

2018 HSC Senior Science Marking Guidelines

Section I, Part A

Multiple-choice Answer Key

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

Section I, Part B

Question 21 (a)

Criteria	Marks
• Provides TWO relevant precautions	2
• Provides a relevant precaution	1

Sample answer:

- Wear protective clothing
- Don't apply on windy days.

Question 21 (b)

Criteria	Marks
<ul style="list-style-type: none"> • Links harmful nature of chemicals in pesticides to an unintended effect • States why biodegradability limits the effect 	2
<ul style="list-style-type: none"> • Identifies harmful nature of chemicals in pesticides OR <ul style="list-style-type: none"> • States a consequence of biodegradability 	1

Sample answer:

Chemicals in pesticides may be harmful to organisms other than the target. If they are biodegradable, then their harmful effects can be limited because they do not persist in the environment.

Question 22 (a)

Criteria	Marks
<ul style="list-style-type: none"> Relates a feature of the communication system to an effect on society 	2
<ul style="list-style-type: none"> Provides a feature of the communication system OR <ul style="list-style-type: none"> Provides a relevant effect on society 	1

Sample answer:

Radio allowed instantaneous information dissemination, providing more people in a wider area access to current news.

Question 22 (b)

Criteria	Marks
<ul style="list-style-type: none"> States an advantage and a disadvantage of transmission using digital technology in comparison to AM/FM 	4
<ul style="list-style-type: none"> States advantage/disadvantage of digital technology transmission Makes a comparison with AM/FM 	3
<ul style="list-style-type: none"> States advantage/disadvantage of digital technology or AM/FM 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

An advantage of transmitting digital content for music is that the information received is identical to the information transmitted, whereas with AM/FM degradation of the signal can occur.

A disadvantage of transmitting digital data is that access to digital technology could be limited in communities that are remote or scattered, whereas AM/FM gives a better coverage at less cost than internet or digital radio.

Answers could include:

Loss of information in process of digital encoding.

Question 23 (a)

Criteria	Marks
<ul style="list-style-type: none"> Relates effect of X to size/volume of drops 	2
<ul style="list-style-type: none"> Identifies X reduces drop size OR <ul style="list-style-type: none"> Identifies X as a surfactant OR Identifies the effect of X has on results 	1

Sample answer:

Liquid X lowers the surface tension of the water, resulting in smaller drops and hence, more drops required.

Question 23 (b)

Criteria	Marks
<ul style="list-style-type: none"> Establishes results are reproducible and can identify outliers Identifies the outlier in table 	3
<ul style="list-style-type: none"> Identifies that repeating increases reliability Refers to table with reference to reliability/outlier 	2
<ul style="list-style-type: none"> Refers to reliability OR <ul style="list-style-type: none"> Identifies outlier 	1

Sample answer:

In the table, the result for Trial 4 for beaker A is a lot larger than the others. This makes it an outlier. By repeating this experiment, we are able to identify and remove any outliers. Repetition can reduce the effect of errors. Doing both of these increases the reliability of the results.

Question 24

Criteria	Marks
<ul style="list-style-type: none"> Describes role/components of the respiratory system Describes role/components of the circulatory system Provides a link between the functions of each system Links the role of each system to the maintenance of life 	6
<ul style="list-style-type: none"> Outlines role/components of the respiratory system Outlines role/components of the circulatory system Links the functions of each system Outlines a link to maintaining life 	5
<ul style="list-style-type: none"> Outlines role/components of the respiratory system Outlines role/components of the circulatory system Identifies a link between the systems OR identifies a link to maintaining life 	4
<ul style="list-style-type: none"> Identifies role/components of the respiratory system Identifies role/components of the circulatory system Identifies a link between the two systems 	3
<ul style="list-style-type: none"> Identifies a component of the respiratory system Identifies a component of the circulatory system OR <ul style="list-style-type: none"> Identifies a link between the two systems 	2
<ul style="list-style-type: none"> Identifies a component of the respiratory system OR circulatory system OR <ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

The diaphragm allows air to be inhaled through the mouth/nose. Air travels down the trachea, through the bronchi and into the alveoli. Each alveolus is surrounded by capillaries and oxygen diffuses from the alveoli into the bloodstream.

The heart pumps oxygen-rich blood via the arteries around the body. Oxygen diffuses into the body cells from capillaries. Carbon dioxide, a waste product, diffuses from these cells into the bloodstream where it is carried back to the lungs via the veins. CO₂ diffuses from the capillaries into the alveoli. The diaphragm allows CO₂ containing air to be exhaled, removing it from the body.

Human cells require oxygen to function. The respiratory system provides the interface for gaseous exchange to occur. The circulatory system is necessary to transport these gases to and from this exchange surface. The two systems work together to provide life-giving oxygen and to remove CO₂.

Question 25 (a)

Criteria	Marks
<ul style="list-style-type: none"> Provides a correct reason for the use of the component in the shampoo 	1

Sample answer:

Sodium laureth sulfate is an emulsifier.

