2007 HSC Notes from the Marking Centre Physics

Published by Board of Studies NSW
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ISBN 978 174147 8303

2007740

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2007 HSC NOTES FROM THE MARKING CENTRE PHYSICS

Introduction

This document has been produced for the teachers and candidates of the Stage 6 course in Physics. It contains comments on candidate responses to the 2007 Higher School Certificate examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

This document should be read along with the relevant syllabus, the 2007 Higher School Certificate examination, the marking guidelines and other support documents which have been developed by the Board of Studies to assist in the teaching and learning of Physics.

General Comments

In 2007, approximately 9120 candidates attempted the Physics examination. The most popular options were From Quanta to Quarks (45%) and Medical Physics (27%).

Teachers and candidates should be aware that examiners may write questions that address the syllabus outcomes in a manner that requires candidates to respond by integrating their knowledge, understanding and skills developed through studying the course, including the Prescribed Focus Areas. This reflects the fact that the knowledge, understanding and skills developed through the study of discrete sections should accumulate to a more comprehensive understanding than may be described in each section separately. It is important to understand that the Preliminary HSC course is assumed knowledge for the HSC course.

Teachers and candidates are reminded that mandatory skills content in Module 9.1 is examinable in both the Core and Option questions.

Candidates need to be reminded that the answer space provided and the marks allocated are guides to the maximum length of response required. Candidates should use examination time to analyse the question and plan responses carefully, working within that framework to produce clear and concise responses. Responses may include the use of dot points, diagrams and/or tables, and should avoid internal contradictions. This is particularly so in holistic questions which need to be logical and well structured. There was evidence that some candidates had a very poor knowledge of basic definitions specific to terminology associated with the course.

Better responses indicate that candidates had followed the instructions provided on the examination paper. In these responses, candidates:

- set out all working for numerical questions
- thought carefully about the units to be used and the quantities to be substituted into formulae

- did not repeat the question as part of the response
- looked at the structure of the whole question and noted that in some questions the parts follow from each other, ie responses in part (a) lead to the required response in part (b) etc
- used appropriate equipment, for example, pencils and a ruler to draw diagrams and graphs. (A clear plastic ruler helps candidates to plot points that are further from the axes and rule straight lines of best fit.)

In Section II the option question is divided into a number of parts. Candidates should clearly label each part of the question when writing in their answer booklets. In part (c) of the 2007 option questions the best responses presented ideas coherently and included the correct use of scientific principles and ideas. Many candidates wrote a lot of information that was not relevant to the question. Some responses showed evidence of rote learning of an anticipated answer based on a single source. These responses did not address the syllabus content and/or outcomes being assessed and hence did not score full marks. Candidates are required to attempt one question only in Section II, but some candidates responded to more than one option question. Candidates are strongly advised to answer the option they have studied in class.

Section I – Core

Part A – Multiple choice

Question	Correct Response
1	A
2	A
3	B
4	D
5	D
6	D
7	C
8	D

Question	Correct Response
9	C
10	A
11	D
12	A
13	C
14	C
15	A

Part B

Question 16

(a) Better responses utilised a curved line of best fit as required in the question.

(b)(ii) Better responses used the correct height when calculating the time of fall before calculating the ball's horizontal velocity. Better responses converted data to SI units when substituting into formulae.

(c) Better responses used the relevant equation, correctly substituted data, and identified the directions of the vector quantities involved.

Question 17

(a) Better responses connected the direction of the Earth's rotational velocity with the launch direction and not to the Earth's orbital velocity.

(b) The best responses were those in which candidates substituted all terms into the correct formula to calculate the satellite's height above the surface. Weaker responses showed some confusion about the satellite described as being on the Earth's surface yet being expected to calculate its height when in orbit.

Question 18

(a) Better responses provided supporting evidence for the link between the constancy of the speed of light and time, for example time dilation.

(b) In better responses, candidates correctly substituted into the correct equation.

(c) Best responses correctly rearranged the relevant equation to calculate the velocity.

Question 19

In better responses, candidates stated Einstein's theory as a hypothesis and then linked it to the parts of the Scientific Method by indicating some or all of the testable predictions that arose from it.

Question 20

In better responses, the candidates clearly expressed a judgement on the effect that the AC generators had on both today's society and the environment.

Question 21

(a) In better responses, candidates justified the choice of point by identifying the direction of the torque on the coil.

(b) Better responses identified the correct distance of the line of action of the force.

Question 22

The best responses clearly compared and differentiated between similar structural and operational features of both thermionic and solid state devices.

Question 23

(c) Better responses provided a clear sequence of cause and effect in the explanation.

Question 24

(a) Better responses indicated a clear understanding of the nature of the electric field.

(b) The best responses included a data list that enabled candidates to select the formula to substitute into.

Question 25

Better responses included accurate, fully labelled diagrams and were explicit in their descriptions of function and comparison.

Question 26

(a) Better responses indicated the differences between AC and DC in terms of alternating magnetic fields.

(b) The best responses related the energy losses to the properties and structure of transformers.

(c) Better responses distinguished between energy and power and used the correct time units in the calculations.

Question 27

(a) In the better responses, candidates linked quantum theory to problems with classical predictions.

(b) In the better responses, candidates described the use of UV light and the observed spark at the receiver.

(c) (i) In the best responses, the candidates used the units from the axes when calculating the gradient.

