BOARD OF STUDIES
NEW SOUTH WALES

2012 HSC Physics
Marking Guidelines

Section I, Part A

Multiple-choice Answer Key

Question	Answer
1	D
2	A
3	C
4	B
5	C
6	C
7	B
8	A
9	B
10	D
11	C
12	A
13	B
14	D
15	D
16	C
17	B
18	C
19	C
20	B

Section I, Part B

Question 21 (a)

Criteria	Marks
• Provides details of the method used, including what data would be collected and repetition for reliability • Outlines how data would be used to determine the acceleration due to gravity	3
• Provides details of the method used, including what data would be collected.	2
• Identifies a practical method that could lead to a determination of 'g'	1

Question 21 (b)

Criteria	Marks
• Indicates that the value obtained experimentally should be compared with an accepted standard value obtained from a reliable source.	1

Question 21 (c)

Criteria	Marks
• States that repetition of the experiment is required to establish reliability	1

Question 21 (d)

Criteria	Marks
• States that the less the measurements vary from the mean, the more reliable is the experimental data.	1

Question 22 (a)

Criteria	Marks
• Relates a change in flux through the coil when it is moved, to the production of an emf across the coil • Indicates that a current flows because the short circuit completes the current pathway through the coil	2
• States that there is a change in flux through the coil when it is moved	1

Question 22 (b)

Criteria	Marks
• Relates the correct polarity of the coil's field to the change in flux through the coil • Relates the coil's magnetic field to the production of a force on the magnet that causes a reduction in the reading on the balance • Relates the increasing distance between the magnet and the coil to the return of the reading on the balance to its original value before the coil was moved	4
• Relates the change in flux through the coil to the correct polarity of the coil's field • Relates the coil's magnetic field to the production of a force on the magnet that causes a reduction in the reading on the balance	3
• Relates that the change in the reading on the balance is due to a force caused by the current in the coil.	2
• Any relevant statement	1

Question 23

Criteria	Marks
• Describes the behaviour of the mass dropped from tower B and relates this to the motion of tower B • Describes the path and change in acceleration of the mass dropped from tower A and relates this to the location of tower A and the change in acceleration with decreasing distance from Earth's centre.	4
• Describes the behaviour of the mass dropped from tower B and relates this to the motion of tower B • Describes the path of the mass dropped from tower A and relates this to the location of tower A.	3
• Relates the motion of either mass to the location of the tower OR • Describes the path of both masses	2
• Provides one relevant piece of information	1

Question 24 (a)

Criteria	Marks
• Correctly labelled diagram • Shows relative band gaps for all three materials.	2
• Evidence of an understanding of the existence of a band gap in materials	1

Question 24 (b)

Criteria	Marks
• Relates the formation of electron-hole pairs and the movement of carriers in the valence and conduction bands to the applied electric field.	3
• Relates the movement of electrons or holes to the applied electric field OR • Describes the formation of electron-hole pairs in the conduction-valence bands	2
• Any correct statement about the current in a semiconductor	1

Question 25 (a)

Criteria	Marks
• Identifies two differences between transistors and thermionic devices	2
• Identifies one difference between transistor circuits and thermionic devices	1

Question 25 (b)

Criteria	Marks
• Makes a judgment, supported by detailed evidence, of the effects of transistors. Effects described must relate explicitly to society. The answer reflects depth of understanding, evidenced by the use of scientific language and thorough understanding of the connection between transistors and changes in society	5
• Makes a judgment, supported by evidence, of the effects of transistors on society. The answer uses some scientific language and demonstrates an understanding of the connection between transistors and changes in society	4
• Makes a judgment, identifies an application of transistors which affect either individual people, or society	3
• Identifies an application of transistors, and an associated effect of transistors, either on individual people, or on society	2
• Identifies an application of transistors or an effect of transistors on people	1

Question 26

Criteria	Marks
• Calculates the power loss resulting from all three designs and concludes, based on the least power lost/consumed that design B is the best of the three systems. Answer shows all calculations with correct and comparable units. • Shows a clear understanding of the physics principles involved	6
• Calculates the power usage/loss in two systems, including correct scientific units AND • Applies a correct method for the third (but does not arrive at the correct answer with units) OR • Makes a correct judgment of the best design	5
• Calculates the power usage/loss in design B and one of A or C OR • Relates the principles of power loss to the three designs	4
• Calculates the power usage for two designs OR OR • Relates the principles of power loss to two designs	3
• Calculates the power usage of one design OR • Relates the principles of power loss to the design	2
• A relevant statement that demonstrates understanding of the problem	1

