2015 HSC Senior Science Marking Guidelines

Section I, Part A

Multiple-choice Answer Key

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

Section I, Part B

Question 21 (a)

Criteria	Marks
• Provides reasons for the use of thermography • Links its use to a diagnosis	2
• Any relevant information	1

Sample answer:

Thermography is used because it is a non-invasive technology. It can be used as a diagnostic tool to detect abnormal blood flow to an area associated with injuries or tumours.

Question 21 (b)

Criteria	Marks
• Any relevant disadvantage	1

Sample answer:

The technique does not provide information about deep tissues or structures.

Question 22

Criteria	Marks
• Links properties of electromagnetic waves to relevant communication systems • Indicates the usefulness of these properties	4
• Identifies propert(ies) of electromagnetic waves • Identifies relevant communication system(s) • Indicates the usefulness of propert(ies)	3
• Identifies properties of electromagnetic waves OR • Identifies communication systems OR • Identifies a property linked to a communication system	2
• Any relevant information	1

Sample answer:

Electromagnetic waves travel at the speed of light. This makes them useful in communication since this enables almost instantaneous communication on Earth eg via TV networks.

Electromagnetic waves travel in straight lines. This makes them useful in communication since it enables satellites to be positioned predictably and provide clear signals. This can be used for mobile phone signals.

Question 23 (a)

Criteria	Marks
• Provides explanations for the use of polyethylene in artificial joints	3
• Provides an explanation for the use of polyethylene OR • Identifies relevant properties and/or uses of polyethylene	2
• Any relevant information	1

Sample answer:

Polyethylene is used to cover the articulating ends because it is durable. This means that the joints will withstand high impact and pressure. Polyethylene has low friction making it easy for the two ends of the joint to slide past each other offering minimal resistance to the movement.

Question 23 (b)

Criteria	Marks
• Provides characteristics of superalloys and relates them to their usefulness in artificial joints	3
• Lists characteristic(s) of superalloys AND/OR • Outlines how superalloys are useful	2
• Any relevant information	1

Sample answer:

Superalloys are useful because:

• they have high strength – this is particularly useful in ball and stem joints since the joints are subjected to high stresses associated with impact. The high strength means that the joint will not shatter under this impact.

• they are biocompatible – this is useful so that the body does not attack the superalloy and degrade the artificial joint.

Question 24

Criteria	Marks
• Identifies different types of information that can be carried using mobile phones • Outlines impacts on society of each type of information	5
• Identifies different types of information that can be carried using mobile phones • Outlines an impact on society of each type of information	4
• Identifies type/types of information that can be carried using mobile phones • Outlines impact(s) on society/individuals of a type of information	2–3
• Any relevant information	1

Sample answer:

As well as sound information, mobile phones can carry text and images.

The capacity of mobile phones to transmit text was initially used simply to send short messages consisting only of text.

As the number of mobile phones in use rapidly increased and because sending text messages could be done very cheaply, the number of text messages being sent increased dramatically. Some impacts on society include: groups of friends keeping in almost constant contact; emergency services transmitting warnings which can be seen immediately by most people.

Because text messages are stored, people can look at them immediately or act on them later – this is a change to the way society deals with information.

Later generations of phones could transmit images as part of messages and the capacity of mobile phones to transmit images became a key part of mobile social media such as Facebook and Twitter. This has increased the frequency of communication between people as well as increasing the number of people that individuals communicate with.

Answers could include:

The widespread use of mobile phones and their capacity to carry text and images has also increased social problems such as bullying and terrorism.

Question 25 (a) (i)

Criteria	Marks
• Draws a line of best fit • Shows how the pH and the number of drops are related • Correctly predicts the pH	2
• Any relevant information	1

Sample answer:

10.3

Answers may include:
10.2 – 10.4

Question 25 (a) (ii)

Criteria	Marks
• States why it is invalid to extrapolate the graph	2
• Any relevant information	1

Sample answer:

If the graph was extrapolated it would reach a pH above 14 when there were 100 drops of detergent. A pH above 14 would not be correct. Thus the graph is of no use in predicting the effect on pH.

Question 25 (a) (iii)

Criteria	Marks
• Relates the inappropriate pH to a problem for the skin	2
• Any relevant information	1

Sample answer:

The high pH detergent may irritate the skin because of the large pH difference compared to the skin.

Question 25 (b)

Criteria	Marks
• Provides a judgement of the usefulness of the graph • Provides reasoning for judgement	2
• Negative judgement OR • Positive judgement with plausible reasoning	1

Sample answer:

The graph is not useful in the prediction of the pH because no shampoo is related to any other. There is no reason for the order in which the shampoos are listed, so a trend cannot be inferred.

Question 26

Criteria	Marks
• Describes differences between the coding systems	4
• Describes a difference between the coding systems • Identifies other information about a coding system	3
• Provides information about each coding system OR • Provides features of one coding system	2
• Any relevant information	1

Sample answer:

Compact discs encode information digitally using discrete zeros and ones whereas AM radio encodes information using continuous variation of the amplitude of an electromagnetic wave. Information on CDs is encoded physically as pits on the disc surface. In contrast, AM radio encodes information by using energy.

Answers could include:

Information encoded on a CD allows the information to be stored, while information encoded in the radio wave cannot be stored.

Question 27 (a)

Criteria	Marks
• Provides the meaning of *microflora*	1

Sample answer:

Microflora are microorganisms such as bacteria and fungi that live on our skin in a mutualistic relationship with humans.

Question 27 (b)

Criteria	Marks
• Identifies the effect of microflora on the pH of the skin	1

Sample answer:

Microflora produce acids which lower the pH of the skin.

Question 27 (c)

Criteria	Marks
• Shows the effect of soap pH on the pH of the skin • Relates how this affects the microflora numbers	2
• Any relevant information	1

Sample answer:

Body soaps have an alkali pH and can strip away the acidic surface of the skin. This reduces the numbers of microflora on the skin and can reduce their ability to inhibit the growth of pathogens.