Question 25 (b)

Criteria	Marks
<ul style="list-style-type: none"> Identifies the skin is acidic Links the pH of the skin to microflora Relates the need for skin/hair products to match skin pH 	3
<ul style="list-style-type: none"> Identifies the skin is acidic AND links to microflora OR <ul style="list-style-type: none"> Identifies the skin is acidic AND relates to skin/hair product matching pH OR <ul style="list-style-type: none"> Links microflora to pH of skin and relates to the matching of the pH of the product 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

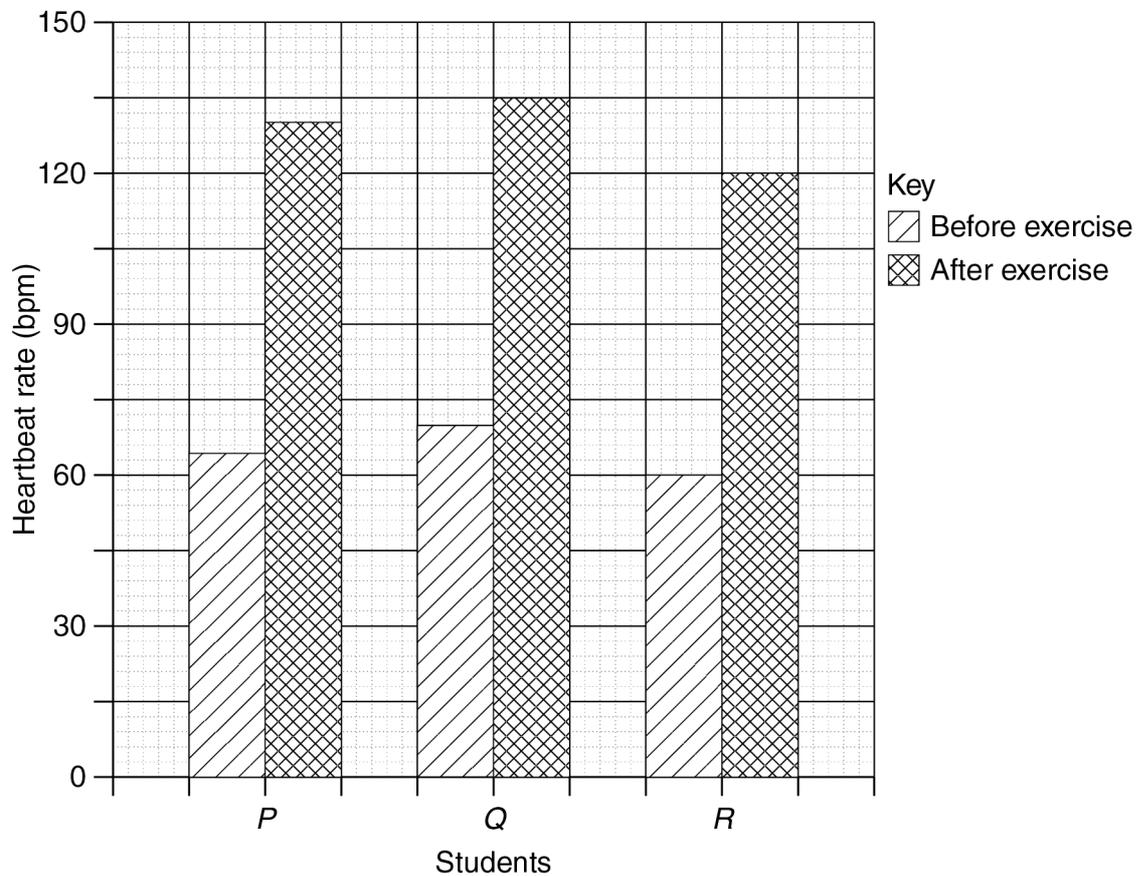
Sample answer:

The skin is slightly acidic which reduces the ability for undesirable microflora to live on it but encourages useful microflora. To ensure that the skin remains slightly acidic, skin and hair products have their pH adjusted to match the pH of the skin.

Question 26 (a)

Criteria	Marks
<ul style="list-style-type: none"> • Constructs an appropriate column/bar graph • Includes: <ul style="list-style-type: none"> – labels on axes – units – key – correctly plotted points 	4
<ul style="list-style-type: none"> • Constructs a substantially correct graph 	3
<ul style="list-style-type: none"> • Constructs a partially correct graph 	2
<ul style="list-style-type: none"> • Provides some correct elements of a graph 	1

Sample answer:



Question 26 (b) (i)

Criteria	Marks
<ul style="list-style-type: none"> Provides a valid hypothesis 	1

Sample answer:

Boys' heart rates increase more with exercise than girls' heart rates.

Note: a question or an aim is NOT a hypothesis.

Question 26 (b) (ii)

Criteria	Marks
<ul style="list-style-type: none"> Describes TWO changes to the procedure Identifies the new variable(s) Clearly links change(s) to validity Outlines a reason for the change(s) 	3
<ul style="list-style-type: none"> Outlines TWO changes to the procedure OR <ul style="list-style-type: none"> Outlines ONE change to the procedure Links the change to validity 	2
<ul style="list-style-type: none"> Identifies a change to the procedure OR <ul style="list-style-type: none"> Identifies a new variable 	1

Sample answer:

Students' data would have to be separated into groups of boys and girls so that the different groups could be compared.

All students would need to be weighed so that they were in the same weight range as each other.

