GCSE to A level Physics

Transition Paper

Section A – Combined Science content

Question 1

Candidates should be confident in interpreting and using velocity-time graphs.

a) This should cause few difficulties, although less able candidates may confuse the significance of horizontal sections of a distance-time graph with those of a velocity-time graph in part (ii).

b) Candidates should be able to recall and use the equation to calculate acceleration. They should be able to recall the units.

c) Candidates should be able to recall and use the equation for speed; although may omit to refer to an average.

d) Confident candidates will refer to the area under the graph very early on in their response and go on to make a visual comparison. This is an indicator of good exam technique: candidates should realise that with only 2 marks available, a calculation is not necessary for full marks to be scored.

Question 2

Candidates should have a sound understanding of radioactivity and radioactive decay.

a) Candidates should be able to recall the definition of isotopes. Answers that refer to neutrons and protons are probably more likely to be correct than those that refer to atomic number and mass number but confuse the two terms.

b) Expect various spellings of Geiger-Muller and condone reference to a counter (rather than a tube). Once again, candidates with sound exam technique will succinctly describe comparison of penetration by the three materials to provide the required evidence for two marks. Less confident candidates will probably attempt too much detail about the setup and run out of space before making both mark points.

c) Look for evidence of correct evaluations (such as a point or cross) of activity at 15 and 30 hours. It is possible that the 30,350 point may be incorrectly plotted, however, it is still possible to gain MP3 if the line passes through that point AND is curved AND extends to 40 hours. A score of 2/3 still indicates a reasonable understanding of radioactive decay.

Question 3

Candidates should have an understanding of energy transfers.

a) Candidates may either use work done = force x distance or (change in gravitational) potential energy = mgh. The most common error is to use the distance along the slope (25m) rather than the distance above the ground (18m) to give 2,375,000 J. Allow 1 mark for this.

b) Candidates need to recognise that work done against gravity would become kinetic energy as the car went down the slope and that the maximum kinetic energy would simply be the value calculated for part (a). Attempts at calculating KE indicate both poor exam technique and understanding of the equations.

c) Expect a description of transfer between (gravitational) potential and kinetic energy. Weaker candidates may have the transfer the wrong way round but would still score 1 mark out of 2. Answers that only refer to transfers to other energy stores such as electrical, heat and sound have missed the point. These are not the main energy transfers in this system.

d) Candidates should be able to select and use the required equation. The value shown on a calculator has several decimal places. Able candidates will correctly round this value to an appropriate number of significant figures.

e) Candidates will show some understanding of motion by correctly relating the increased distance with an increase in the time taken to come to a stop. Beware that "longer" may refer to distance or time. Lower ability candidates may express this in terms of being "less sudden" which is acceptable for the first mark, however, expressions such as "more gradual" or "more smoothly" are too vague to be credited. More able candidates may use the fact the force was proportional to the rate of change of momentum or that the slower deceleration would require a smaller force on the car and its passengers. Less able candidates will try to provide explanations including "whiplash" or that it would allow the passengers time to prepare themselves. They may also state that the momentum would be less instead of referring to the rate of change of momentum.

Question 4

Candidates should understand the use of experimental data and also be able to use standard form.

a) This should cause few difficulties.

b) Most candidates will suggest further readings; often in terms of "repeat" readings. More able candidates will appreciate that there was a range of angles for which there was no data and suggest a procedure for this particular context.

c) Candidates should be confident in using numbers given in standard form and correctly manipulate the exponents. Less confident candidates may arrive at the correct answer by converting between standard and unit form. The unit of frequency should be known although the capitalisation may be incorrect.

Question 5

Candidates should show understanding of magnetic field lines and of the motor effect.

a) Although possibly daunted at first sight of the diagram, candidates should be able to mark the correct direction of two field lines. The most common reason for failing to score full marks will be attempting to draw contradictory arrows on more than two lines. Most candidates will understand that the force is horizontal but only the higher ability candidates will be able to apply Fleming's Left Hand Rule correctly.

b) Most candidates will score full marks by careful drawings. Less able candidates may display lack of care with lines that are not straight, parallel and evenly spaced. A well-drawn non-uniform field could be given full credit due to the poles of the magnet not being very close together and the magnets not being specified as very strong.

c) Candidates that have done this investigation should have no difficulty in giving a description that scores at least 2 out of 3 marks. A mark will usually be lost by neglecting to join the plotted points together. All three marks could be awarded for a good diagram on its own. Although the question specifies a plotting compass, credit can be given for use of several plotting compasses. Candidates that attempt to describe using iron filings have not read the question correctly.