Question 27

Criteria	Marks
• Correctly substitutes into the derived equation	4
• Equates derived expressions	3
• Derives correct expressions for time of flight	2
• Derives correct expressions for horizontal and vertical components of launch velocity	1

Question 28 (a)

Criteria	Marks
• Briefly describes an experimental result or technological application, which is consistent with one prediction of the theory of relativity.	2
• Identifies relevant evidence	1

Question 28 (b)

Criteria	Marks
• Shows a deep understanding of the process of validating a theory based on agreement with observations and experiments and the capacity to make correct predictions	3
• Shows a limited understanding of the process of validating a theory	2
• Demonstrates an elementary understanding of how a theory is validated eg by stating one way that a theory can be validated	1

Question 28 (c)

Criteria	Marks
• Correct formula with correct substitution	2
• Substitutes one correct value into the length contraction formula	1

Question 29

Criteria	Marks
• Draws a labelled diagram showing the coil, magnet and speaker cone with the wire in the coil cutting across the magnetic field • Describes the oscillation of the coil/cone produced by AC in the coil in a magnetic field (motor effect) and states that the vibration of the cone produces the sound • Accounts for the production of louder sounds through the use of larger currents in the coil • Relates the pitch (frequency) of sound to the changes in the current through the speaker coil	5
• Draws a labelled diagram showing the coil and the magnet with the wire in the coil within the magnetic field • Describes the oscillation of the coil/cone produced by AC/varying current in the coil in a magnetic field (motor effect) • Relates changes in both loudness OR frequency of the sound to changes in the current through the coil	4
• Draws a labelled diagram showing a wire near a magnet • Describes the force on the wire produced by the current in a magnetic field (motor effect) • Identifies that the vibration of the coil/cone produces a sound	3
• Draws a labelled diagram AND • Describes the force on the wire produced by the current in a magnetic field (motor effect) OR • Draws a labelled diagram showing a wire and a magnet OR • States that an alternating current/ varying current passes through the wire OR • Identifies that the vibration of the coil/cone produces sound	2
• Any relevant statement OR • Diagram showing a coil and a magnet	1

Question 30 (a)

Criteria	Marks
• States that the two particles have opposite charges	1

Question 30 (b)

Criteria	Marks
• Provides reasons	2
• Provides a reason	1

Question 30 (c)

Criteria	Marks
• Qualitatively relates the radius of curvature of the path to two properties of the particle	2
• Relates the radius of curvature to one property of the particle	1

Section II

Question 31 – Geophysics

Question 31 (a)

Criteria	Marks
• Relates two variables to the effect that they produced on the pendulum's period	3
• Identifies two variables that changed the period of the pendulum OR • Relates a variable to the effect that it produced on the pendulum's period	2
• Identifies one variable that changed the period of the pendulum	1

Question 31 (b) (i)

Criteria	Marks
• Describes one variable that changes over time and how it affects the field	2
• Identifies one changing variable that affects the Earth's magnetic field	1

Question 31 (b) (ii)

Criteria	Marks
• Shows how parts of the model fail to relate to observations of the Earth's magnetic properties or the scientific representation of magnetic fields	3
• Identifies two deficiencies in the model OR • Explains one deficiency	2
• Identifies a deficiency in the model	1

Question 31 (c) (i)

Criteria	Marks
• Outlines what C1 and C2 represent	2
• Makes a correct statement about C1 or C2	1

Question 31 (c) (ii)

Criteria	Marks
• Features of both graphs are related to Earth's internal structure	4
• Accounts for features of one graph and a feature of the other in terms of the Earth's structure	3
• Accounts for features of one graph OR a feature of the other in terms of the Earth's structure	2
• Relates the Earth's structure to a feature of either graph	1

Question 31 (d) (i)

Criteria	Marks
• Relates the magnetic anomaly pattern to processes taking place at the plate boundary and its significance to the theory of plate tectonics	3
• Describes seafloor spreading that is taking place at the mid-ocean ridge and relates this to the magnetic anomalies	2
• Describes a feature of the magnetic anomaly pattern OR • Makes a correct statement about divergent plate boundaries	1

Question 31 (d) (ii)

Criteria	Marks
• Relates plate tectonic theory to evidence supporting it	2
• Identifies evidence consistent with plate tectonic theory	1