(ii) In the better responses, candidates related the gradients to Planck's constant.

Section II – Options

Question 28 — Geophysics

(a) (ii) In better responses, candidates correctly manipulated the data and equations provided.

(b)(ii) In the best responses, candidates clearly identified the cause of palaeomagnetism and used this in their explanation.

(c) The best responses clearly identified two areas linked to remote sensing satellites.

(d) (i) In the best responses, candidates compared both the sequence and type of wave evident in each seismogram.

(ii) In the best responses, candidates related the use of seismograms to nuclear tests.

(iii) The best responses included both the specific purpose together with a detailed description of how the seismic information was utilised in their example.

Question 29 — Medical Physics

(a) (i) The best responses selected the correct equation, derived a correct fraction being reflected and thus calculated the fraction of the ultrasound transmitted.

(ii) The best responses explained the dipolar nature of piezoelectric crystals and the need for an oscillating voltage then related these to the production and detection of ultrasound.

(b)(i) The best responses identified several statements in the article which were either erroneous or oversimplifications and then explained the nature of MRI imaging.

(ii) The best responses identified that the main reason for ultrasound not being used was the difference in acoustic impedance between flesh and skull bone.
Some responses correctly noted that ultrasound imaging of the brain was possible in infants through the fontanel.

(c) Better responses provided detailed descriptions of each technology, often with labelled diagrams and linked these technologies to specific uses. These responses included support of the assessment of the impact on both individuals and the community separately and provided specific answers as evidence.

(d) (i) In the best responses, candidates used a table to compare both advantages and disadvantages for both CAT and PET in terms of structure and function and to identify the differences between each technology.

(ii) The better responses were those where candidates applied their knowledge of the physics of the imaging techniques to the unfamiliar situation by referring to measurement of bone density.

Question 30 — Astrophysics

(a) (i) The best responses named detection methods and showed how these are used to deduce the presence of a binary star.

(ii) Better responses used the correct distance units when substituting into the correct linked formulae.

(b) (i) The better responses described one of the two relevant mandated first-hand investigations and then related the results to one characteristic of stars.

(c) The better responses used specific examples of the technologies, their advantages and linked these to our scientific understanding of celestial objects. Weaker responses contained an excessive amount of information related to the topic area being examined but had little relevance to the question being asked.

(d) (i) The better responses identified the correct star and were able to provide sufficient justification.

(ii) The best responses showed the basic content of an H-R diagram including relevant labels or scales.

(iii) The better responses used a table to make the comparison between the two stars after having identified their evolutionary stage.

Question 31 — From Quanta to Quarks

(a) (i) Better responses identified the correct formula and stated that the electron would be removed from the second shell to a higher shell due to the incoming EM radiation.

(ii) In the best responses, candidates named the unexplained feature and then gave some information about that feature.

(b) (i) Better responses provided the main features of the investigation which included the position of the radioactive source and an observation of the radiation.

(ii) Better responses correctly named the radio-isotope and clearly showed the link between its radioactive properties and its use.

(c) In the best responses, candidates demonstrated a thorough understanding of the move from classical physics to quantum physics linking the relevance of de Broglie's explanations on the limitations of the Bohr atom and the experimental evidence that supported this explanation. The better responses showed clear planning and linkages within the structure of the response whereas weaker responses consisted of an excessive amount of information related to the topic area being examined without addressing the question.

(d) (i) In the better responses, candidates clearly explained their interpretation of the graph.

(ii) In the best responses candidates identified and provided a reason for the choice of the relevant component.

Question 32 — The Age of Silicon

(a) (i) Better responses drew a logic diagram that was labelled clearly and that corresponded to the logic expression given.

(ii) Better responses developed a truth table for which there were a number of columns, rather than providing the initial inputs and the final output column. In doing so the candidates demonstrated clear understanding of the effect of each gate on an input for the logic diagram drawn in part (i).

(b) (i) Better responses used a step-by-step circuit analysis when working through the problem. The final result was then shown to be the sum of the individual results for the two input voltages.

(ii) Better responses analysed the effect of the OP amp on each of the two sections of the input waveform and then showed the resultant waveform.

(c) Better responses clearly identified links between developments in the semiconductor industry and a specific resultant reduction in energy consumption. Weaker responses often described development in the semiconductor industry without making the link to reducing energy consumption.

(d) (i) Some better responses provided data in a table to answer the question.

(ii) Better responses showed all parts of the circuit analysis used to determine R1.

(iii) Better responses showed all parts of the circuit analysis and identified that the thermistor was in parallel with the 1k resistor.