Question 28 (a)

Criteria	Marks
• Identifies relevant equipment • Lists at least two steps that would be taken in the investigation	2
• Any relevant information	1

Sample answer:

1. Collect a stethoscope
2. Place the end of it over the heart
3. Listen and identify two distinct sounds (lub-dub)

Answers could include:

Use of an ECG printout, machine, data logger, app

Question 28 (b)

Criteria	Marks
• Outlines observations • Relates observations to the actions of the heart	3
• Outlines observation(s) AND/OR • Outlines action(s) of the heart	2
• Any relevant information	1

Sample answer:

The first/loudest sound (lub) is the sound of the valve between the atrium and ventricle closing as the ventricle contracts. The second loud sound (dub) is the valve in the artery closing to stop backflow as the ventricle relaxes.

Answers could include:

Students may describe their analysis of an ECG printout.

Question 29

Criteria	Marks
• Relates the two graphs to each other to infer the pH for absorption of aspirin and therefore the site of absorption	4
• Relates the two graphs to each other OR • Correctly states the area where aspirin is absorbed with a correct inference from ONE graph	3
• Outlines the trend in each graph	2
• Any relevant information	1

Sample answer:

The rate of absorption of aspirin is highest when there is a smaller percentage of aspirin molecules ionised (Graph 1).

The second graph shows that the smaller percentage of aspirin molecules being ionised occurs in the pH region less than 7.

This means that aspirin would be absorbed most readily in the low pH regions of the digestive system eg stomach.

Question 30

Criteria	Marks
• Relates the geostationary nature of satellites as well as different footprints to the satellites' location	4
• Outlines features about the location of both satellites	3
• Outlines a feature about the location of both satellites OR • Outlines features of one satellite	2
• Any relevant information	1

Sample answer:

The 2 satellites cover different footprints enabling communication between geographically different areas eg Satellite 1 allows communication between Australia and the Middle East/India/Europe, Satellite 2 allows communication between Australia and Japan.

The satellites are above the equator and at an altitude of 36 000 km so they are geostationary satellites and will always be at the same point above the Earth.

Question 31

Criteria	Marks
• Extensive description of structures and functions of the body • Relates structures and functions of the body to the design and use of a medication and a bionic device • Logical, concise and coherent flow • Uses extensive scientific terminology	8
• Thorough description of structures and functions of the body • Relates structures and functions of the body to the design and use of a medication and a bionic device • Uses scientific terminology	6–7
• Sound description of structures and/or functions of the body • Relates structures and/or functions of the body to the design and use of medication(s) and/or bionic device(s) • Uses some scientific terminology	4–5
• Outlines structure(s) and/or function(s) of the body AND/OR • Provides example(s) of medication(s) and/or bionic device(s)	2–3
• Any relevant information	1

Sample answer:

A knowledge of the structure of the skin has allowed us to design and use medications such as subdermal implants. These continuously release a medication into the bloodstream from under the surface of the skin. This allows it to bypass the digestive system stopping the breakdown of the medication in the stomach and can also overcome the problem of people forgetting to take the medication, or having reactions to oral medications.

The function of the heart is to push blood around the body. The heart muscles contract when the SA node produces an electrochemical impulse. An understanding of how the heart functions has allowed us to replace the function of the SA node with a bionic device such as a pacemaker. This produces an electrical impulse that also causes the heart muscles to contract. In a modern pacemaker, information flows both into and out of the pacemaker, so that information can be gained about the progress of the patient's heart function and to set the parameters for the functioning of the pacemaker.

Section II

Polymers

Question 32 (a) (i)

Criteria	Marks
• States a correct use	1

Sample answer:

Downpipes, guttering, water pipes

Question 32 (a) (ii)

Criteria	Marks
• States TWO properties related to part (i) answer	2
• Any relevant information	1

Sample answer:

Lightweight, strong

Question 32 (b) (i) (1)

Criteria	Marks
• Writes a relevant, testable statement	2
• Writes an aim or a question or an explanation	1

Sample answer:

Wool has a higher thermal insulation capacity than cotton.

Question 32 (b) (i) (2)

Criteria	Marks
• States or implies independent and dependent variables • States or implies a control/controlled variables (at least 2) • Repetition • Logical steps • Method must relate to hypothesis and show what is being measured	4
• States or implies independent and dependent variables • States or implies a control or a controlled variable • Repetition • Must relate to hypothesis	3
• Some steps that could be used to test the hypothesis	2
• Any relevant information	1

Sample answer:

- Wrap identical thickness of wool and cotton around identical beakers, covering the sides and bottoms
- Cut identical polystyrene lids to fit tightly inside the beakers and make a hole in each for a thermometer
- Place identical amounts of boiling water in each beaker, fit the lids in and insert the thermometers into the same positions
- Measure and record the time, using a stopwatch, for the temperature to drop to the same arbitrary temperature eg 40°C
- Repeat the identical experiment and compare the results to check that they are similar in order to establish reliability

Question 32 (b) (ii)

Criteria	Marks
• Links properties of wool to their use	3
• Links a property of wool to its use	2
• Any relevant information	1

Sample answer:

Wool is elastic so it is used in clothing and jumpers to allow a comfortable fit.
Wool is flame resistant and is used in blankets to decrease the risk of burns from fires.