Question 31 (e)

Criteria	Marks
• Explains a range of remote sensing processes and the physical principles upon which they depend. Uses scientific language to clarify the response	6
• Describes a range of remote sensing processes and at least one physical principle upon which one of these depends	4–5
• Identifies examples of remote sensing and mentions a physics principle	2–3
• Identifies an example of remote sensing	1

Question 32 – Medical Physics

Question 32 (a) (i)

Criteria	Marks
• Displays a clear understanding of the fact that CAT scans produce more data than X-rays • Outlines that a named technology for CAT was not readily available until 1972	2
• Shows some understanding of the fact that CAT produces more data than X-rays OR • Shows understanding that a named technology required for CAT scans was not available before 1972	1

Question 32 (a) (ii)

Criteria	Marks
• Displays a clear understanding of the differences in the information obtained using each technique	2
• Shows understanding of the information obtained using one technique	1

Question 32 (a) (iii)

Criteria	Marks
• Shows clear understanding of the differences in the production mechanism of radiation used in both technologies	3
• Shows some understanding of the production of X-ray radiation for CAT AND • Shows clear understanding of the production of gamma rays for PET OR • Shows some understanding of the production of gamma rays for PET AND • Shows clear understanding of the production of X-rays for CAT	2
• Shows some understanding of the production of X-ray radiation for CAT OR • Shows clear understanding of the production of gamma rays for PET	1

Question 32 (b) (i)

Criteria	Marks
• Shows a clear link of the effects of radio waves on the hydrogen nuclei's spin alignment	3
• Shows some understanding of the effect that radio waves have on the alignment and/or precession of proton nuclei	1–2

Question 32 (b) (ii)

Criteria	Marks
• Shows a clear understanding of the technologies involved with MRI scans and provides clear outlines of the advances in physics understanding required to develop these	3
• Shows some understanding of the technologies involved with MRI scans and provides a basic connection to the advances in physics understanding associated with these	2
• Shows some understanding of the technologies involved with MRI scans OR • Shows some understanding of the physics development that was required to develop an MRI device	1

Question 32 (c)

Criteria	Marks
• Clearly describes at least two desirable properties of radioactive isotopes for medical imaging AND • Provides a named example of a radioactive isotope with medical application	3
• States desirable properties of a radioactive isotope for medical applications OR • Names example of a radioactive isotope with medical applications and states one property of the isotope	2
• Shows some understanding of the desirable properties of a radioactive isotope for medical applications OR • Provides a named example of a radioactive isotope with medical applications	1

Question 32 (d)

Criteria	Marks
• Shows a clear understanding of how endoscopes work, including the function and design of the optical fibres	3
• Shows some understanding of the types of fibre bundles used in endoscopes but is unclear about their specific function or design	2
• Shows some understanding of the fibre bundles used in endoscopes OR • Shows some understanding of how optical fibres work	1

Question 32 (e)

Criteria	Marks
• Uses scientific language • Discusses multiple uses and limitations of medical ultrasound imaging	6
• Describes some uses and limitations of ultrasound imaging	4–5
• Outlines uses and/or limitations of ultrasound imaging	2–3
• Identifies a use or a limitation of ultrasound imaging	1

Question 33 – Astrophysics

Question 33 (a) (i)

Criteria	Marks
• Identifies a reason	1

Question 33 (a) (ii)

Criteria	Marks
• Compares methods used to obtain both photometric and spectroscopic data	4
• Describes methods used to obtain both photometric and spectroscopic data	3
• Identifies a method by which each of photometric and spectroscopic data are obtained by astronomers	2
• Identifies one method by which photometric or spectroscopic data about stars is obtained	1

Question 33 (b) (i)

Criteria	Marks
• Relates limitations in resolution of ground-based optical telescopes to a cause of their limitations	3
• Identifies a factor which limits resolution of optical telescopes • Relates the limit to its cause	2
• Identifies a factor that limits the resolution of a telescope	1

Question 33 (b) (ii)

Criteria	Marks
• Describes methods of improving the resolution of optical telescopes	2
• Identifies one method of improving resolution of an optical telescope	1

Question 33 (c) (i)

Criteria	Marks
• Flow diagram correctly relates all of the identified objects	2
• Flow diagram correctly relates three of the identified objects	1

Question 33 (c) (ii)