Physics

2007 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I Part A			
1	1	9.2.2.2.8, 9.2.3.3.4	H9
2	1	9.2.4.2.9, 14.1(f)	H6, H14
3	1	9.2.1.2.3, 12.4(b)	H7, H12
4	1	9.2.3.3.2, 12.4(b), 14.1(f)	H9, H12, H14
5	1	9.2.2.3.1, 14.1(a)	H6, H14
6	1	9.3.1.1.6, 12.4(b), 14.1(f)	H9, H12, H14
7	1	9.3.2.2.3, 9.3.2.2.4, 14.1(a)	H9, H14
8	1	9.3.2.3.2, 14.1(f)	H9, H14
9	1	9.3.2.3.4, 14.1(f)	H9, H14
10	1	9.4.2.3.2, 9.4.2.2.5	H7, H10
11	1	9.4.1.3.3, 12.4(b)	H9, H12
12	1	9.4.4.2.1	H8, H10
13	1	9.4.1.3.3, 9.4.1.2.3, 12.4(b), 14.1(f)	H9, H12, H14
14	1	9.4.3.2.7	H10
15	1	9.3.2.2.5, 9.3.4.2.4, 9.4.2.2.6, 9.2.1.2.2.	H6, H7, H9, H10
Section II Part B			
16 (a)	2	9.2.2.2.1, 9.2.2.3.2, 13.1(f)	H6, H13
16 (b) (i)	1	9.2.2.2.1, 9.2.2.3.1, 9.2.2.3.2, 12.3(b)	H6, H12
16 (b) (ii)	2	9.2.2.2.1, 9.2.2.3.2, 9.2.2.3.1, 12.4(b)	H6, H12
17 (a)	1	9.2.2.2.6, 13.1(e)	H6, H13
17 (b)	3	9.2.2.2.9, 9.2.2.3.5, 12.4(b)	H6, H12
18 (a)	2	9.2.4.2.7	H6
18 (b)	2	9.2.3.3.5, 12.4(b)	H6, H7, H12

Question	Marks	Content	Syllabus outcomes
18 (c)	3	9.2.4.3.5, 12.4(b)	H6, H12
19	6	9.2.4.3.4, 14.1(e-h), 14.3(b)	H2, H6, H14
20	4	9.3.3.3.2.1, 9.3.3.2.5	H4, H7
21 (a)	1	9.3.1.2.3, 9.3.1.2.4, 9.3.1.3.4	H9
21 (b)	2	9.3.1.2.3, 9.3.1.3.4, 12.4(b)	H9, H12
21 (c)	2	9.3.1.2.3, 9.3.1.3.4, 12.4(b)	H9, H12
22	4	9.4.3.2.8	H10
23 (a)	1	9.4.4.2.7, 14.1(a)	H10, H14
23 (b)	1	9.4.4.2.5	H10
23 (c)	2	9.4.4.2.7, 9.4.4.3.3	H9
24 (a)	1	9.4.1.2.4, 8.3.2.2.1, 13.1(e)	H9, H13
24 (b)	2	9.4.1.3.3, 12.4(b)	H9, H12
25	4	9.3.3.2.2, 14.3(e)	H7, H9, H14
26 (a)	2	9.3.2.2.4, 9.3.3.32	H9
26 (b)	2	9.3.4.3.3	H7
26 (c)	2	9.3.4.2.4, 8.3.4.3.2, 12.4(b)	H7, H12
27 (a)	3	9.4.2.2.5, 9.4.2.2.6	H10
27 (b)	2	9.4.2.2.1	H10
27 (c) (i)	2	9.4.2.2.6, 14.3(c)	H10, H14
27 (c) (ii)	1	9.4.2.2.6	H10
Section II **Question 28 — Geo Physics**			
28 (a) (i)	3	9.5.1, 9.5.1.2.1, 9.5.3.2.1, 9.5.3.2.2, 9.5.3.2.5, 14.1(a), 13.1(f)	H7, H8, H13, H14
28 (a) (ii)	2	9.5.1, 9.5.1.2.1, 9.5.3.2.1, 9.5.3.2.2, 13.1(d), 14.1(f)	H7, H8, H13, H14
28 (b) (i)	2	9.5.4.3.1, 13.1(e)	H9, H13
28 (b) (ii)	4	9.5.4.2.2, 9.5.4.2.3, 14.1(a)	H9, H14
28 (c)	7	9.5.2.2.1, 9.5.2.2.2, 9.5.2.2.3, 9.5.2.2.4, 9.5.2.2.5, 9.5.2.3.1, 14.3(b)	H1, H3, H6, H9, H14

Question	Marks	Content	Syllabus outcomes
28 (d) (i)	3	9.5.3.2.1, 12.3(c), 14.1(a)	H7, H8, H12, H14
28 (d) (ii)	2	9.5.5.2.2, 9.5.5.1	H7, H8
28 (d) (iii)	2	9.5.5.2.1, 9.5.5.2.2, 9.5.5.1	H7, H8
Section II **Question 29 — Medical Physics**			
29 (a) (i)	2	9.6.1.2.5, 9.6.1.3.5, 12.4(b), 13.1(d)	H8, H12, H13
29 (a) (ii)	3	9.6.1.2.2	H7, H8
29 (b) (i)	4	9.6.4.3.4, 12.3(c), 12.4(f), 14.1(h)	H8, H9, H10, H12, 14
29 (b) (ii)	2	9.6.1.3.1	H8
29 (c)	7	9.6.4.3.5, 14.3(b)	H4, H9, H10, H14
29 (d) (i)	3	9.6.4.3.4, 12.3(c)	H8, H12
29 (d) (ii)	4	9.6.4.2.2, 9.6.4.2.3, 9.6.4.2.4, 9.6.4.3.2, 14.1(a)	H10, H14
Section II **Question 30 — Astrophysics**			
30 (a) (i)	2	9.7.5.2.1	H6, H9
30 (a) (ii)	3	9.7.4.3.1, 8.2.3.2.4, 12.4(b), 13.1(d)	H8, H12, H13
30 (b) (i)	2	9.7.3.3.1, 14.1(a)	H7, H8, H14
30 (b) (ii)	4	9.7.3.2.5, 9.7.5.2.1	H7, H8
30 (c)	7	9.7.1.2.5, 9.7.2.3.2, 9.7.4.2.5, 14.3(b)	H1, H3, H10, H14
30 (d) (i)	1	9.7.4.2.1, 9.7.4.3.1, 12.3(c)	H7, H8, H12
30 (d) (ii)	3	9.7.6.3.1, 9.7.6.3.3, 12.3(c), 13.1(f), 14.1(g)	H8, H12, H13, H14
30 (d) (iii)	3	9.7.6.3.2	H7, H8, H9
Section II **Question 31 — From Quanta to Quarks**			
31 (a) (i)	2	9.8.1.2.5, 9.8.1.3.3, 12.4(b), 13.1(d)	H8, H12, H13
31 (a) (ii)	3	9.8.1.3.4	H7, H8
31 (b) (i)	2	9.8.3.3.1, 9.8.3.2.1	H10
31(b) (ii)	4	9.8.4.2.2, 9.8.4.3.2	H10
31 (c)	7	9.8.2, 9.8.2.2.1, 9.8.2.2.4, 14.3(b)	H1, H8, H14