Question 32 (c) (i)

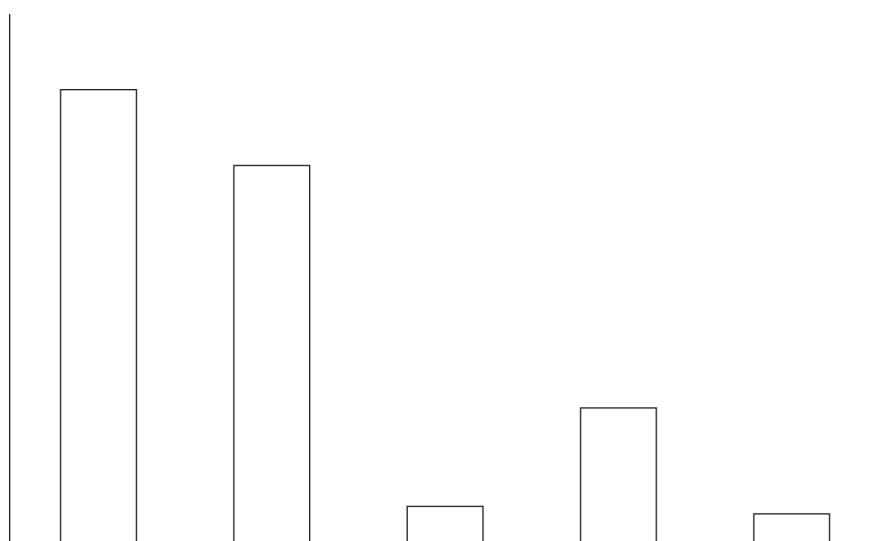| Criteria	Marks
• Columns and rows with appropriate headings and units • All data correctly recorded in the table	3
• Columns and rows with appropriate headings • Incomplete recording of information	2
• Any relevant information	1

Sample answer:

Item	Number	Weight (kg)
Water bottles	20	6
Fruit juice containers	125	5
Cling wrap plastic	55	0.5
Food bar wrappers	375	1.8
Drinking straws	70	0.4

Question 32 (c) (ii)

Criteria	Marks
• Correctly states graph type with an appropriate justification and a sketch	3
• Correctly states the graph type with a sketch OR • Correctly justifies graph type with a sketch	2
• Any relevant information	1

Sample answer:

The information would be best represented in a column/bar graph since each item is not dependent on the other items. They are discrete variables so they could not be presented as another type of graph.

Question 32 (d)

Criteria	Marks
• Demonstrates extensive knowledge of polymers • Describes the effects of natural polymers on the environment • Describes the effects of synthetic polymers on the environment • Makes a judgement • Shows logical and sequential progression • Use of scientific terminology	7
• Demonstrates thorough knowledge of polymers • Describes the effects of natural polymers on the environment • Describes the effects of synthetic polymers on the environment • Makes a judgement • Shows logical and sequential progression • Use of scientific terminology	6
• Demonstrates sound knowledge of polymers • Outlines the effects of natural polymers on the environment • Outlines the effects of synthetic polymers on the environment • May include a judgement • Use of some scientific terminology	4–5
• Demonstrates some knowledge of polymers • Outlines the effects of natural polymers on the environment AND/OR • Outlines the effects of synthetic polymers on the environment	2–3
• Any relevant information	1

Sample answer:

Natural polymers are biodegradable therefore have little effect on the environment after they are used. However to obtain these polymers a lot of land and water for crops or grazing animals must be used which may degrade the natural environment.

Most synthetic polymers are not biodegradable. We try to recycle these polymers to reduce their detrimental effects. However, when additives (eg fire-retardants) are used in synthetic polymers they cannot be recycled and will have to go into landfill. In addition, a build-up in aquatic environments can have negative effects on organisms living in that environment. Plastics are a problem in the environment because they are lightweight which will allow them to float a long way in aquatic environments. Animals can be strangled in plastic debris or it can kill animals that ingest it.

Synthetic polymers are produced from coal, oil or natural gas. Fossil fuels have been produced from dead plants and animals over millions of years. Fossil fuels are a finite resource due to the time required to make more. The mining, drilling and transporting processes for fossil fuels can have detrimental effects on the aquatic environment eg if there is an oil spill. The processing of plastics from fossil fuels releases carbon dioxide into the atmosphere adding to the greenhouse effect.

Both natural and synthetic polymers can cause some detrimental effects on the environment, however, synthetic polymers tend to be the most detrimental to the environment.

Preservatives and Additives

Question 33 (a) (i)

Criteria	Marks
• Names a food additive that is not a preservative	1

Sample answer:

Colouring

Question 33 (a) (ii)

Criteria	Marks
• Provides effects of food additives	2
• Any relevant information	1

Sample answer:

Improves the appearance
Improves the texture

Question 33 (b) (i) (1)

Criteria	Marks
• Writes a relevant, testable statement	2
• Writes an aim or a question	1

Sample answer:

UHT milk has a longer shelf life than pasteurised milk.

Question 33 (b) (i) (2)

Criteria	Marks
• States or implies independent and dependent variables • States or implies a control/controlled variables (at least 2) • Repetition • Logical steps • Method must relate to hypothesis and show what is being measured	4
• States or implies independent and dependent variables • States or implies a control/controlled variables (at least 2) • Repetition • Must relate to hypothesis	3
• Some steps that could be used to test the hypothesis	2
• Any relevant information	1

Sample answer:

• Place a 1 L sealed container of pasteurised milk and a 1 L sealed container of UHT milk on a table next to each other at room temperature for 5 days

• Compare the colour, smell and texture of the contents of each container after 5 days and record your observations

• Repeat the identical experiment and compare the results to check that they are similar in order to establish reliability

Question 33 (b) (ii)

Criteria	Marks
• Provides physical methods of food preservation • Relates how each method limits the effect of microorganisms	3
• Provides physical methods of food preservation OR • Provides a method and relates how this method limits the effect of microorganisms	2
• Any relevant information	1

Sample answer:

Ultraviolet radiation kills microorganisms and makes the food sterile. This reduces the detrimental effects of microbes on both humans and foods.

Drying/dehydrating food removes water from the food making it hard for microorganisms to survive, thus reducing microbial growth and the effects of microbes on humans.