Criteria	Marks
• Describes conditions and processes of hydrogen to helium conversion, helium burning and heavy element nucleosynthesis in supernovae	3
• Outlines two processes by which heavy elements are produced	2
• Identifies a process by which lighter nuclei form heavier nuclei	1

Question 33 (d) (i)

Criteria	Marks
• Relates the calculated distance to the motion of the Earth around the Sun and the relatively fixed, distant stars	3
• Shows a basic understanding of how parallax shift of a star can, due to Earth's orbital motion, be used to calculate the star's distance	2
• Identifies a variable that is significant in the process of determining the distance to a star using parallax	1

Question 33 (d) (ii)

Criteria	Marks
• Outlines a limitation to the use of the parallax method of determining stellar distance	1

Question 33 (e)

Criteria	Marks
• Gives a detailed description of the system including quantitative analysis of at least TWO characteristics • Gives detailed description of each star comparing characteristics (from Herzsprung-Russell diagram) • Uses scientific language	6
• Gives a description of the system including a quantitative analysis • Gives a description of a star's characteristics • Uses scientific language	4–5
• Gives a description of the system based on analysis OR • Identifies the stars in the system based on analysis	2–3
• Any correct statement drawn from the data	1

Question 34 – From Quanta to Quarks

Question 34 (a) (i)

Criteria	Marks
• Shows a clear understanding of Bohr's model • Shows a clear understanding of how the Balmer series is produced • Uses a clear labelled diagram to aid in explaining either Bohr's model OR the Balmer series	3
• Shows some understanding of the Bohr model • Shows some understanding of the Balmer series • Uses a diagram to aid their explanation	2
• Shows some understanding of the Bohr model OR • Shows some understanding of the Balmer series	1

Question 34 (a) (ii)

Criteria	Marks
• Clearly outlines TWO observations	2
• States at least one observation	1

Question 34 (b) (i)

Criteria	Marks
• Shows a clear understanding of the key requirements	3
• Shows a clear understanding of the majority of the key requirements	2
• Shows a clear understanding of at least one of the key requirements	1

Question 34 (b) (ii)

Criteria	Marks
• Shows a good understanding of the relevance of Einstein's $E=mc^2$ to the radioactive decay process	2
• Shows some understanding of the connection between Einstein's $E=mc^2$ and radioactive decay OR • Shows some understanding of the mass changes during radioactive decay	1

Question 34 (c)

Criteria	Marks
• Shows a clear understanding of the wave nature of moving neutrons • Shows a clear understanding that the periodic arrangement of metal nuclei will diffract the neutrons in turn revealing their arrangement • Shows a clear understanding that the neutral neutrons will not scatter from the electrons • Connects the above points into a coherent description	4
• Shows some understanding of the above points and some understanding of how they are related	3
• Shows some understanding of the above points	1–2

Question 34 (d) (i)

Criteria	Marks
• Outlines the number and types of quarks in the proton and the neutron • Identifies two composite properties and outlines how these are determined by the quarks present in each case	3
• Shows some understanding of the internal structure of protons and neutrons • Identifies a composite property and outlines how this is determined by the internal structure	2
• Shows some understanding of the internal structure of the proton or neutron	1

Question 34 (d) (ii)

Criteria	Marks
• Identifies charged particles are accelerated • Identifies that collision products are analysed	2
• Identifies charged particles are accelerated OR • Identifies that collision products are analysed	1

Question 34 (e)

Criteria	Marks
• Displays a good understanding of the role that conservation laws have played in the development of atomic physics • Outlines more than one relevant example of a conservation law and relates them to developments in atomic physics • Provides a coherent description and uses scientifically correct terminology throughout	5–6
• Displays an understanding of the role the conservation laws have played in the development of atomic physics • Outlines one relevant example of a conservation law and relates it to developments in atomic physics	3–4
• Displays some understanding of the role that conservation laws have played in the development of atomic physics OR • Outlines ONE example of a conservation law relevant to atomic physics	1–2

Question 35 – The Age of Silicon

Question 35 (a) (i)

Criteria	Marks
• Correctly classifies the circuit • Provides valid reasoning	2
• Correct statement related to the classification of the circuit	1

Question 35 (a) (ii)

Criteria	Marks
• Identifies the two transducers • Identifies the function of the two transducers	2
• Identifies a transducer • Identifies its function	1

Question 35 (a) (iii)