Question 27 (a)

Criteria	Marks
<ul style="list-style-type: none"> Identifies a specific problem related to the decoding of BAT and DIM Provides a valid solution 	2
<ul style="list-style-type: none"> Identifies a relevant problem in decoding using the equipment OR <ul style="list-style-type: none"> Correctly codes one word OR <ul style="list-style-type: none"> Provides a solution 	1

Sample answer:

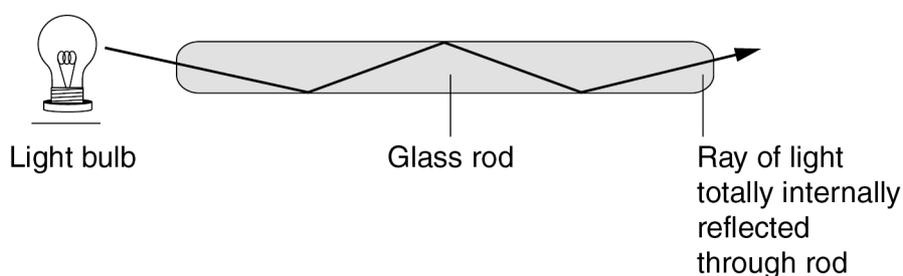
These words have the same sequence of dots and dashes, (BAT = - - - DIM = - - -) so Alice and Bob would need to agree on how to show that the end of a letter had been reached, eg by a longer pause between letters.

Question 27 (b)

Criteria	Marks
<ul style="list-style-type: none"> Identifies total internal reflection Provides a correct description and a relevant labelled diagram 	3
<ul style="list-style-type: none"> Provides a description and a relevant labelled diagram OR <ul style="list-style-type: none"> Identifies total internal reflection and provides a description OR <ul style="list-style-type: none"> Identifies total internal reflection and a relevant labelled diagram 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

A glass rod could be held with an end close to the light bulb. Flashes of light entering the end of the rod would travel down the rod, undergoing total internal reflection every time the ray reached the boundary between the rod and the surrounding air. The flashes of light would emerge from the other end of the rod where they would be visible.



Question 28

Criteria	Marks
<ul style="list-style-type: none"> Identifies two artificial biomaterials Describes the properties of each Identifies the relevant damaged skeletal structures Links the properties of each biomaterial to its suitability in replacing the relevant damaged skeletal structure 	6
<ul style="list-style-type: none"> Identifies two artificial biomaterials Describes the properties of each Identifies the damaged skeletal structures Describes the replacement of the damaged structures with a biomaterial 	5
<ul style="list-style-type: none"> Identifies two artificial biomaterials Outlines their properties Identifies damaged structures 	4
<ul style="list-style-type: none"> Identifies one artificial biomaterial Outlines a property Outlines the replacement of damaged structures with this biomaterial 	3
<ul style="list-style-type: none"> Identifies one artificial biomaterial Outlines a property <p>OR</p> <ul style="list-style-type: none"> Outlines the replacement of a damaged structure with this biomaterial 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

	<i>Biomaterial 1</i>	<i>Biomaterial 2</i>
<i>Name</i>	<ul style="list-style-type: none"> silicone 	<ul style="list-style-type: none"> porous titanium-aluminium-vanadium alloy
<i>Properties</i>	<ul style="list-style-type: none"> strong flexible biocompatible easily shaped 	<ul style="list-style-type: none"> strong non-corrosive porous bio-compatible
<i>Replaced skeletal structure</i>	<ul style="list-style-type: none"> damaged finger joints 	<ul style="list-style-type: none"> total hip replacement for worn hip joint
<i>Reasons for using this biomaterial</i>	<ul style="list-style-type: none"> low friction allows pain-free movement similar density to natural tissue good mechanical strength 	<ul style="list-style-type: none"> being strong and non-corrosive meets the needs for hip replacement porosity allows movement of oxygen to reach surrounding cells

Question 29 (a)

Criteria	Marks
• Relates muscle contraction and action of tendon to the straightening of leg	2
• Identifies contraction of the muscle or action of tendon	1

Sample answer:

The muscle contracts, pulling on the tendon connected to the tibia. This pulls the tibia upward, causing the leg to straighten.

Question 29 (b)

Criteria	Marks
• Describes all types of movement	3
• Describes two types of movement	2
• Identifies a type of movement	1

Sample answer:

The hip joint allows for three independent types of movement. It allows:

1. the leg to swing forwards and backwards
2. the leg to swing from side to side, in a plane perpendicular to that in (1)
3. for limited rotation of the whole leg around the long axis of the leg.

[NOTE: Because of the ambiguity, '360 degrees rotation' can score a maximum of one mark.]

Question 30

Criteria	Marks
<ul style="list-style-type: none"> • Describes TWO suitable communication systems • Links both communications systems to their relevant use • Provides advantage(s)/disadvantage(s) for each system 	6
<ul style="list-style-type: none"> • Describes TWO suitable communication systems • Links ONE communications system to its relevant use • Provides an advantage or disadvantage for one system 	4–5
<ul style="list-style-type: none"> • Identifies TWO communication systems • Identifies a use of one of these communication systems <p>OR</p> <ul style="list-style-type: none"> • Describes ONE suitable communication system • Links the communications system to its relevant use • Provides an advantage or disadvantage for the system <p>OR</p> <ul style="list-style-type: none"> • Identifies TWO communication systems • Provides an advantage or disadvantage for the system 	3
<ul style="list-style-type: none"> • Identifies TWO communication systems <p>OR</p> <ul style="list-style-type: none"> • Identifies a use of one of these communication systems 	2
<ul style="list-style-type: none"> • Provides some relevant information 	1

Sample answer:

The mine could use UHF radios (walkie-talkies) for their security personnel while patrolling the mine. These are lightweight and portable and allow spoken communications between two or more people. They have a limited range however, and this is further affected by terrain.

The workers in the mine could use satellite internet to establish communications with other locations. This would allow voice and data to be transmitted and emails and reports to be sent. The multi-modal nature of satellite communications makes it most suitable for this situation, however, the high cost of set-up and operations is a disadvantage.