Question	Marks	Content	Syllabus outcomes
31 (d) (i)	2	9.8.3.2.8, 12.3(c), 14.1(a)	H10, H12, H14
31 (d) (ii)	2	9.8.3.2.11, 9.8.4.2.1,12.3(c)	H7, H10, H12
31 (d) (iii)	3	9.8.4.2.3	H7, H10
Section II **Question 32 — The Age of Silicon**			
32 (a) (i)	2	9.9.5.2.1, 9.9.5.3.2, 13.1(d)	H7, H13
32 (a) (ii)	3	9.9.5.2.1, 9.9.5.3.2, 14.1(f)	H7, H14
32 (b) (i)	3	9.9.6.2.2, 9.9.6.3.3, 12.3(c), 14.1(f), 12.4(b)	H7, H12, H14
32 (b) (ii)	3	9.9.6.2.2, 9.9.6.2.8, 9.9.6.3.1, 12.3(c), 12.4(b), 14.1(f)	H7, H12, H14
32 (c)	7	9.9.4.2.3, 9.9.4.3.3, 14.3(b)	H4, H7, H14
32 (d) (i)	3	9.9.3.2.1, 9.9.3.3.3	H7
32 (d) (ii)	2	9.9.3.3.2, 9.9.2.2.4, 12.4(b)	H7, H12
32 (d) (iii)	2	9.9.3.3.2, 9.9.3.2.6, 9.9.3.2.4, 9.9.3.2.5, 9.9.3.3.1, 12.4(b), 14.1(f)	H7, H12, H14

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2007 HSC Physics
Marking Guidelines

Section I, Part B

Question 16 (a)

Outcomes assessed: H6, H13

MARKING GUIDELINES

Criteria	Marks
• Draws line of best fit which is: - a curve - close to all points - has approximately the same number (if any) of points above and below the line AND EITHER • Correctly plots all seven points OR • Plots SIX points correctly and seventh incorrectly by not more than TWO divisions OR • Plots FIVE points correctly and sixth and seventh incorrectly by not more than ONE division	2
• Correctly plots all seven points ONLY OR • Plots SIX points correctly and seventh incorrectly by not more than TWO divisions ONLY OR • Plots FIVE points correctly and sixth and seventh incorrectly by not more than ONE division ONLY OR • Draws a line (close to all points and approximately the same number of points above and below the line)	1

Question 16 (b) (i)

Outcomes assessed: H6, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Predicts the range as 92 cm ± 1cm (whether or not marked on the graph) OR • Predicts the range consistent with correct extrapolation of graph	1

Question 16 (b) (ii)

Outcomes assessed: H6, H12

MARKING GUIDELINES

Criteria	Marks
• Calculates correct velocity for range chosen	2
• Identifies correct equations to calculate velocity	1

Question 17 (a)

Outcomes assessed: H6, H13

MARKING GUIDELINES

Criteria	Marks
• Draws arrow towards East from X • Provides an appropriate justification	1

Question 17 (b)

Outcomes assessed: H6, H12

MARKING GUIDELINES

Criteria	Marks
• Identifies correct formula • Correctly substitutes G, M and T • Subtracts the Earths radius to calculate value r	3
• Any two of the above OR • Recalls correct value for satellite radius and subtracts radius of Earth	2
• Any one of the above OR • Recalls correct value of altitude	1

Question 18 (a)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Refers to *c* as a constant, so time is relative to observer • Refers to *c* as a constant, so time can be used to define length OR • States an example of time dilation of a rapidly moving object	2
• Refers to *c* as a constant, so time is relevant to observer OR • Refers to *c* as a constant, so that time can be used to define length OR • States an example of time dilation of a rapidly moving object	1

Question 18 (b)

Outcomes assessed: H6, H7, H12

MARKING GUIDELINES

Criteria	Marks
• Identifies correct formula AND correctly substitutes	2
• Identifies correct formula	1

Question 18 (c)

Outcomes assessed: H6, H12

MARKING GUIDELINES

Criteria	Marks
• Identifies correct formula and correctly substitutes • Manipulates correct formula to extract *v*	3
• Identifies correct formula and correctly substitutes	2
• Identifies correct formula	1

