direction, as the change in flux is related to the direction of the field, positive change is in the direction of the field, negative change is in the opposite direction to the field.
27. Would the induced current graph look the same as the induced EMF graph?
    Using V = IR, the V and I graph will have the same shape, just a different scale.
28. Induced voltage graph from flux change graph. Do we join the two sections with a line, or should it be two line segments and a dot between them.
    A dotted or solid line is fine, the marks for the questions are for more important aspects of the questions
29. Electromagnetic Induction: With the example where there are X's both inside and outside the circuit, how can I know what direction is current?
    The field was into the page, but you are only interested in the field INSIDE the loop (or rectangle). Use the field inside the loop to determine the direction of the induced current.
30. Does Lenz's law state that the direction of the magnetic field induced by an induced current is opposite to the direction of the magnetic field that induced the current that induced the magnetic field?
    No. The direction of the induced current creates a field to oppose the CHANGE IN FLUX. So the direction of the intial field is not the only consideration. It depends on whether the field is increasing or decreasing. A better statement is that the direction of the induced magnetic field is such that is opposes the change in magnetic flux
31. How would you answer a question asking why there is a limit on how much voltage you can have in a wire?
    Are you asking about whether the wire will be destroyed if the voltage across it is too high? If the current is too large for the wire then it will heat up and may fail. So the maximum applied voltage will be determined by the current capability of the wire. This will be a factor of the materials that that wire is made of. You can have two wires of the same resistance, but because of the construction of the wire, one may be quite capable of handling a higher current then the other. The power rating of the wire determines the current, and hence the voltage that can be applied. Hope that makes sense.
32. Why is the graph for DC output is always a positive amplitude?
    The graph does not need to be positive. DC means it does not change direction. Therefore always negative is DC and perfectly acceptable on the exam.

Motors and generators

33. In this case, must a generator be the rotation of a loop like we study through change in flux etc.
    The typical generator is rotation of a loop, because we get a cyclic output. We can also generate an EMF by changing the flux by changing the field.
34. So if you are asked to draw a graph, will you get a mark if the amplitude is wrong but the peaks are drawn correctly?
    It will depend on how many marks are available for the question. Often there's a correct shape mark and correct amplitude mark. Also the correct shape must start at the correct position. e.g. if the graph starts at 0, or a maximum/minimum.
35. Is there only one method of generation to be considered
    The only power generation method in the course is rotating a coil in a magnetic field.
36. Do we need to memorise the frequency values of AC voltages or are they provided to us in the question?
    You will be given the values.

Transformers and T'n lines

37. Do transformers still work with DC that has been created from AC (not batteries)
    Transformers work if there are changes in voltage, so as long as the voltage is changing, power can be transferred from one side of the transformer to the other.
38. What happens to the V loss? IIs it going to be transformed?
    If you're referring to voltage drop across the transmission lines, that is lost as heat, a bit of noise, etc. That won't be available for anything else. If you're referring to the change in voltage across a transformer; we assume that the transformers are ideal so there's no power loss.

39. Do we need to know detail about n-type and p-type semiconductors?
    n-type and p-type are not on the course, hence cannot be examined.

