# 2000 HSC Notes from the Examination Centre Physics



Published by
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Internet: http://www.boardofstudies.nsw.edu.au



ISBN 0731348222

*Job Number 200120*

# Physics

## Introduction

While addressing the syllabus to a suitable depth and scope, the 2000 Physics examination stressed the use of vectors and vector arithmetic, which served to highlight the general weakness within the candidature to perform these operations successfully. Also poorly handled were questions that asked candidates to explain an effect. Many candidates did not show a causal relationship, as required by the instruction to 'explain'.

## Section A – Multiple choice

The following table shows the correct answers and the percentage of the candidature that selected the correct answer for each question.

| Question | Correct Answer | Percentage of candidature |
|---|---|---|
| 1 | A | 78.58 |
| 2 | C | 65.74 |
| 3 | D | 48.76 |
| 4 | C | 71.80 |
| 5 | B | 56.37 |
| 6 | B | 54.48 |
| 7 | D | 22.00 |
| 8 | A | 48.42 |
| 9 | B | 49.55 |
| 10 | D | 87.28 |
| 11 | A, C | 33.67, 25.81 |
| 12 | D | 46.13 |
| 13 | B | 77.76 |
| 14 | B | 55.18 |
| 15 | A | 60.41 |

## Section B – Three-mark questions

**Question 16**
This question required candidates to apply their knowledge of uniform circular motion. Many candidates experienced difficulty in manipulating angular velocity, $\omega$, and did not succeed at this question.

**Question 17**
This question required candidates to perform vector arithmetic to calculate relative velocity, however the required vector arithmetic was poorly handled by candidates. Many candidates were not able to construct a vector triangle relating the velocities, or to state a direction for the velocity of the ferry relative to the water.

**Question 18**
This question required candidates to perform vector arithmetic to add a number of forces. Being a simpler problem than question 17, many candidates were able to successfully complete this operation.

**Question 19**
This question required candidates to identify and analyse force vectors. Many candidates did not distinguish between forces and force components, and were not able to correctly identify the various forces with appropriate labels.

**Question 20**
This question required candidates to perform vector arithmetic to analyse the momentum of a ball striking a wall. Only some candidates succeeded in this question, which required a subtle distinction between change in momentum, and change in a component of momentum. Many candidates did not understand the term 'normal' in this context.

**Question 21**
This question required candidates to perform vector arithmetic to analyse an explosion. Many candidates successfully completed this question, despite not knowing the mass and being asked for speed.

**Question 22**
This question required candidates to apply their skills of circuit analysis. Most candidates scored well in this question, while those that did not often confused potential difference and resistance.

**Question 23**
This question required candidates to apply their knowledge of parallel current-carrying conductors. This question was answered successfully by most candidates.

**Question 24**
This question required candidates to use the motor effect to explain the operation of electric meters. The explanations were not completed well by candidates, who did not show the required causal relationships.

**Question 25**
This question required candidates to apply their knowledge of standing waves in strings. Many candidates were able to score well in the simple calculations of parts (a) and (b), however the explanation required in (c) was poorly completed.

## Section C – Five-mark questions

**Question 26**
This question required candidates to use their skills of projectile motion analysis, and was successfully completed by many candidates. Poor vector handling was the most common error in this question.

**Question 27**
This question required candidates to analyse the forces acting on two bodies, and was successfully completed by many candidates.

**Question 28**
This question required candidates to use vector arithmetic to analyse a two dimensional collision. This question was successfully completed by many candidates. The most common error was to ignore directions and to attempt to solve as a one-dimensional problem.

**Question 29**
This question required candidates to apply their skills of circuit analysis, and was successfully completed by many candidates.

**Question 30**
This question required candidates to apply their knowledge of moving charges in magnetic fields. A power calculation was required and was often poorly performed. Candidates were also asked to draw the path of a charge in a magnetic field, in a general rather than specific case, and candidates' responses varied widely.

**Question 31**
This question required candidates to apply their knowledge of standing waves in tubes, and was successfully completed by many candidates.

## Electives

**Question 32 History of Ideas in Physics**

**Question 32A (Gravitation)**
In part (d) many candidates were able to successfully use a sketch to supplement their explanation. However in part (e), when mathematical skills were required, many candidates forgot to square the distance in the law of universal gravitation.

**Question 32B (The Nature of Light)**
In part (a) many candidates were not able to provide the required explanation, which related to a relatively minor syllabus point. Part (b)(ii) asked in general terms about the work of Young and Fresnel, however many candidates did not focus their response upon the work of these physicists with respect to the nature of light. In part (e), many candidates did not understand the energy units of electron-volts (eV), despite the presence of a conversion factor to joules appearing in the data sheet.

**Question 32C (Atomic Structure)**
Candidates responded well, presenting clear explanations and descriptions where required, with the exception that many candidates erroneously maintained that electric charges are attracted to, or repelled from, magnets.

## Question 33 Wave Properties of Light

Candidates coped well with both the descriptive and numerical portions of this elective. Part (a) of this question required an explanation of refraction through a glass prism. Many candidates then confused refraction with diffraction, reflection and scattering. In their numerical work, most candidates were able to successfully calculate the result of the first refraction. Many of these candidates were able to go on to calculate the result of the second refraction as the ray emerges from the prism. The remainder of this elective was completed successfully by most candidates.

## Question 34 Rotation

The parallel axis theorem was thoroughly examined in a number of parts, however these parts did vary greatly in difficulty. Candidates were able to score well on parts (a) and (b), however scores in parts (c), (d) and (e) were poor to very poor. Parts (c) and (d) were numerical, while part (e) was descriptive, with many candidates unable to explain the direction of precession.

## Question 35 Physics in Technology

### Question 35A (Engineering Materials and Structures)

This question was successfully completed by most candidates.

### Question 35B (Optical Instruments)

This question was successfully completed by most candidates.

### Question 35C (Transformation of Energy)

While numerical responses were generally satisfactory, candidates showed an inability to draw diagrams that supported their explanations and, in particular, draw flowcharts as requested in part (d). Many explanations provided by candidates indicated that the candidates had not grasped the meaning of a question, for example (d)(ii) referred specifically to energy conversion processes, while many candidates wrote generally of nuclear power plants.

## Question 36 Astronomy

Parts (a), (c), (e), (f) and (g) were all well done by candidates. Part (b) required a description and an explanation in regard to emission and absorption spectra. This part was very poorly answered by the candidature, who was unable to provide a difference between these spectra (that is, contrast a feature of both spectra) or a lucid explanation of the production of an emission spectrum. Part (h) revealed a weakness within the candidature also displayed in question 32B. This part required candidates to complete a nuclear reaction to identify a particular nuclide. While a simple operation, many candidates were unable to complete it.