Question 19

Outcomes assessed: H2, H6, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of scientific method and Einstein's Theory of Special Relativity and the evidence supporting it • Identifies the evidence to support Einstein's Theory of Special Relativity • Outlines the development and acceptance of the theory • Links the development of the theory and the evidence supporting it to the steps in the model of scientific method • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	5-6
• Demonstrates knowledge of scientific method and Einstein's Theory of Special Relativity and the evidence supporting it AND EITHER • Describes the development and acceptance of the theory and evidence used to support it OR • Describes some aspects of the theory, some evidence supporting it and attempts to relate this to the steps in the model of scientific method	3-4
• Demonstrates a limited knowledge of scientific method and Einstein's Theory of Special Relativity AND EITHER • Describes some aspects of Einstein's theory OR • Describes some parts of the model of scientific method including 3 steps	1-2

Question 20

Outcomes assessed: H4, H7

MARKING GUIDELINES

Criteria	Marks
• Describes positive and/or negative effects of the development of AC generators on society and environment to justify their value judgment on its effects	3-4
• Provides some positive and/or negative effects of the development of AC generators on society and environment OR • Provides value judgement of its effects	1-2

Question 21 (a)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Gives correct answer with justification	1

Question 21 (b)

Outcomes assessed: H9, H12

MARKING GUIDELINES

Criteria	Marks
• Identifies correct equation • Calculates correct value of torque	2
• Identifies correct equation	1

Question 21 (c)

Outcomes assessed: H9, H12

MARKING GUIDELINES

Criteria	Marks
• Identifies correct equation • Manipulates to calculate the number of turns	2
• Identifies correct equation	1

Question 22

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Provides reasons why solid state devices have replaced thermionic devices • Shows how solid state and thermionic devices are similar /different	3–4
• Sketches in general terms the features, solid state and thermionic devices	2
• Sketches in general terms the function of either device OR • Identifies that the two devices perform a similar function	1

Question 23 (a)

Outcomes assessed: H10, H14

MARKING GUIDELINES

Criteria	Marks
• Recognises and names what scientists are trying to achieve	1

Question 23 (b)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Identifies one property and the effect that critical temperature has on it	1

Question 23 (c)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• States there is a force of repulsion between the magnet and the superconductor and shows how the repulsion occurs	2
• States there is a force of repulsion between the magnet and the superconductor	1

Question 24 (a)

Outcomes assessed: H9, H13

MARKING GUIDELINES

Criteria	Marks
• Draws lines with direction arrows, which are symmetrical L/R AND point in the correct direction	1

Question 24 (b)

Outcomes assessed: H9, H12

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies formulae • Substitutes given values correctly	2
• Correctly identifies formula F = Eq	1

Question 25

Outcomes assessed: H7, H9, H14

MARKING GUIDELINES

Criteria	Marks
• Using identified common components of both, explains how motors and generators work with reference to a comparison of energy inputs and outputs • Includes a diagram showing at least TWO features	4
• Using identified common components of both, describes differences in function between motors and generators • Includes a diagram showing at least TWO features	3
• Describes how a motor and a generator works OR • Identifies common features • Includes a diagram showing at least TWO features	2
• Lists common features	1

Question 26 (a)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Explains the need for AC current in terms of change in magnetic flux	2
• States that transformers will not work with DC current OR • Explains the need for AC current with no reference to magnetic flux	1

Question 26 (b)

Outcomes assessed: H7

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms TWO possible causes of energy loss	2
• Sketches in general terms ONE possible cause of energy loss	1

Question 26 (c)

Outcomes assessed: H7, H12

MARKING GUIDELINES

Criteria	Marks
• Correctly states the input and output power. • Calculates the power loss and the energy lost in 8 hours	2
• Correctly calculates the input OR output power OR • States that E = Pt or VIt	1

Question 27 (a)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Describes a black body in terms of its features and radiation curve • Links the shape of the curve to emission of energy in packets/quanta	3
• Describes a feature of a black body or radiation curve • States the emitted energy is quantized	2
• Any of the above	1

Question 27 (b)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Provides features of the photoelectric effect observed by Hertz	2
• Provides limited features of the observed photoelectric effect	1

Question 27 (c) (i)

Outcomes assessed: H10, H14

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates the gradient of sodium	2
• Attempts to calculate the gradient of sodium	1

Question 27 (c) (ii)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Identifies the significance of the gradient	1

Question 28 (a) (i)

Outcomes assessed: H7, H8, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Provides features and characteristics of the differences in rigidity and density of rock in the mantle and core • Makes the connection between the speed of *P* and *S* waves at different depths and the differences rigidity and density	3
• Provides features and characteristics of the differences in rigidity and density of rocket in the mantle and core • States the speed of *P* or *S* waves at different depths	2
• States any observable relationship between a wave type, depth, rigidity or density	1

Question 28 (a) (ii)

Outcomes assessed: H7, H8, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates the ratio of the velocities and provides the correct answer	2
• States the correct formula that could be used to calculate the ratio of the velocities	1

Question 28 (b) (i)

Outcomes assessed: H9, H13

MARKING GUIDELINES

Criteria	Marks
• Describes a plausible investigation to model a variation in inclination • Provides features and characteristics of the inclination obtained	2
• Sketches in general terms the modeling investigation OR • Correct statement of what magnetic inclination is	1