Criteria	Marks
• Draws a correctly labelled graph with the correct line plotted using the potential divider formula	3
• Draws a correctly labelled graph with clearly incorrect values plotted but with the correct general trend OR • Plots the correct values but with the graph incorrectly formatted / labelled	2
• Displays understanding of the need to read values from the provided plot and use the potential divider formula to find the potentials	1

Question 35 (a) (iv)

Criteria	Marks
• Outlines the configuration of the circuit in Section A • Relates this configuration to the operation of the circuit	3–4
• Displays some understanding of the configuration or operation of the circuit	1–2

Question 35 (a) (v)

Criteria	Marks
• Calculates an equilibrium temperature • Demonstrates an understanding of the effect of R4 on the operation of the circuit	3
• Calculates an equilibrium temperature but ignores R4	2
• Displays a clear understanding of how to perform the calculation but does not arrive at the correct result OR • Displays a clear understanding of the operation of the circuit but does not arrive at a correct result	1

Question 35 (b)

Criteria	Marks
• Displays a clear understanding of when to use each and why	2
• Displays some understanding of the relevance of transistors and relays to high current switching	1

Question 35 (c)

Criteria	Marks
• Correctly calculates the truth table	3
• Correctly constructs a truth table with the majority of entries correct	1 – 2

Question 35 (d)

Criteria	Marks
• Demonstrates a good overall understanding of the relationship between the understanding of the properties of materials and the development of modern electronics • Demonstrates a good overall understanding of the relationship between the development of complex manufacturing techniques and the development of modern electronics • Shows an understanding of the relationship between the above two points • Uses clear, concise and scientifically correct language	5–6
• Demonstrates some understanding of the relationship between the understanding of the properties of materials and the development of modern electronics • Demonstrates some understanding of the relationship between the development of complex manufacturing techniques and the development of modern electronics • Shows some understanding of the relationship between the above two points	3–4
• Demonstrates limited understanding of the relationship between the understanding of the properties of materials and the development of modern electronics AND/OR • Demonstrates limited understanding of the relationship between the development of complex manufacturing techniques and the development of modern electronics	1–2

Physics

2012 HSC Examination Mapping Grid

Section I
Part A

Question	Marks	Content	Syllabus outcomes
1	1	9.3.3.2.3, 9.3.1.2.6, 9.3.5.2.1	H9
2	1	9.2.4.2.8	H3
3	1	9.4.1.2.9	H9, H10
4	1	9.2.1.2.3	H12.3c, H9
5	1	9.4.3.2.6, 7	H3
6	1	9.4.1.2.6	H9, H13.1e
7	1	9.3.1.3.5	H9
8	1	9.3.1.3.3	H9
9	1	9.2.2.2.9	H9
10	1	9.3.4.3.2	H9, H7, H12.3c
11	1	9.2.2.2.7	H9
12	1	9.2.2.3.4	H9
13	1	9.2.2.3.5	H9
14	1	9.3.2.2.4, 9.3.2.2.5	H9
15	1	9.4.4.3.3	H9
16	1	9.3.2.2.6	H9
17	1	9.3.1.3.1, 9.3.1.2.2	H9
18	1	9.2.3.3.2	H9
19	1	9.3.2.3.3	H9
20	1	9.4.3.3.4, 9.4.2.3.4, 9.4.3.2.2, 9.4.2.2.6	H3

Section I
Part B

Question	Marks	Content	Syllabus outcomes
21 (a)	3	9.2.1.3.1	H11
21 (b)	1	9.1	H11.2c, H12, H12.4c
21 (c)	1	9.1	H11.2c, H12, H12.2b
21 (d)	1	9.1	H11.2c, H12, H12.4e
22 (a)	2	9.3.2.3.1, 9.3.2.3.2, 9.3.2.2.4	H9
22 (b)	4	9.3.2.3.1, 9.3.2.3.2, 9.3.2.2.4, 9.2.1.3.3	H9
23	4	9.2.2.2.9, 9.2.3.3.1, 9.2.2.2.8	H9
24 (a)	2	9.4.3.2.2	H13.1e
24 (b)	3	9.4.3.3.1, 9.4.3.2.4, 9.4.3.2.3	H9
25 (a)	2	9.4.3.2.8, 9.4.3.3.3	H3
25 (b)	5	9.4.1, 9.4.3.3.2	H4