Question 33 (c) (i)

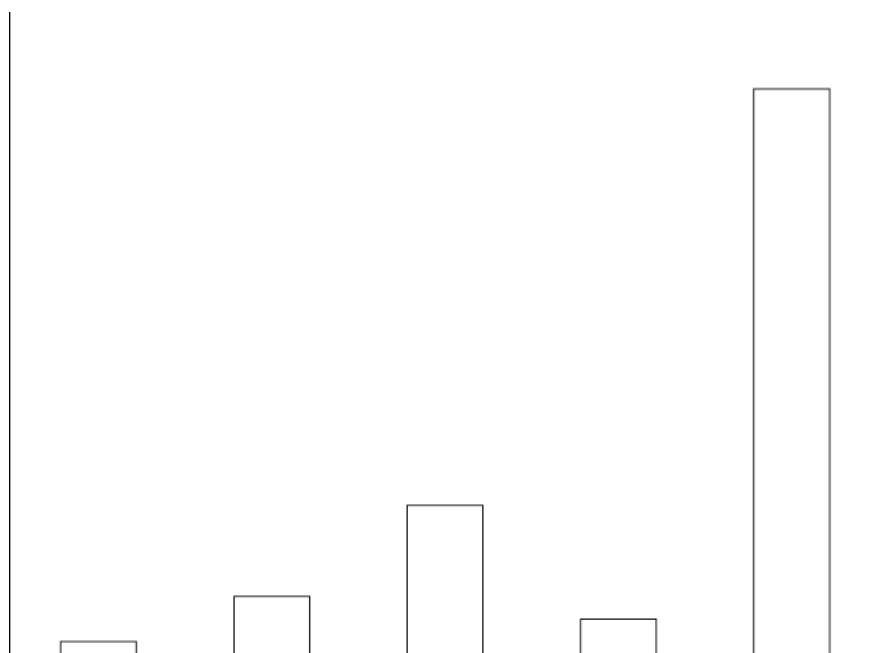| Criteria	Marks
• Columns and rows with appropriate headings and units • All data correctly recorded in the table	3
• Columns and rows with appropriate headings • Incomplete recording of information	2
• Any relevant information	1

Sample answer:

Cosmetic	Water (%)	Alcohol (mL)
Shampoo	70	2
Moisturiser	60	8
Mouthwash	75	20
Deodorant	30	5
Perfume	20	75

Question 33 (c) (ii)

Criteria	Marks
• Correctly states graph type with an appropriate justification and a sketch	3
• Correctly states the graph type with a sketch OR • Correctly justifies graph type with a sketch	2
• Any relevant information	1

Sample answer:

The information would be best represented in a column/bar graph since each item is not dependent on the other items. They are discrete variables so they could not be presented as another type of graph.

Question 33 (d)

Criteria	Marks
• Demonstrates extensive knowledge of government legislation • Describes the effects of labelling and regulating food products • Makes a judgement • Shows logical and sequential progression • Use of scientific terminology	7
• Demonstrates thorough knowledge of government legislation • Describes the effects of labelling and regulating food products • Makes a judgement • Shows logical and sequential progression • Use of scientific terminology	6
• Demonstrates sound knowledge of government legislation • Outlines the effects of labelling and regulating food products • May include a judgement • Use of some scientific terminology	4–5
• Demonstrates some knowledge of government legislation • Outlines the effects of labelling and/or regulating food products	2–3
• Any relevant information	1

Sample answer:

The manufacture of food is controlled by the Australian food standard code. Australia and New Zealand Food Authority (ANZFA) develops and maintains this code. One of the objectives of the code is to provide adequate information about the manufacture of food so that consumers can make informed choices about the food they consume.

All manufacturers must adhere to a list of standards associated with labelling and advertising, including for food additives, preservatives, colouring, flavouring, artificial sweeteners and modifying agents. Health inspectors have the authority to enforce these standards.

Food labelling must contain a complete list of what is contained in the product that is being sold. Since many individuals have developed allergies to certain chemicals, it is important that the label contains a complete list of preservatives and additives. This labelling needs to be closely monitored and regulated by government officials. It is therefore important that all legally required information is provided on the packaging.

Since December 2002 it is legally required that nutritional information, the presence of potential allergens and the percentage of the main ingredients of the food also be placed on labels. Since names of additives can be very long, an internationally recognised numbering system has been developed and can be used on labels. Although somewhat cryptic the numbering system still provides consumers with sufficient information to make informed choices.

The maintenance of these standards is very important and therefore government legislation and monitoring play an essential role in labelling and regulating ingredients.

Pharmaceuticals

Question 34 (a) (i)

Criteria	Marks
• Provides a correct name for the process	1

Sample answer:

Binary fission or asexual reproduction

Question 34 (a) (ii)

Criteria	Marks
• Identifies limitations	2
• Any relevant information	1

Sample answer:

Penicillin has been so widely used that some bacteria are now resistant to it and it is no longer useful. There are some people that have a severe allergic reaction to penicillin so they cannot be given this antibiotic.

Question 34 (b) (i) (1)

Criteria	Marks
• Writes a relevant, testable statement	2
• Writes an aim or a question	1

Sample answer:

In an acidic solution, aspirin capsules dissolve more rapidly than enteric-coated aspirin tablets.

Question 34 (b) (i) (2)

Criteria	Marks
• States or implies independent and dependent variables • States or implies a control/controlled variables (at least 2) • Repetition • Logical steps • Method must relate to hypothesis and show what is being measured	4
• States or implies independent and dependent variables • States or implies a control or a controlled variable • Repetition • Must relate to hypothesis	3
• Some steps that could be used to test the hypothesis	2
• Any relevant information	1

Sample answer:

- Obtain an aspirin capsule and an enteric-coated aspirin tablet
- Place 50 mL of an acidic solution of pH 3.0 into each of 2 beakers
- Place one tablet into each beaker and measure and record using a stopwatch how long it will take for the capsule and the tablet to dissolve
- Repeat the identical experiment and compare the results to check that they are similar in order to establish reliability

Question 34 (b) (ii)

Criteria	Marks
• Identifies TWO mechanisms • Relates them to the reduction of pain	3
• Identifies TWO mechanisms OR • Identifies ONE mechanism and relates it to the reduction of pain	2
• Any relevant information	1

Sample answer:

Aspirin inhibits the amount of prostaglandin being produced by an injured cell. This reduces fever and inflammation. In addition, aspirin reduces the transmission of chemical messengers across the synapse which reduces the signals received by the pain receptors and thus reduces pain for the patient.