Section II

Question 31 (a) (i)

Criteria	Marks
<ul style="list-style-type: none"> Provides information about the hazard and its mitigation 	2
<ul style="list-style-type: none"> Identifies a hazard or an aspect of the mitigation process 	1

Sample answer:

Hot water that can cause burns is used in glassware. Heat-resistant gloves should be used when handling the glassware.

Question 31 (a) (ii)

Criteria	Marks
<ul style="list-style-type: none"> Presents a logical, complete and relevant sequence of steps Identifies ways of ensuring validity and reliability 	4
<ul style="list-style-type: none"> Presents some relevant steps Identifies ways of ensuring validity and/or reliability 	3
<ul style="list-style-type: none"> Presents some relevant steps Identifies a variable OR a step in ensuring validity/reliability 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

Equal weight samples of woollen, cotton and silk fabrics were wrapped securely around separate, identical conical flasks. A fourth conical flask was left unwrapped as a control. Equal volumes of hot water, all at the same temperature, were added to each flask. A thermometer fitted to a rubber bung to seal the flask was placed in each sample of water. The temperature of the water in each flask was recorded every minute until the temperature ceased decreasing. Results from other groups in the class were compared to improve the reliability.

Question 31 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides the features of an environmental impact that is linked to increased use of plastics with reference to the graph 	3
<ul style="list-style-type: none"> Describes an environmental impact of plastic use 	2
<ul style="list-style-type: none"> States an environmental impact OR <ul style="list-style-type: none"> Provides a correct statement related to the graph 	1

Sample answer:

The graph clearly shows that plastic production has increased from 10 million tonnes in 1960 to 265 million tonnes in 2010 and is projected to increase further. Since many plastic products are only used once and most plastics are non-biodegradable, the disposal of used plastics can create environmental problems. Increased plastic waste can make its way into marine environments where it can adversely affect aquatic organisms.

Question 31 (c)

Criteria	Marks
<ul style="list-style-type: none"> Provides TWO relevant reasons for recycling synthetic polymers Explains the desirability of recycling 	4
<ul style="list-style-type: none"> Describes TWO reasons for recycling synthetic polymers 	3
<ul style="list-style-type: none"> States TWO reasons for recycling synthetic polymers OR <ul style="list-style-type: none"> Outlines a reason for recycling synthetic polymers 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

Synthetic polymers are mainly sourced from non-renewable petroleum. As supplies of petroleum decrease, recycling of synthetic polymers could provide raw materials for the polymer industry. Hence, recycling extends the availability of synthetic polymers.

Increased use of non-biodegradable synthetic polymers for one-off use is increasing the demand for landfill space. Recycling of synthetic polymers can reduce landfill requirements.

Question 31 (d) (i)

Criteria	Marks
• Correctly identifies two plastics by type	2
• Names either a thermoplastic or a thermoset plastic	1

Sample answer:

<i>Example of a thermoplastic</i>	<i>Example of a thermoset plastic</i>
Polyethylene	Polyurethane

Question 31 (d) (ii)

Criteria	Marks
<ul style="list-style-type: none"> • Provides a relevant distinction between thermoplastics and thermoset plastics related to properties • Provides a use for each 	4
<ul style="list-style-type: none"> • Provides a property of thermoset plastics and thermoplastics • Provides a use for one 	3
<ul style="list-style-type: none"> • Provides a property of a thermoset plastic or a thermoplastic • Provides a use for one 	2
<ul style="list-style-type: none"> • Provides some relevant information 	1

Sample answer:

Thermoset plastics can be moulded when heated initially but become very rigid on cooling. This prevents the thermoset plastic from being remoulded, even if reheated. Rigid insulation panels are often made of polyurethane.

Thermoplastics can be repeatedly heated, moulded while softened and then set when cooled, eg polyethylene milk bottles can be broken down, reheated and reformed into plastic bags.

Question 31 (e)

Criteria	Marks
<ul style="list-style-type: none"> Identifies synthetic polymers Outlines a range of properties of those polymers Links the identified properties to uses in society Makes a clear judgement based on criteria 	6
<ul style="list-style-type: none"> Identifies synthetic polymers Outlines properties of those polymers Links properties to uses Provides a judgement 	5
<ul style="list-style-type: none"> Identifies a synthetic polymer Provides properties of this polymer Describes uses in society 	4
<ul style="list-style-type: none"> Identifies a synthetic polymer and/or provides properties and/or provides a use in society 	3
<ul style="list-style-type: none"> Identifies a synthetic polymer and/or provides a property and/or provides a use in society 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

PET is a transparent and tough polymer with closely packed polymer chains that prevent the passage of gases. This makes PET suitable for blow moulding of liquid containers, particularly those used to hold pressurised carbonated soft drinks. This has a beneficial impact on society as PET bottles are cheap and easy to manufacture, replacing more fragile glass containers with a leak-proof, easily recyclable alternative.

Polyester has a high melting point and resists solvents well and has a low ability to absorb moisture while resisting creasing. This makes polyester ideal for clothing fabrics and carpets, as polyester will not shrink, while maintaining an uncreased appearance. This has provided society with cheap, hardwearing alternatives to more expensive natural fibres such as wool or cotton.

Question 32 (a) (i)

Criteria	Marks
• Provides information about the hazard and its mitigation	2
• Identifies a hazard or an aspect of the mitigation process	1

Sample answer:

Sodium nitrite can cause irritation if it comes in contact with the eyes. Wear safety glasses to avoid contact.