Question 6

Candidates should have an understanding of efficiency

a) There should be no difficulty in recalling and using the equation for (change in gravitational) potential energy. Candidates should produce well laid out working in order to demonstrate confidence in performing calculations, rather than simply writing down the final answer. This is especially the case here where a power of ten error could have been due to either an arithmetic slip or not including *g*.

b) Candidates should be able to make at least some progress through this complex, two-stage calculation. Once again, good exam technique will include clearly laid out working in order to enable partial credit to be awarded where deserving. The most common error will be to use the wrong value of energy in the second stage of the calculation.

c) Candidates should show an understanding that, in an engine, the input energy is greater than the useful output energy because some energy is dissipated in less useful ways. This may be expressed in a number of different creditworthy ways. The second mark point may be awarded more frequently than the first.

Question 7

Candidates should understand how the kinetic theory can explain the behaviour of gases and do calculations involving pressure.

a) This should not cause any difficulty for candidates.

b) Explanations must be in terms of kinetic theory of particles and, at the very least, reference the idea of particles being in motion. Most candidates will describe collisions with the container wall giving rise to a force. More able candidates will correctly link this force acting over an area to the existence of a pressure. Many candidates will link a rise in temperature to an increase in the (average) force over a given area; either in terms of more frequent collisions or greater force of each collision. Higher ability candidates will describe an increase in the (average) speed of the particles.

c) The, relatively, simple calculation in part (i) is made more complex by the use of standard form. Even the higher achieving candidates may struggle to show a clear sequence of steps. In part (ii), candidates will usually be able to select the correct equation, but some may substitute for the two values of pressure in the wrong place. This may make it difficult for the examiner to award a mark for rearrangement unless the working is clear. Confident candidates will show clear working and score at least one mark.

Question 8

Candidates should be able to recall and use calculations involving electrical quantities and have carried out investigations using electrical circuits.

a) Most will be able to do the simple calculation in part (i). Part (ii), however, is a complex, two-stage calculation requiring recall and use of the appropriate equations. Many candidates will recall at least one of those but will often attempt to use it out of context. Once again, clear working enables at least partial credit to be awarded. Some candidates will know and successfully apply the equation that links power, voltage and resistance. Even though this is not specified in the syllabus they, of course, deserve full credit.

b) Candidates should be expected to reach at least level 1 by one of the responses shown in the guidance notes in the mark scheme. Most candidates will be able to reach level 2 by producing a correct circuit diagram together with a partial explanation of the method. A common omission may either be a description of how the p.d. across the lamp can be varied or how the resistance can be calculated from the measurements. High ability candidates will give a succinct and clear description of the method and also state how the resistance can be calculated for a level 3 response.

Section B – Physics only

Question 9

Candidates should be able to use the principle of moments.

a) The equation will be recalled by most candidates.

b) Candidates should be able to make some progress through this calculation and the steps need not be in the order given in the mark scheme. The most common error will be to use the wrong distance for the effort force. This could score two marks if the rest of the method is correct.

Question 10

Candidates should have a basic understanding of nuclear fission.

a) This is a standard definition, and candidates should be able to score both marks. A common error will be descriptions involving different numbers of electrons.

b) Candidates should be able to give a correct definition here, but some will lose marks for imprecise language e.g. cell / molecule instead of nuclei.

c) Most candidates should score a mark here, but may refer simply to a "nuclear reactor", which is not precise enough.

d) This is a challenging question. Many candidates will score only a single mark for knowing that temperature affects the speed of nuclei. Only the best candidates will describe repulsion between nuclei being a factor.

Question 11

Candidates should have an understanding of alternating current and transformers

a) The mark scheme allows for full marks to be scored from a variety of correct statements and most candidates will be able to score at least one mark here.

b) Most candidates will be able to draw a "wavy line" and many of those will draw that line symmetrically around the x-axis. Good candidates will attempt to fit in two cycles but will often end up with one positive and one negative peak over the 1^{st} second and repeat for another second, thereby having a frequency of 1Hz.

c) Able candidates will select the correct transformer equation. Lower ability candidates often attempt to use the equation linking pd and current. They may either substitute and then rearrange or *vice-versa*. Most errors occur in the rearrangement and so a mark could still be awarded for a correct substitution if this is clear. Unfortunately, this is not always the case and if the only working consists of numbers in an incorrect expression then the examiner has no way of knowing which step of the calculation was done correctly. Candidates with good exam technique will always show symbols and numbers in a process that follows correct mathematical syntax throughout.

Question 12

Candidates should understand some simple concepts about the Solar System.

a) Candidates should find no difficulty here.

b) Although this appears to be a simple question, many candidates may find it difficult to interpret the question correctly. Able candidates will appreciate the significance of the different orbits of the two planets but many may get side-tracked into attempting to describe variations in speed and / or elliptical orbits. In such cases a mark could be scored if it made clear that the moon orbits the earth and the two planets orbit the sun.

c) Candidates should be able to give at least one of the many acceptable correct statements.