Question 28 (b) (ii)

Outcomes assessed: H9, H14

MARKING GUIDELINES

Criteria	Marks
• Provides how palaeomagnetism is formed • Provides how the ancient south pole can be determined from each continent • Outline how the lining up of the ancient south pole provides evidence for continental drift	4
• Any TWO of the above	3
• ONE of the above	2
• States that iron in lava aligns with Earth's magnetic field as it cools	1

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Question 28 (c)

Outcomes assessed: H1, H3, H6, H9, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough understanding of two areas of knowledge of Earth that the introduction of satellites have contributed to • Identifies areas of knowledge of Earth that were previously inaccessible • Identifies information that satellites can tell us about Earth and that satellites have contributed to out knowledge of Earth • Makes the relationship between the introduction of satellites and how they have contributed to the areas of knowledge of Earth that were previously inaccessible evidence • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates a sound understanding of the areas of knowledge of Earth that were inaccessible before the introduction of satellites • Describes information that can be determined about Earth from satellites • Describes the areas of knowledge of Earth that satellites have contributed to	4–5
• Demonstrates a basic knowledge of how satellites have contributed to our understanding of Earth AND EITHER • Outlines areas of knowledge that have satellites have contributed to OR • Describes information that can be determined about Earth from Satellites	2–3
• Demonstrates limited knowledge of satellites and our knowledge of Earth AND EITHER • Provides some relevant information about what satellites can tell us about Earth • Provides some relevant information about an area of Knowledge of Earth that was previously inaccessible	1–2

Question 28 (d) (i)

Outcomes assessed: H7, H8, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Shows how the two seismograms are similar/different in terms of both P and S waves • States the cause of the differences between the seismograms in terms of the original disturbance	3
• Makes a point of comparison between the two seismograms • Describes the difference in the types of waves produced by an earthquake and nuclear test	2
• Makes a valid comparison between the two seismograms eg. intensity	1

Question 28 (d) (ii)

Outcomes assessed: H7, H8

MARKING GUIDELINES

Criteria	Marks
• States TWO pieces of information obtained from seismograms	2
• States ONE piece of information obtained from seismograms	1

Question 28 (d) (iii)

Outcomes assessed: H7, H8

MARKING GUIDELINES

Criteria	Marks
• Gives features of seismogram studies in a natural hazard reduction application or mineral exploration OR • Gives ONE feature of seismogram studies in a natural hazard reduction application or mineral exploration and correctly outlines the use of the feature	2
• Identifies a specific use for seismogram studies in natural hazard reduction or mineral exploration	1

Question 29 (a) (i)

Outcomes assessed: H8, H12, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies and substitutes data into appropriate equation • Deducts answer	2
• Correctly identifies and substitutes data into appropriate equation	1

Question 29 (a) (ii)

Outcomes assessed: H7, H8

MARKING GUIDELINES

Criteria	Marks
• Identifies the structure of a piezoelectric crystal • Shows how it acts as a source of ultrasonic waves • Shows how it acts as a detector of ultrasonic waves OR • Shows a detailed understanding of how it acts as both source and detector	3
• Identifies the structure of a piezoelectric crystal AND shows how it acts as a source of ultrasonic waves OR • Identifies the structure of a piezoelectric crystal AND shows how it works as a detector of ultrasonic waves OR • Shows how it acts as both source and detector	2
• Identifies the structure of a piezoelectric crystal OR • Shows how it acts as a source of ultrasonic waves OR • Shows how it acts as a detector of ultrasonic waves	1

Question 29 (b) (i)

Outcomes assessed: H8, H9, H10, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Provides a judgment of THREE statements from the article in terms of their scientific accuracy showing a detailed understanding of the physics involved	4
• Provides a judgment of TWO statements in terms of their scientific accuracy showing a detailed understanding of the physics involved OR • Provides a judgment on THREE statements showing limited understanding of the physics involved	3
• Provides a judgment on ONE statement in term of its scientific accuracy showing a detailed understanding of the physics involved. • Provides a judgment on TWO statements showing limited understanding of the physics involved	2
• Attempts to provide a judgment of ONE statement in terms of its scientific accuracy demonstrating limited understanding of the physics involved	1

Question 29 (b) (ii)

Outcomes assessed: H8

MARKING GUIDELINES

Criteria	Marks
• Identifies that the percentage of waves transmitted into the brain is too small for imaging to occur and relates this to the large percentage of waves reflected due to the large difference in acoustic impedance of brain and skull	2
• Identifies that the percentage of waves transmitted into the brain is too small for imaging to occur	1

Question 29 (c)

Outcomes assessed: H4, H9, H10, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough understanding of production and use of x-rays, CAT scans and MRI • Describe the effect of these technologies on lives of individuals and the wider community • Makes a judgment of the effect of these technologies on lives of individuals and the wider community • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates a sound understanding of production and use of x-rays, CAT scans and MRI • Outlines the effect of these technologies on the lives of individuals and/or the wider community	4–5
• Demonstrates a basic knowledge of production and/or use of x-rays, CAT scans or MRI AND EITHER • Outlines the effect of these technologies on the lives of individuals and the wider community OR • Describes the effect of a technology on the lives of individuals OR the wider community	2–3
• Demonstrates limited knowledge of production and/or use of x-rays and/or CAT scans and/or MRI OR • Outlines the effect of a technology on the lives of individuals or the wider community	1