Question 32 (a) (ii)

Criteria	Marks
• Presents a logical, complete and relevant sequence of steps • Identifies ways of ensuring validity and reliability	4
• Presents some relevant steps • Identifies ways of ensuring validity and/or reliability	3
• Presents some relevant steps • Identifies a variable OR a step in ensuring validity/reliability	2
• Provides some relevant information	1

Sample answer:

1. In three 200 mL beakers, place 5 g of sodium nitrate into 100 mL of water at room temperature.
2. Gently stir the mixture until all the crystals have dissolved.
3. Using a stopwatch, record how long it takes for the salt to dissolve.
4. Repeat steps 1–3 replacing sodium nitrate with sodium nitrite.

Repeating the experiment three times increases the reliability of the data collected. Using the same measurements of liquids, solids, temperature and vigour of stirring increases the validity of the data collected.

Question 32 (b)

Criteria	Marks
<ul style="list-style-type: none"> Makes an explicit reference to the label Provides advantages and/or disadvantages of the labelling system for food products 	3
<ul style="list-style-type: none"> Makes an explicit reference to the label Provides an advantage or disadvantage of the labelling system for food products 	2
<ul style="list-style-type: none"> Makes an explicit reference to the label <p>OR</p> <ul style="list-style-type: none"> Provides an advantage or disadvantage of the labelling system for food products 	1

Sample answer:

FSANZ requires identification of ingredients, in order of quantity. On the label, water is the most abundant ingredient followed by sugars. This information could be critical to a person with diabetes. The manufacturer has the choice of either writing the entire name of the food additive on the ingredient labelling or using an additive description or a code number as shown on the label. With this system, someone who has intolerance to a particular additive can make an informed decision as to whether they should purchase the food or not.

Question 32 (c)

Criteria	Marks
<ul style="list-style-type: none"> Identifies a cause of food spoilage Links the cause of food spoilage to the use of preservation techniques 	4
<ul style="list-style-type: none"> Identifies a cause of food spoilage Links the cause of food spoilage to the use of a preservation technique 	3
<ul style="list-style-type: none"> Identifies a cause of food spoilage Identifies a preservation technique 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

Food spoilage can result from the microbial decomposition of food. Microbes such as bacteria thrive in moist and warm conditions and hence using preservation techniques that limit one or both of these conditions limits the growth of bacteria and preserves food.

Cold temperatures in the fridge slow the growth of microbes and therefore preserve food for longer.

Salting removes the moisture from food which limits the growth of bacteria and hence preserves food.

Question 32 (d) (i)

Criteria	Marks
<ul style="list-style-type: none"> Provides TWO reasons for using additives 	2
<ul style="list-style-type: none"> Provides ONE reason for using additives 	1

Sample answer:

- To enhance appearance
- To improve texture.

Question 32 (d) (ii)

Criteria	Marks
<ul style="list-style-type: none"> Names an additive that is not a preservative Links an advantage to its use Links a disadvantage to its use 	4
<ul style="list-style-type: none"> Names an additive that is not a preservative Links an advantage to its use States a disadvantage <p>OR</p> <ul style="list-style-type: none"> Names an additive that is not a preservative Links a disadvantage to its use States an advantage 	3
<ul style="list-style-type: none"> Names an additive that is not a preservative States an advantage or disadvantage of using the additive 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

During food processing flavour may be lost. MSG is added to enhance flavour and make the food more palatable. However, some people are intolerant to MSG as an additive. Consuming food containing this additive can result in adverse reactions.

Question 32 (e)

Criteria	Marks
<ul style="list-style-type: none"> Identifies food preservation techniques Provides examples to illustrate positive and negative impacts on society Makes a clear judgement of value/outcomes 	6
<ul style="list-style-type: none"> Identifies food preservation techniques Provides example(s) to illustrate positive and negative impact(s) on society Provides a judgement 	5
<ul style="list-style-type: none"> Identifies food preservation technique(s) Provides example(s) to illustrate positive or negative impact(s) on society 	4
<ul style="list-style-type: none"> Identifies food preservation technique(s) Provides an example to illustrate impact(s) or advantages on society 	3
<ul style="list-style-type: none"> Identifies a food preservation technique and an impact on society OR <ul style="list-style-type: none"> Identifies food preservation techniques OR <ul style="list-style-type: none"> Identifies an impact on society or an advantage 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

Food preservation techniques such as canning and refrigeration have a significant impact on society although these impacts have been both positive and negative.

Refrigeration and canning have allowed a wide variety of perishable, exotic and out-of-season foodstuffs to be stored for long periods of time and transported globally. This is important because it allows people access to food that is not otherwise available. It has also created more jobs in a wide range of industries such as manufacturing, recycling and transport which all contribute to the economy, benefiting society.

Preservation techniques reduce the occurrence of food-borne illnesses. This lowers the cost to society in terms of medical expenses, loss of income and reduced productivity, benefiting society. However, some preservation techniques increase consumption of sugars and salts, leading to obesity and heart disease which have a negative effect on society.

Question 33 (a) (i)

Criteria	Marks
• Provides information about the hazard and its mitigation	2
• Identifies a hazard or an aspect of the mitigation process	1

Sample answer:

There is a chance of cultivating pathogens. This can be reduced by sealing Petri dishes and not opening them prior to safe disposal.

Question 33 (a) (ii)

Criteria	Marks
• Presents a logical, complete and relevant sequence of steps • Identifies ways of ensuring validity and reliability	4
• Presents some relevant steps • Identifies ways of ensuring validity and/or reliability	3
• Presents some relevant steps • Identifies a variable OR a step in ensuring validity/reliability	2
• Provides some relevant information	1

Sample answer:

- Sterilise hands and work bench
- Obtain sterile agar plates
- Seal one and set aside as a control
- Using sterile swabs, take samples from different surfaces in the hospital and inoculate each remaining agar plate
- Seal and label each one
- Incubate all plates at the same temperature
- Repeat procedure.