Question 34 (c) (i)

Criteria	Marks
• Columns and rows with appropriate headings and units • All data correctly recorded in the table	3
• Columns and rows with appropriate headings • Incomplete recording of information	2
• Any relevant information	1

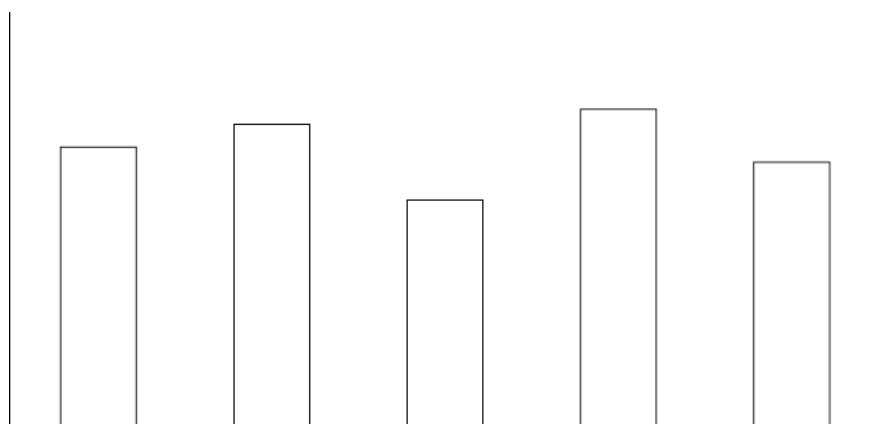*Sample answer:*

Bacteria	*Temperature* *(°C)*	*Time taken to double* *(minutes)*
S. aureus	37	28
E. coli	40	21
L. acidophilus	30	80
B. subtilis	42	26
C. perfringens	35	10

Question 34 (c) (ii)

Criteria	Marks
• Correctly states graph type with an appropriate justification and a sketch	3
• Correctly states the graph type with a sketch OR • Correctly justifies graph type with a sketch	2
• Any relevant information	1

Sample answer:

The information would be best represented in a column/bar graph since each item is not dependent on the other items. They are discrete variables so they could not be presented as another type of graph.

Question 34 (d)

Criteria	Marks
• Demonstrates extensive knowledge of the role of the circulatory system • Describes the transportation of pharmaceuticals around the body • Describes how the body responds to disease • Links these to the role of the circulatory system • Refers to examples in each case • Shows a logical and sequential progression • Use of scientific terminology	7
• Demonstrates thorough knowledge of the role of the circulatory system • Describes the transportation of pharmaceuticals around the body • Describes how the body responds to disease • Attempts to relate in general terms the role of the circulatory system • Shows a logical and sequential progression • Use of scientific terminology	6
• Demonstrates sound knowledge of the role of the circulatory system • Outlines the transportation of pharmaceuticals around the body • Outlines how the body responds to disease • Outlines in general terms the role of the circulatory system • Use of some scientific terminology	4–5
• Demonstrates some knowledge of the role of the circulatory system • Outlines one role of the circulatory system OR • Gives examples of pharmaceuticals or body defenses	2–3
• Any relevant information	1

Sample answer:

The circulatory system is the major transportation system for the body. It consists of the heart which pumps blood through a network of arteries, veins and capillaries to the tissues of the body.

This system not only transports gases, nutrients and hormones around the body, but also removes wastes, responds to invasion by pathogens and transports pharmaceuticals to various organs and tissues.

Pharmaceuticals (drugs) may be administered orally, injected into muscle tissue or into veins. Oral medications need to be absorbed from the digestive system into capillaries while drugs injected into the muscles get into the bloodstream faster. Injection into veins is the most direct way of getting into the bloodstream.

The circulatory system can then rapidly transport these medications around the body to the tissues where they can diffuse into most cells. Once there they can reduce pain (such as with analgesics), kill or inhibit the growth of bacteria (eg with penicillin), or reduce inflammation (eg with antihistamines).

The circulatory system also has a major role in the body's defence against disease. In the case of invasions by bacteria and other pathogens, the bloodstream transports white blood cells to the point of infection where they are responsible for destroying or inhibiting further growth of pathogens or attacking body cells that have been invaded by infecting agents. These white blood cells also release chemicals that trigger the inflammation response which helps the body to control the damage and remove the dead cells and pathogens.

Disasters

Question 35 (a) (i)

Criteria	Marks
• Names a type of fire extinguisher	1

Sample answer:

Carbon dioxide

Question 35 (a) (ii)

Criteria	Marks
• Identifies responsibilities of managers	2
• Any relevant information	1

Sample answer:

Check the location is appropriate
Check access is not obscured
Check correct type of extinguisher is appropriate for the products used in that area

Answers could include:

Check the pressure level is correct
Check it has been serviced within the recommended timeframe

Question 35 (b) (i) (1)

Criteria	Marks
• Writes a relevant, testable statement	2
• Writes an aim or a question	1

Sample answer:

Gum leaves will take less time to burn than pine needles.

Question 35 (b) (i) (2)

Criteria	Marks
• States or implies independent and dependent variables • States or implies a control/controlled variables (at least 2) • Repetition • Logical steps • Method must relate to hypothesis and show what is being measured	4
• States or implies independent and dependent variables • States or implies a control or a controlled variable • Repetition • Must relate to hypothesis	3
• Some steps that could be used to test the hypothesis	2
• Any relevant information	1

Sample answer:

- Weigh out 100 g of gum leaves and 100 g of pine needles. Ensure they are all green leaves or needles. Arrange the leaves/needles in the same shaped pile on a gauze mat over a Bunsen burner.
- Light the leaves at the bottom of each pile using the Bunsen burner and then turn the Bunsen burner off.
- Measure and record the time taken for the leaves in each pile to completely finish burning.
- Repeat the identical experiment and compare the results to check that they are similar in order to establish reliability

Question 35 (b) (ii)

Criteria	Marks
• Identifies TWO methods used to reduce the risk of bushfires and relates them to the reduced risk of bushfires	3
• Identifies TWO methods used to reduce the risk of bushfires OR • Identifies ONE method and relates it to the reduced risk of bushfires	2
• Any relevant information	1

Sample answer:

Controlled burning removes the build-up of fuel that can increase the risk of bushfires and increase their heat. It needs to be done on a regular basis and under controlled conditions which are low risk.