Question 29 (d) (i)

Outcomes assessed: H8, H12

MARKING GUIDELINES

Criteria	Marks
• Provides a detailed comparison of the advantages and disadvantages of CAT and PET scans with reference to both structure AND function of the brain	3
• Compares some advantages and disadvantages of CAT and PET scans with reference to EITHER structure or function of the brain	2
• Describes a PET scan OR • Describes a CAT scan	1

Question 29 (d) (ii)

Outcomes assessed: H10, H14

MARKING GUIDELINES

Criteria	Marks
• Identifies the imaging techniques and provides a detailed description of each • Provides a statement of comparison	4
• Identifies the imaging techniques • Provides a detailed description of each	3
• Identifies imaging techniques and provides a limited description of each OR • Identifies one imaging technique and provides a detailed description of it	2
• Identifies imaging techniques OR • Identifies an imaging technique and provides a limited description of it	1

Question 30 (a) (i)

Outcomes assessed: H6, H9

MARKING GUIDELINES

Criteria	Marks
• Provides features of how the existence of binary star may be deduced by referencing BOTH the orbital motion AND the companion	2
• Provides features of how the existence of binary star may be deduced by referencing EITHER the orbital motion OR the companion	1

Question 30 (a) (ii)

Outcomes assessed: H8, H12, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates apparent magnitude	3
• Correctly substitutes into appropriate formulae	2
• Uses the inverse square law to identify a reduction in intensity by a factor of 100 OR • Identifies one of the correct formula	1

Question 30 (b) (i)

Outcomes assessed: H7, H8, H14

MARKING GUIDELINES

Criteria	Marks
• Provides features of the investigation and results obtained	2
• Provides features of either the investigation OR results obtained OR • Outlines the investigation and results obtained	1

Question 30 (b) (ii)

Outcomes assessed: H7, H8

MARKING GUIDELINES

Criteria	Marks
• Show how properties of a star are both deduced	4
• Lists TWO properties of a star and explains how one of these is deduced	3
• Lists TWO properties of a star OR • Lists a property and explains how it is deduced	2
• Lists a property of a star	1

Question 30 (c)

Outcomes assessed: H1, H3, H10, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough understanding of technologies used in modern astrophysics that have changed our understanding of celestial objects • Describes technologies used in modern astrophysics • Describes how each technology has changed our scientific understanding of celestial bodies • Makes a judgment on the ways technologies used in modern astrophysics have changed our understanding of celestial bodies • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates a sound understanding of technology used in modern astrophysics that have changed our scientific understanding of celestial bodies • Describes a technology used in modern astrophysics • Describes how this technology has changed our understanding of celestial bodies	4–5
• Demonstrates a basic knowledge of technology used in astrophysics AND EITHER • Describes a technology used in astrophysics OR • Describes how technology has changed our scientific understanding	2–3
• Demonstrates limited knowledge of technology used in astrophysics • Provides some relevant information about technology used in astrophysics or how our scientific knowledge has changed about celestial bodies	1

Question 30 (d) (i)

Outcomes assessed: H7, H8, H12

MARKING GUIDELINES

Criteria	Marks
• Identifies the most distant star AND provides a correct reason	1

Question 30 (d) (ii)

Outcomes assessed: H8, H12, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Draws HR diagram with main sequence and plots positions of the 5 stars correctly	3
• Draws an appropriate HR diagram with main sequence	2
• Draws an appropriate HR diagram	1

Question 30 (d) (iii)

Outcomes assessed: H7, H8, H9

MARKING GUIDELINES

Criteria	Marks
• Shows similarities or differences of one physical property, nuclear reactions and evolutionary stage	3
• Shows similarities or differences of ONE physical property, nuclear reactions and evolutionary stage OR • Shows similarities or differences of ONE physical property, nuclear reactions and evolutionary stage	2
• Shows similarities or differences of a physical property or nuclear reactions or evolutionary stage	1

Question 31 (a) (i)

Outcomes assessed: H8, H12, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly substitutes values into correctly identified equation	2
• Identifies correct equation	1

Question 31 (a) (ii)

Outcomes assessed: H7, H8

MARKING GUIDELINES

Criteria	Marks
• Outlines more than TWO spectral features	3
• Outlines TWO spectral features OR • Names more than TWO spectral features	2
• Outlines a spectral feature OR • Names TWO spectral features	1

Question 31 (b) (i)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Provides features of the investigation	2
• Outlines the investigation OR • Provides ONE feature of the investigation	1

Question 31 (b) (ii)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Selects two different isotopes, each relevant to the nominated field • Shows how the properties of each are related to their respective uses	3–4
• Correctly chooses an isotope relevant to a nominated field and shows how the properties are related to its use OR • Selects two different isotopes each relevant to the nominated field but with little or no explanation	1–2

Question 31 (c)