All steps above increase the validity of the investigation and data gathered. Repetition of the procedure will increase the reliability.

Question 33 (b)

Criteria	Marks
<ul style="list-style-type: none"> Identifies cell X Provides two roles of white blood cells 	3
<ul style="list-style-type: none"> Identifies cell X States a role of white blood cells 	2
<ul style="list-style-type: none"> Identifies cell X OR <ul style="list-style-type: none"> States a role of white blood cells 	1

Sample answer:

Cell X is a white blood cell. Two roles are to identify tissue damage and fight infection by recognising, engulfing and digesting any foreign matter.

Question 33 (c)

Criteria	Marks
<ul style="list-style-type: none"> Provides an advantage with a reason why it is an advantage Provides a disadvantage with a reason why it is a disadvantage 	4
<ul style="list-style-type: none"> Provides an advantage with a reason why it is an advantage Provides a disadvantage OR <ul style="list-style-type: none"> Provides a disadvantage with a reason why it is a disadvantage Provides an advantage 	3
<ul style="list-style-type: none"> Provides an advantage with a reason OR a disadvantage with a reason OR <ul style="list-style-type: none"> Provides an advantage AND a disadvantage 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

An advantage of inflammation is that the histamine chemicals released upon injury attract white blood cells to the site to fight infection. This results in more rapid recovery from injury.

A disadvantage is that some allergic reactions cause an over-reaction and an unnecessary release of histamines that in turn give rise to rashes, runny noses or swelling.

Question 33 (d) (i)

Criteria	Marks
<ul style="list-style-type: none"> Identifies the chemical composition of aspirin Identifies a group of pharmaceuticals to which aspirin belongs 	2
<ul style="list-style-type: none"> Identifies the chemical composition of aspirin OR <ul style="list-style-type: none"> Identifies a group of pharmaceuticals to which aspirin belongs 	1

Sample answer:

Aspirin is acetyl salicylic acid.
 Analgesics (pain killers) are a group of pharmaceuticals that aspirin belongs to.

Answers could include:

NSAID, blood thinners.

Question 33 (d) (ii)

Criteria	Marks
<ul style="list-style-type: none"> Outlines a similarity in the responses Outlines a difference in the responses 	4
<ul style="list-style-type: none"> Identifies TWO similarities OR <ul style="list-style-type: none"> Identifies TWO differences OR <ul style="list-style-type: none"> Outlines ONE difference OR <ul style="list-style-type: none"> Outlines ONE similarity 	3
<ul style="list-style-type: none"> Identifies a similarity OR a difference 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

A reflex arc transmits a stimulus along a sensory neuron to the CNS. A response is immediately transmitted from the CNS by passing the brain's pain centre along a motor neuron to a muscle to respond to the stimulus.

The response to a painful stimulus passes from the pain receptor, along the sensory neuron to the CNS then to the brain's pain centre which interprets the impulse as pain.

Question 33 (e)

Criteria	Marks
<ul style="list-style-type: none"> Provides TWO biological/structural effects of antibiotics Describes both positive and negative impacts of antibiotic use on society 	6
<ul style="list-style-type: none"> Provides TWO biological/structural effects <p>AND</p> <ul style="list-style-type: none"> Outlines ONE positive and ONE negative impact on society <p>OR</p> <ul style="list-style-type: none"> Outlines TWO positive impacts on society <p>OR</p> <ul style="list-style-type: none"> Outlines TWO negative impacts on society 	5
<ul style="list-style-type: none"> Provides ONE biological/structural effect Outlines ONE impact on society 	4
<ul style="list-style-type: none"> Provides ONE biological/structural effect <p>AND</p> <ul style="list-style-type: none"> Identifies ONE impact on society 	3
<ul style="list-style-type: none"> Provides ONE biological/structural effect <p>OR</p> <ul style="list-style-type: none"> Identifies ONE impact on society 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

Antibiotics are a group of natural and synthetic chemicals that kill or inhibit the growth of bacteria.

Some antibiotics prevent the cell wall from forming on newly divided bacterium while others interfere with the cell division process. This means that when antibiotics are introduced into infected humans, they attack the bacteria but not the normal body cells because animal cells have no cell walls.

The body's immune system is then able to cope with the depleted bacterial invasion and destroys the remaining bacteria.

Antibiotics have had an impact on society since they were first introduced, by reducing the number of deaths due to bacterial infections like cholera, typhoid fever etc. The result of this is increased longevity and better health standards for society. A negative impact stems from the overuse of antibiotics. Bacteria can mutate and multiply rapidly and as well as antibiotics killing off 'beneficial' bacteria, antibiotic resistant strains of bacteria are increasing so that there are now strains of bacteria, such as MDR tuberculosis, that resist treatment. This could lead to epidemics that will dramatically affect large populations in society until new antibiotics can be developed.

Question 34 (a) (i)

Criteria	Marks
• Provides information about the hazard and its mitigation	2
• Identifies a hazard or an aspect of the mitigation process	1

Sample answer:

The students should carry out the investigation in a fume cupboard because the burning leaves could produce gases that could harm them if inhaled.