Backburning can be carried out to create a fire-break while a fire is burning. This removes the fuel for the fire so that it cannot continue to spread.

Question 35 (c) (i)

Criteria	Marks
• Columns and rows with appropriate headings • All data correctly recorded in the table	3
• Columns and rows with appropriate headings • Incomplete recording of information	2
• Any relevant information	1

Sample answer:

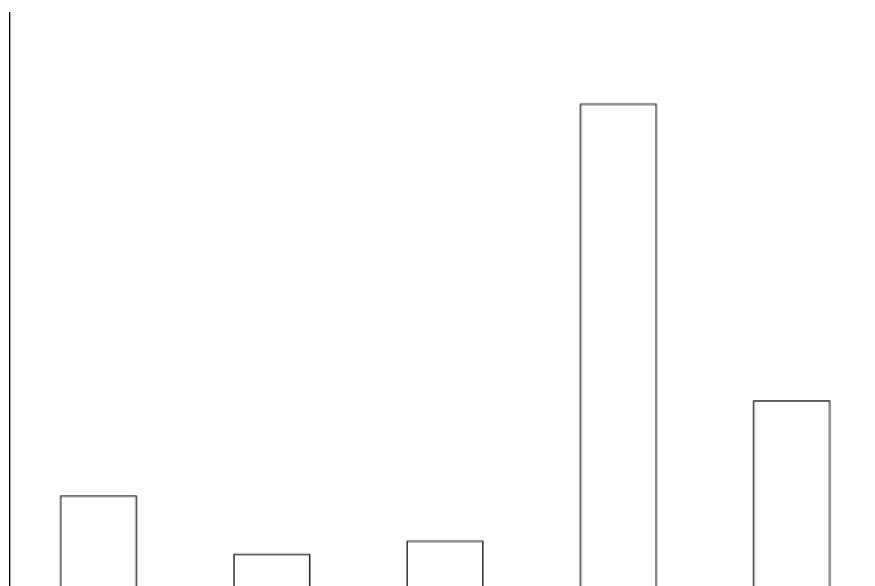| *Location*	*Year*	*Deaths*	*Type of Disaster*
Darwin	1974	71	Cyclone
Newcastle	1989	13	Earthquake
Thredbo	1997	18	Landslide
Victoria	2009	173	Bushfire
Brisbane	2010	35	Flood

Question 35 (c) (ii)

Criteria	Marks
• Correctly states graph type with an appropriate justification and a sketch	3
• Correctly states the graph type with a sketch OR • Correctly justifies graph type with a sketch	2
• Any relevant information	1

Sample answer:

The information would be best represented in a column/bar graph since each item is not dependent on the other items. They are discrete variables so they could not be presented as another type of graph.

Question 35 (d)

Criteria	Marks
• Demonstrates extensive knowledge of three types of earthquake waves • Relates types of waves to the location of the epicentre • Relates the location of the epicentre to damage to the environment • Relates the types of earthquake waves to the damage to the environment • Shows logical and sequential progression • Use of scientific terminology	7
• Demonstrates thorough knowledge of three types of earthquake waves • Relates types of waves to the location of the epicentre • Relates the location of the epicentre to damage to the environment • Relates the types of earthquake waves to the damage to the environment • Shows logical and sequential progression • Use of scientific terminology	6
• Demonstrates sound knowledge of three types of earthquake waves • Relates the types of earthquake waves to the damage to the environment AND/OR • Relates the location of the epicentre to damage to the environment AND/OR • Relates types of waves to the location of the epicentre • Use of some scientific terminology	4–5
• Demonstrates some knowledge of earthquake waves • Outlines the effects of these waves on the environment AND/OR • Outlines the link between the waves and the location of epicentre	2–3
• Any relevant information	1

Sample answer:

The 3 types of waves produced by earthquakes are *P*, *S* and *L* waves. *P* waves travel the most quickly. Thus they are measured with seismographs first. *S* waves travel more slowly.

The epicentre of an earthquake is the location on the surface of the crust directly above the focus. The epicentre can be located using the time difference between *P* and *S* waves. The time difference can be related to the distance from the epicentre and then plotted on a map. If 3 different seismograph stations are located near the epicentre, the 3 circles of distance from the seismograph station can be used to locate the epicentre of the earthquake.

P and *S* waves are body waves while *L* waves are surface waves. *P* waves are longitudinal waves while *S* waves are transverse waves. *L* waves cause the most damage to the environment because they move up and down and side to side at the surface of the earth's crust. They are more likely to cause landslides as well as damage to buildings and the environment.

The location of the earthquake also affects the level of damage to the environment. Shallow focus earthquakes usually cause more damage since they still have a large amount of energy once the waves reach the surface. Also, epicentres located on soft ground (eg river alluvium) cause much more damage to the environment than epicentres located on hard bedrock (eg granite) since the soft ground moves more and can even amplify the vibrations or cause liquefaction of the ground. Similarly, epicentres located where buildings are not designed to withstand earthquakes, have more damage to the environment than when the epicentre is located in an earthquake-prone area that is prepared for seismic activity. Additionally, if the location of the epicentre is in the ocean, it can cause a tsunami on the coastline, causing great damage to the environment.