Outcomes assessed: H1, H8, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough understanding that the limitations of classical physics gave birth to quantum physics • Identifies de Broglie's concepts/ideas and supporting experimental evidence caused the move • Describes the evidence and ideas/concepts • Makes the relationship evident between the cause of the move from classical physics to quantum physics and de Broglie's ideas and supporting evidence • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates a sound understanding that the limitations of classical physics gave birth to quantum physics • Describes de Broglie's concepts/ideas and supporting experimental evidence that caused the move • Outlines the limitations of classical physics OR what quantum physics attempts to explain	4–5
• Demonstrates a basic knowledge that the limitations of classical physics gave birth to quantum physics AND EITHER • Outlines the limitations of classical physics or what quantum physics attempts to explain OR • Outlines de Broglie's ideas/developments OR supporting experimental evidence	2–3
• Demonstrates limited knowledge that the limitations of classical physics gave birth to quantum physics AND EITHER • Provides some relevant information about de Broglie's ideas/concepts or supporting experimental evidence OR • Provides some relevant information about the limitations of classical physics or what quantum physics attempts to explain	1

Question 31 (d) (i)

Outcomes assessed: H10, H12, H14

MARKING GUIDELINES

Criteria	Marks
• States what would have happened and provides a reason why	2
• States what would happen without providing a reason	1

Question 31 (d) (ii)

Outcomes assessed: H7, H10, H12

MARKING GUIDELINES

Criteria	Marks
• Identifies 'control rods' • Provides a reason why they regulate the rate of fission reaction	2
• Identifies 'control rods' OR • Outlines how control rods work	1

Question 31 (d) (iii)

Outcomes assessed: H7, H10

MARKING GUIDELINES

Criteria	Marks
• Provides a thorough link between TWO properties of a neutron and its ability to investigate the properties of the matter OR • Outlines THREE features of neutrons and provides a link with its ability to investigate matter	3
• Outlines TWO features of neutron behaviour and provides a sound link between one of these properties and its ability to investigate the properties of matter OR • Outlines THREE features of neutron properties	2
• Outlines features of neutron behaviour without providing a link to its application OR • Outlines a feature of a neutron and links its ability to investigate properties of matter	1

Question 32 (a) (i)

Outcomes assessed: H7, H13

MARKING GUIDELINES

Criteria	Marks
• Uses correct symbols for gates and logic operations and draws correct circuit with inputs and output	2
• Uses incorrect symbols but shows inputs and outputs correctly OR • Uses correct symbols	1

Question 32 (a) (ii)

Outcomes assessed: H7, H14

MARKING GUIDELINES

Criteria	Marks
• Provides all correct columns OR four correct columns with a maximum of one logic error	3
• Provides columns 1–4 correctly with a maximum of one logic error OR • Provides columns 1–3 correctly	2
• Has incorrect truth table but gives correct equivalent gate for C OR • Provides 1st and 2nd columns correctly with a maximum of one logic error	1

Question 32 (b) (i)

Outcomes assessed: H7, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Correctly draws the output waveform with supporting calculations also provided	3
• Calculates correct gains but does not show correct waveform OR • Uses correct formulae but makes a mistake with V_2 or V_1 gain and then carries this to the final waveform plot	2
• Uses correct formulae but makes mistakes in applying them to the circuit eg does not identify R_1, R_2, and R_f correctly OR • Draws correct waveform without justification or identifies a negative voltage OR • Identifies circuit as a summing amplifier	1

Question 32 (b) (ii)

Outcomes assessed: H7, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Correctly draws the output waveform with supporting information also provided	3
• Calculates correct gain but does not show correct waveform for one or other of the half-cycles OR • Makes a numerical mistake and draws the correct waveform based on the incorrect calculations	2
• Identifies correct formula OR • Identifies circuit as an inverting amplifier	1

Question 32 (c)

Outcomes assessed: H4, H7, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough understanding of developments in semiconductors that have led to a reduction of energy consumption • Identifies specific examples of solid state devices that have resulted in energy savings • Identifies how these devices reduce energy consumption • Makes the relationship evident between developments in semiconductor industry and reduction in energy consumption • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates a sound understanding of developments in semiconductors that have led to a reduction of energy consumption • Describes examples of semiconductors that have resulted in energy savings	4–5
• Demonstrates a basic knowledge of developments in semiconductors that have led to a reduction of energy consumption AND EITHER • Outlines examples of semiconductors that have led to a reduction of energy consumption OR • Describes an example of a semiconductor that has led to a reduction of energy consumption	2–3
• Demonstrates limited knowledge of developments in semiconductors that have led to a reduction of energy consumption • Provides general information of semiconductors that have led to a reduction in energy consumption	1

Question 32 (d) (i)

Outcomes assessed: H7

MARKING GUIDELINES

Criteria	Marks
• Provides an explanation of how input and output transducers are different • Provides an example of an input transducer and an output transducer	3
• Provides an explanation of how input and output transducers are different OR • Provides an example of an input transducer and an output transducer	2
• Names devices that are transducers OR • Identifies what an input or output does	1

Question 32 (d) (ii)

Outcomes assessed: H7, H12

MARKING GUIDELINES

Criteria	Marks
• Correctly evaluates R_1	2
• Recognises potential divider circuit but does not solve for R_1 OR • Carries out an equivalent calculation	1

Question 32 (d) (iii)

Outcomes assessed: H7, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Calculates correct answer OR • Calculates correct R but makes mistake finding T from graph	2
• Uses correct method but makes errors in algebra so gets wrong R and $\therefore$ wrong T OR • Doesn't recognise that the resistor and thermistor are in parallel	1