Question 34 (a) (ii)

Criteria	Marks
• Presents a logical, complete and relevant sequence of steps • Identifies ways of ensuring validity and reliability	4
• Presents some relevant steps • Identifies ways of ensuring validity and/or reliability	3
• Presents some relevant steps • Identifies a variable OR a step in ensuring validity/reliability	2
• Provides some relevant information	1

Sample answer:

1. Weigh out the same mass of dried leaves from different types of trees.
2. Place the leaves from one type of tree on a fireproof, ventilated support in a fume cupboard.
3. Light the leaves at the bottom of the pile in the centre.
4. Time how long the leaves take to burn and record the time.
5. Repeat steps 2–4 for each type of leaf, allowing the chamber to reach the same conditions of temperature and humidity each time the experiment begins.
6. Repeat the process for each type of leaf at least three times to check that the results are reliable.

Validity is ensured when each step is carried out in exactly the same way, just varying the type of leaf being tested.

Question 34 (b)

Criteria	Marks
<ul style="list-style-type: none"> Identifies TWO types of fire extinguisher AND states a use of each 	3
<ul style="list-style-type: none"> Identifies a type of fire extinguisher AND states a use OR	2
<ul style="list-style-type: none"> Identifies TWO types of fire extinguisher 	
<ul style="list-style-type: none"> Identifies a type of fire extinguisher 	1

Sample answer:

Carbon dioxide extinguishers are used on electrical fires.
 Powder BE extinguishers are suitable for use on burning fats and cooking oils.

Question 34 (c)

Criteria	Marks
<ul style="list-style-type: none"> States a limitation of each type of seismograph and a reason for the limitation Provides information about the type of earthquake wave that can be detected using each type of seismograph 	4
<ul style="list-style-type: none"> States a limitation of one of the seismographs and a reason for the limitation Provides information about the earth movements associated with each type of earthquake wave OR	3
<ul style="list-style-type: none"> States a limitation of each type of seismograph and a reason for the limitation Provides information about the earth movements associated with one type of earthquake wave 	
<ul style="list-style-type: none"> States a limitation of one of the seismographs and a reason for the limitation OR	2
<ul style="list-style-type: none"> Provides information about the earth movements associated with types of earthquake wave OR	
<ul style="list-style-type: none"> Identifies limitations of one instrument OR	
<ul style="list-style-type: none"> Correctly describes propagation of two of <i>P</i>, <i>S</i> and <i>L</i> waves 	1
<ul style="list-style-type: none"> Provides some relevant information 	

Sample answer:

Seismograph *A* can only detect vertical movements associated with earthquake waves. Hence it is suitable for monitoring *S* waves, and *P* waves under some circumstances.

Seismograph *B* can be used to monitor either *P* or *L* waves which cause the ground to vibrate horizontally, the type of motion that *B* can detect. However, this type of seismograph cannot detect *P* waves when they propagate perpendicular to the plane in which the pendulum swings, nor can it detect *L* waves when they propagate along the direction parallel to the plane in which the pendulum swings.

Question 34 (d) (i)

Criteria	Marks
• Relates factors involved in the formation of tornados	2
• Provides a factor that contributes to the formation of tornados	1

Sample answer:

Horizontal wind shear creates a vortex between air layers. Rising air causes the vortex to become vertical, producing a tornado.

Question 34 (d) (ii)

Criteria	Marks
<ul style="list-style-type: none"> • Presents information about how the light is used, related to its reflection/scattering, detection and analysis • Identifies specific uses of LIDAR • Provides examples of information obtained 	4
<ul style="list-style-type: none"> • Presents aspects of the process • Outlines a specific use of LIDAR • Provides an example of information obtained 	3
<ul style="list-style-type: none"> • Presents aspects of the process OR <ul style="list-style-type: none"> • Identifies one aspect of the process and identifies a use of LIDAR 	2
<ul style="list-style-type: none"> • Presents some relevant information 	1

Sample answer:

Laser light of several frequencies is shone upwards into the atmosphere. The amount of light scattered back to detectors on the ground at the same frequency is processed using computers (or analysed) to extract information about the amount of water and types of clouds present at different altitudes.

Answers could include:

- Measurement of the amount of water, type and altitude of clouds and wind speed (using the Doppler effect)
- Information about the pulsing of the laser light.

Question 34 (e)

Criteria	Marks
<ul style="list-style-type: none"> Relates features of long-term weather patterns to their effects and the preparation for possible bushfire events Relates features of short-term weather patterns to their effects, and the preparation for possible bushfire events 	6
<ul style="list-style-type: none"> Relates features of long-term and features of short-term weather patterns to their effects Relates an aspect of the preparation for possible bushfire events to the monitoring of weather 	5
<ul style="list-style-type: none"> Relates a feature of long-term and short-term weather patterns to their effects Relates an aspect of the preparation for possible bushfire events to the monitoring of weather 	4
<ul style="list-style-type: none"> Relates features of weather to their effects Relates an effect of weather to bushfires 	3
<ul style="list-style-type: none"> Identifies effects of weather on bushfires or preparation for them 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

Favourable weather, such as regular rainfall over several years, can lead to a build-up of fuel load in the form of both living plant material as well as dead leaves and bark. The longer the favourable conditions last, the greater the fuel load accumulation. Monitoring long-term weather patterns can assist in predicting fuel load build-up and mitigating risks by controlled burning and clearing firebreaks during safe periods when rain is predicted and winds are low.

Fuel load build-up followed by a season with lower-than-average rainfall causes plants to die or drop leaves and branches. As these dry out they become fuel for large fires.