Space Science

Question 36 (a) (i)

Criteria	Marks
• Identifies the correct part of the mission	1

Sample answer:

Launch

Question 36 (a) (ii)

Criteria	Marks
• Outlines benefits of using space shuttles	2
• Any relevant information	1

Sample answer:

The pilots of space shuttles can choose where to land and land almost exactly where they are required. Space shuttles are reusable.

Answers could include:

Space shuttles could carry more astronauts than a capsule could carry.

Question 36 (b) (i) (1)

Criteria	Marks
• Writes a relevant, testable statement	2
• Writes an aim or a question	1

Sample answer:

Disruption of sleep cycles increases astronauts' reaction times

Question 36 (b) (i) (2)

Criteria	Marks
• States or implies independent and dependent variables • States or implies a control/controlled variables (at least 2) • Repetition • Logical steps • Method must relate to hypothesis and show what is being measured	4
• States or implies independent and dependent variables • States or implies a control or a controlled variable • Repetition • Must relate to hypothesis	3
• Some steps that could be used to test the hypothesis	2
• Any relevant information	1

Sample answer:

- Choose a method for measuring reaction time eg electronic time measurement of the interval between seeing a light flash and pressing a button.
- Test the reaction times of 10 astronauts who are sleeping regularly to establish what are their normal reaction times.
- Disrupt the astronauts' sleep cycles by waking them at random times throughout the night.
- Test their reaction times and compare each with the established norms.
- Repeat the identical experiment and compare the results to check that they are similar in order to establish reliability.

Question 36 (b) (ii)

Criteria	Marks
• Identifies TWO problems for astronauts and relates their causes and effects	3
• Identifies TWO problems for astronauts OR • Identifies ONE problem and relates an effect to the cause	2
• Any relevant information	1

Sample answer:

Extreme temperature changes in space would kill astronauts so they have to be insulated from these.

Radiation, such as X-rays and gamma rays, are a hazard because there is no atmosphere to absorb them and they can harm humans, so shielding must be used.

Answers could include:

Many psychological challenges face astronauts in space, including isolation from friends and family for extended periods as well as sharing limited space with the same, small number of colleagues for long periods.

Question 36 (c) (i)

Criteria	Marks
• Columns and rows with appropriate headings and units • All data correctly recorded in the table	3
• Columns and rows with appropriate headings • Incomplete recording of information	2
• Any relevant information	1

Sample answer:

Space transportation system (STS)	*Number of astronauts*	*Duration (days)*
131	7	15
132	6	12
133	6	13
134	6	16
135	4	13

Question 36 (c) (ii)

Criteria	Marks
• Correctly states graph type with an appropriate justification and a sketch	3
• Correctly states the graph type with a sketch OR • Correctly justifies graph type with a sketch	2
• Any relevant information	1

Sample answer:

The information would be best represented in a column/bar graph since each item is not dependent on the other items. They are discrete variables so they could not be presented as another type of graph.

Question 36 (d)

Criteria	Marks
• Demonstrates extensive knowledge of space probes and telescopes • Relates the type of information gathered by specific radio and optical telescopes and space probes to the solar system, galaxy and deep space objects • Outlines specific examples of information gathered that shows a clear understanding of the differences between the solar system, galaxies and deep space • Describes the types of information gathered using electromagnetic radiation and other data • Shows logical and sequential progression • Use of scientific terminology	7
• Demonstrates thorough knowledge of space probes and telescopes • Relates type of information gathered by specific radio or optical telescopes and space probes to the solar system, galaxy and deep space objects • Outlines specific examples of information gathered that shows a clear understanding of the differences between the solar system, galaxies and deep space • Describes the types of information gathered using electromagnetic radiation and other data • Shows logical and sequential progression • Use of scientific terminology	6
• Demonstrates sound knowledge of types of space probes and telescopes • Outlines specific examples of information gathered that shows a clear understanding of the differences between the solar system, galaxies and deep space AND/OR • Describes the types of information gathered using electromagnetic radiation and other data • Use of some scientific terminology	4–5
• Demonstrates some knowledge of space probes and/or telescopes • Outlines specific example(s) of information gathered that shows an understanding of the differences between the solar system and/or galaxies and/or deep space AND/OR • Describes the type(s) of information gathered using electromagnetic radiation and/or other data	2–3
• Any relevant information	1

Sample answer:

Space probes and telescopes such as HALCA, Hubble and Voyagers I and II gathered different types of information about the universe by collecting light, radio waves and microwaves. Telescopes such as the VLBA and the Parkes radio telescope gather radio/microwave data and optical telescopes such as the Mauna Kea and Anglo-Australian telescopes gather data at light and infrared wavelengths.

HALCA orbited Earth and gathered important information about pulsars using microwaves emitted by those stars both in and beyond our galaxy.

Hubble is an Earth-orbiting optical telescope that has produced detailed images of planets in the solar system and nebulae in our galaxy and other galaxies by detecting the light that they emit or reflect.

The Voyager I and II space probes gathered data, including optical images and magnetic data, about planets in the outer solar system.

The VLBA uses multiple Earth-based radiotelescopes that detect many different microwave frequencies. It has gathered important information about the 3D structure of the Milky Way as well as accurate measurements of the proper motion of the galaxy M31.

The Parkes radio telescope has gathered vast amounts of data by detecting radio/microwaves about objects such as pulsars in and beyond our galaxy.

Optical telescopes such as those at Mauna Kea and the Anglo-Australian telescopes produce clear images using the light from objects such as planets in the solar system, nebulae in our galaxy and deep space objects such as other galaxies, giving us a better understanding of the universe.