Unit 4 Light and matter

PE Effect

40. Would we get asked to draw the photoelectric effect diagram?
    The questions generally include a diagram of the equipment. You could be given a table of values and be required to produce a graph, plot the points and draw a line of best fit.
41. With Stopping voltage vs. Photocurrent graphs, is photocurrent approx. linearly dependent on voltage until V=0?
    The shape of the current vs voltage graph as the backing voltage is increased depends on the metal and how it is processed, e.g. thickness
42. Is it common to have a question that asks you to draw a diagram of the work function when already given a sketched graph.
    If you are provided with a graph, you would be expected to use that for your answers. If the work function question is only 1 mark, just an answer needed. If worth more than 1 you'll need to explain how you got it.
43. Is the ratio for photon to photoelectron 1:1 for all metals
    Yes. This is the assumption of the Einstein model of the PE Effect.
44. Does the photons energy have to be greater than the work function for it to emit photoelectrons or can energy also be equal to work function for it to emit photoelectrons
    We assume that the energy of the photon is greater than the work function. If they were the same then in effect the photo-electron would have zero KE when it was emitted. If the photolectron had zero KE the electric field would them do work on it and repel it from the collector.
45. Do we need to know the real-life implications of the wavelengths, eg. this wavelength is the size of an atom's radius etc.
    No. You will just need to manage the arithmetic associated with them.
46. When using Planck's constant, how do you know to use eV or Joules for the equation when the unit is not specified or in the question a unit isn't shown either
    The unit in the answer will determine which one you will use. Also if you are asked to determine any property of the electron, e.g its speed or momentum, you will need to use Joule.sec value.
47. Why does wave model predict an increase in KEmax of photoelectrons? If energy is accumulated then wouldn't photoelectrons all be ejected at same minimum energy?
    You need to be aware of the limitations of the wave and particle models within the scope of the course. There is a 1:1 transfer of energy that occurs, one photon transfers energy to one electron. If that packet of energy is big enough, then the photoelectron will be ejected. The experiments show that the ejection of photoelectrons doesn't occur via an accumulation of energy as per the wave model.
48. When intensity increases?
    The wave model predicts that an increase in intensity is an increase in the energy. This would mean that the photoelectrons came out with more KE

Heisenberg

49. Do we have to write the Heisenberg formula to prove momentum and position cannot be measured simultaneously?
    Equations can be a very useful part of your explanations across the exam. You probably won't have to "prove" this relationship.
50. When the uncertainty can be large, why is it small?
    The uncertainty in the position is a measure of how precisely you can specify the position of the photon. As the gap is narrowed the uncertainty decreases
51. In the Heisenberg's Uncertainty Principle video, see link below, what's the difference in momentum and direction if they are both in the up and down?
    If you are referring to the video, then the answer is that the momentum vectors were oblique. They showed momentum in both the X and Y direction. In this situation it is only the uncertainty in the vertical direction that was impacted.

Matter waves

52. What do the peaks and troughs of the wave for the electron around the nucleus represent?
    A probability of the electron being at that point in space
53. So to really see the wavelike behaviour you have to shoot multiple electrons?
    With the experiment, the diffraction pattern produced is an accumulated result from the individual electrons
54. Why is a circular diffraction pattern form?
    If you can imagine the diffraction pattern formed with either single or double slit interference. This is often drawn as a line of bright and dark bands. Now get this pattern and rotate it about the centre. You now have a circular diffraction pattern. This is because the 'slits' are now in all directions inside the crystal.
55. Could you also explain that they would have the same momentum? Or would you need to first say they are the same wavelength?
    Yes you can, but diffraction is a wave property, so stating that the wavelengths are the same is a better explanation so that is what we would be looking for.
56. If an electron absorbs light such that it goes beyond its ionisation energy, does the remaining energy of the light become the kinetic energy of the ejected electron?
    Yes, the remaining available energy will be the kinetic energy of the emitted electron.
57. Should we understand how a single photon passing through a double or single slit can demonstrate the particle nature of light?
    The particle nature of a single photon will be evident on the screen, as a dot. What happens as it passes through the slit or slits can't be explained purely using the particle model. It's the particle-wave duality that needs to be used and the interpretation of quantum mechanics that is still being debated, but that's not in the course.
    I'll add…the relevant dot point in the Study Design states: "interpret the single photon/electron double slit experiment as evidence for the dual nature of light/matter." You'll just need to explain that it demonstrates the aspect of the dual nature of light relevant to the question.

Applets

Phet General	https://phet.colorado.edu/en/simulations/
Phet: Photoelectric effect	https://phet.colorado.edu/en/simulations/photoelectric
Walter Fendt:	https://www.walter-fendt.de/html5/phen/
Ophysics	https://ophysics.com/index.html
Heisenberg Video:	(116) Heisenberg's Uncertainty Principle Explained - YouTube

VCAA

Exam reports, formula sheet, etc Pages - Physics (vcaa.vic.edu.au)