Question	Marks	Content	Syllabus outcomes
26	6	9.3.3.2.4, 9.3.4.3.4, 9.1, 9.4.4.3.5	H3, H7, H13.1e, H14.1c, H14.1f, H14.2b, H14.3c, H14.2d
27	4	9.2.2.3.1	H9
28 (a)	2	9.2.4.3.4	H6
28 (b)	3	9.2.4.3.4	H2
28 (c)	2	9.2.4.3.5	H6
29	5	9.3.1.3.5	H9
30 (a)	1	9.4.1.2.5, 9.4.1.2.3	H9
30 (b)	2	9.4.1.3.3, 9.2.2.3.4	H9
30 (c)	2	9.4.1.3.3, 9.2.2.3.4, 9.2.2.2.7	H9

Section II

Question	Marks	Content	Syllabus outcomes
Question 31		**Geophysics**	
31 (a)	3	9.5.1.3.1, 9.5.2.2.4, 9.5.2.3.2	H9
31 (b) (i)	2	9.5.4.2.2	H9
31 (b) (ii)	3	9.5.4.2.1, 9.5.4.3.1	H9
31 (c) (i)	2	9.5.3.3.2	H8
31 (ii)	4	9.5.3.2.1, 9.5.3.2.2, 9.5.3.2.3, 9.5.3.3.1	H8
31 (d) (i)	3	9.5.4.2.2, 9.5.4.2.3, 9.5.4.3.2	H9
31 (ii)	2	9.5.4.2.3, 9.5.4.2.4	H9
31 (e)	6	9.5.1.1, 9.5.2.2.2, 9.5.2.2.3	H8, H10
Question 32		**Medical Physics**	
32 (a) (i)	2	9.6.2.2.3, 9.6.2.2.1	H10
32 (a) (ii)	2	9.6.2.2.4, 9.6.2.3.2, 9.6.3.2.5, 9.6.3.3.1	H10
32 (a) (iii)	3	9.2.2.1, 9.6.3.2.1, 9.6.3.2.4	H10
32 (b) (i)	3	9.6.4.2.6	H9, H10
32 (b) (ii)	3	9.6.4.3.3, 9.6.4.3.5	H3
32 (c)	3	9.6.3.2.1, 9.6.3.2.2	H3
32 (d)	3	9.6.2.2.5-7, 9.6.2.3.3	H10
32 (e)	6	9.6.1.1	H3, H8

Question 33		**Astrophysics**	
33 (a) (i)	1	9.7.4.2.1	H10
33 (a) (ii)	4	9.7.4.3.2, 9.7.3.2.2	H10
33 (b) (i)	3	9.7.1.2.4	H10
33 (b) (ii)	2	9.7.1.2.5	H3
33 (c) (i)	2	9.7.6.2.1, 9.7.6.2.2, 9.7.6.2.6	H9
33 (c) (ii)	3	9.7.6.2.3, 9.7.6.2.4	H7, H10
33 (d) (i)	3	9.7.2.2.2.	H8
33 (d) (ii)	1	9.7.2.2.3	H8
33 (e)	6	9.7.5.2.1/2, 9.7.5.3.2, 9.7.4.2.2/3	H10
Question 34		**From Quanta to Quarks**	
34 (a) (i)	3	9.8.1.3.2, 9.8.1.2.5, 9.8.1.2.2	H7, H10
34 (a) (ii)	2	9.8.1.3.4	H7, H10
34 (b) (i)	3	9.8.3.2.11	H7
34 (b) (ii)	2	9.8.3.2.9, 9.8.3.2.4	H7
34 (c)	4	9.8.2.2.1, 9.8.4.2.3	H1, H8
34 (d) (i)	3	9.8.4.2.5	H9, H10
34 (d) (ii)	2	9.8.4.2.4	H2, H10
34 (e)	6	9.8.3.2.2, 9.8.3.2.6, 9.8.3.2.9, 9.8.1	H6
Question 35		**The Age of Silicon**	
35 (a) (i)	2	9.9.2.2.1	H9
35 (a) (ii)	2	9.9.3.2.1, 9.9.3.2.4, 9.9.2.2.6	H9
35 (a) (iii)	3	9.9.3.2.4, 9.9.2.3.3	H9
35 (a) (iv)	4	9.9.6.2.5, 9.9.6.2.7, 9.9.6.2.11, 9.9.6.2.8	H9
35 (a) (v)	3	9.9.6.3.2, 9.9.6	H9
35 (b)	2	9.9.4.2.1	H3, H9
35 (c)	3	9.9.5.3.1	H9
35 (d)	6	9.9.1.1	H3