2015 HSC Senior Science
Mapping Grid

Section I
Part A

Question	Marks	Content	Syllabus outcomes
1	1	9.3.2.2.2	H7, H9
2	1	9.4.5.2.3	H10
3	1	9.3.4.2.3	H7, H9
4	1	9.2.1.2.3	H8
5	1	9.3.3.2.2, 9.3.3.3.3	H9
6	1	9.2.4	H8
7	1	9.4.6.2.1	H10
8	1	9.2.1.2.3	H8
9	1	9.4.1.2.1	H10
10	1	9.3.2.2.5, 9.3.2.2.7, 9.3.3.2.5, 9.3.3.2.6	H9
11	1	9.3.4.2.1	H7
12	1	9.3.2.3.6	H7, H9
13	1	9.2.2.2.2, 9.2.2.2.3, 9.2.2.2.4	H8
14	1	9.4.2.2.1, 9.4.2.2.2	H10
15	1	9.1	H11.2a, b
16	1	9.2.1.2.3, 9.2.2.2.1, 9.2.2.3.2	H8
17	1	9.2.1.2.4, 9.2.1.3.4	H8
18	1	9.4.1.2.5, 9.4.1.3.1	H10
19	1	9.4.1.2.3	H10
20	1	9.3.2.2.6	H9

Section I
Part B

Question	Marks	Content	Syllabus outcomes
21 (a)	2	9.3.5.2.2	H3, H4, H10
21 (b)	1	9.3.5.3.1	H3, H4, H10
22	4	9.4.3.2.2, 9.4.3.2.3	H3, H4, H10
23 (a)	3	9.3.3.2.7	H3, H4, H6
23 (b)	3	9.3.3.2.8	H3, H4, H6
24	5	9.4.1.3.2	H3, H4, H10
25 (a) (i)	2	9.2.3.3.2, 9.1	H8, H12.4
25 (a) (ii)	2	9.2.3.3.2, 9.1	H8, H12.4, H14
25 (a) (iii)	2	9.2.3.3.2	H7, H8, H12.4, H14
25 (b)	2	9.2.3.3.2, 9.1	H8, H12.4
26	4	9.4.2.2.1, 9.4.2.3.1	H10
27 (a)	1	9.2.3.2.4	H7

Question	Marks	Content	Syllabus outcomes
27 (b)	1	9.2.3.2.4	H7
27 (c)	2	9.2.3.2.4, 9.2.3.2.5	H7, H8
28 (a)	2	9.3.2.3.2	H7, H9, H11.2
28 (b)	3	9.3.2.3.2	H9, H12.4
29	4	9.2.5.2.1, 9.2.5.2.3, 9.2.5.2.5	H3, H12.4
30	4	9.4.4.2.1, 9.4.4.3.1	H3, H10
31	8	9.2, 9.3, 9.4	H3, H4, H7, H8, H9, H10, H13

Section II

Question	Marks	Content	Syllabus outcomes
Question 32		**Polymers**	
32 (a) (i)	1	9.5.2.2.1	H8
32 (a) (ii)	2	9.5.2.2.1	H8
32 (b) (i) (1)	2	9.1, 9.5.1.2.4, 9.5.1.3.2	H11.1
32 (b) (i) (2)	4	9.1, 9.5.1.2.4, 9.5.1.3.2	H11.2, H11.3, H12
32 (b) (ii)	3	9.5.1.2.4	H6, H8
32 (c) (i)	3	9.5.4.3.3, 9.1	H12.2b
32 (c) (ii)	3	9.5.4.3.3, 9.1	H13.1f
32 (d)	7	9.5.4.2.3, 9.5.2.2.1, 9.5.2.2.4	H11, H13
Question 33		**Preservatives and Additives**	
33 (a) (i)	1	9.6.2.3.6	H8
33 (a) (ii)	2	9.6.2.3.6, 9.6.2.2.4	H8
33 (b) (i) (1)	2	9.1, 9.6.3.3.4, 9.6.2.2.2	H11.1
33 (b) (i) (2)	4	9.1, 9.6.3.3.4, 9.6.2.2.2	H11.2, H11.3, H12
33 (b) (ii)	3	9.6.3.3.4, 9.6.2.2.2	H6, H8
33 (c) (i)	3	9.1, 9.6.1	H12.2b
33 (c) (ii)	3	9.1, 9.6.1	H13.1f
33 (d)	7	9.6.5	H11, H13
Question 34		**Pharmaceuticals**	
34 (a) (i)	1	9.7.4.2.3	H6
34 (a) (ii)	2	9.7.4.2.5/6	H8
34 (b) (i) (1)	2	9.7.3.3.2	H11.1
34 (b) (i) (2)	4	9.7.3.3.2, 9.1	H11.2, H11.3, H12
34 (b) (ii)	3	9.7.3.2.7	H7, H8, H9
34 (c) (i)	3	9.7.4.3.2, 9.1	H12.2b
34 (c) (ii)	3	9.7.4.3.2, 9.1	H13.1f
34 (d)	7	9.7.3.2.1-4, 9.7.3.3.1	H7, H9
Question 35		**Disasters**	
35 (a) (i)	1	9.8.4.3.1	H8
35 (a) (ii)	2	9.8.4.3.1	H4
35 (b) (i) (1)	2	9.8.3.2.7, 9.8.3.3.6, 9.1	H10, H11.1

Question	Marks	Content	Syllabus outcomes
35 (b) (i) (2)	4	9.8.3.2.7, 9.8.3.3.6, 9.1	H11.2, H11.3, H12
35 (b) (ii)	3	9.8.3.2.7, 9.8.3.3.4/5	H4
35 (c) (i)	3	9.8.1.2.1-3, 9.8.1.3.1, 9.1	H10, H12.2b
35 (c) (ii)	3	9.8.1.2.1-3, 9.1	H13.1f
35 (d)	7	9.8.3	H10
Question 36		**Space Science**	
36 (a) (i)	1	9.9.4.2.1	H8
36 (a) (ii)	2	9.9.4.3.1	H8
36 (b) (i) (1)	2	9.1, 9.9.3.2.7	H11.1
36 (b) (i) (2)	4	9.1, 9.9.3.2.7	H11.2, H11.3, H12
36 (b) (ii)	3	9.9.3	H7
36 (c) (i)	3	9.1, 9.9.3	H12.2b
36 (c) (ii)	3	9.1, 9.9.3	H13.1f
36 (d)	7	9.9.5	H6, H10