High temperatures and low humidity increase the fire risk and combined with dry winds and a source of ignition, such as lightning or human activity, can result in a fire spreading rapidly. Monitoring short-term weather conditions so as to put in place measures such as fire bans, having additional fire crews ready and alerting people to be ready for evacuation can reduce the impact of bushfire events.

Because large fires generate their own local winds that spread embers and accelerate the fire spread, being prepared for bushfire events through the monitoring of immediate weather conditions and long-term patterns that lead to dangerous fuel loads can reduce the effects of bushfires.

Question 35 (a) (i)

Criteria	Marks
• Provides information about the hazard and its mitigation	2
• Identifies a hazard or an aspect of the mitigation process	1

Sample answer:

The astronaut may injure their spine if they are bending it under load. They should ensure that they maintain a straight lower spine when performing these motions.

Question 35 (a) (ii)

Criteria	Marks
<ul style="list-style-type: none"> • Identifies TWO plausible activities • Relates the activities to their use in exercising leg muscles 	4
<ul style="list-style-type: none"> • Identifies TWO activities • Relates ONE of the activities to its use of leg muscles 	3
<ul style="list-style-type: none"> • Identifies TWO activities OR <ul style="list-style-type: none"> • Relates ONE activity to exercising leg muscles 	2
• Provides some relevant information	1

Sample answer:

Treadmill – An astronaut could be tethered to a treadmill with elastic material to stop them floating off. This would exercise all the major muscles while allowing exercise of the cardiorespiratory system.

Squats – An astronaut could lift a large force against a spring. This allows the muscles to work against a large force and thus maintain muscle mass and avoid muscle atrophy.

Question 35 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides a correct judgement about the accuracy of the diagrams Provides correct criteria for the judgement 	3
<ul style="list-style-type: none"> Provides correct or incorrect features of two diagrams 	2
<ul style="list-style-type: none"> Identifies a correct or incorrect feature of a diagram 	1

Sample answer:

The first two diagrams are relatively accurate as the density of the particles does get less as altitude increases.

The last diagram shows no particles in deep space. This is inaccurate as there are always particles in space.

Question 35 (c)

Criteria	Marks
<ul style="list-style-type: none"> Provides TWO relevant examples of requirements Relates each to astronauts' survival 	4
<ul style="list-style-type: none"> Provides TWO relevant examples and relates ONE to survival 	3
<ul style="list-style-type: none"> Provides TWO relevant examples <p>OR</p> <ul style="list-style-type: none"> Relates an example to survival 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

- Protection from radiation*
An effective shield would be required to protect astronauts from tissue-damaging, ionising cosmic radiation.
- Breathable atmosphere*
The atmosphere would need the oxygen to be replenished and the carbon dioxide removed from it. Without it, the astronauts would become hypoxic or suffer carbon dioxide poisoning, both fatal.

Answers could include:

References to climate control, food and water.

Question 35 (d) (i)

Criteria	Marks
• Identifies TWO relevant limitations	2
• Identifies a limitation	1

Sample answer:

- Atmospheric interference
- Position on surface limits view of certain parts of the sky.

Question 35 (d) (ii)

Criteria	Marks
• Provides TWO solutions to the limitations • Provides a detailed reason why each solution has overcome the limitation	4
• Provides TWO solutions to limitations • Outlines a reason to why a solution has overcome a limitation	3
• Provides TWO solutions OR • Identifies a solution linked to a limitation	2
• Provides a solution	1

Sample answer:

Atmospheric interference can distort images obtained by a ground-based telescope. Placing a telescope in space, such as the HST, greatly eliminates the interference caused by the atmosphere.

Using space probes has allowed parts of the solar system not easily viewed by ground-based telescopes to be studied in detail, such as the North pole of Saturn by Voyager 1.

Question 35 (e)

Criteria	Marks
<ul style="list-style-type: none"> Identifies examples of past space vehicles Identifies features of past space vehicles that have been used in subsequent vehicles Makes a judgement about using these features 	6
<ul style="list-style-type: none"> Identifies examples of past space vehicles Identifies features of past vehicles used in subsequent vehicles Provides a benefit of ONE of these features 	5
<ul style="list-style-type: none"> Identifies examples of past space vehicles Identifies some features of these vehicles 	4
<ul style="list-style-type: none"> Identifies examples of past space vehicles OR <ul style="list-style-type: none"> Identifies some features of space vehicles 	3
<ul style="list-style-type: none"> Identifies an example or a feature of a past space vehicle 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

The single stage V2 rocket developed during WWII was limited in both its maximum payload and its range. It was not able to launch even light payloads into orbit. Ongoing research then led to multistage rockets, such as the Saturn V. The benefits were that it was able to lift heavy payloads into orbit and even send astronauts to the moon.

The Space Transport System (STS) was the first system to utilise reusable components in order to reduce the cost of space flight. The latest version of reusable rockets, by Space X, uses a booster stage that then falls back to Earth and lands vertically. This allows it to be reused and significantly reduces the cost of space flight.

2018 HSC Senior Science Mapping Grid

Section I Part A

Question	Marks	Content	Syllabus outcomes
1	1	9.3.1.2.1	H3
2	1	9.4.6.2.1, 9.4.6.2.2, 9.4.6.3.1	H3, H10
3	1	9.3.2.2.8, 9.3.2.2.9, 9.3.2.3.6	H3, H7, H9
4	1	9.2.5.2.1	H9
5	1	9.2.1	H8
6	1	9.2.5.2.1, 9.2.5.2.2, 9.5.2.2.3	H7, H9
7	1	9.2.1.3.3, 9.2.1.2.3, 9.2.2.2.1, 9.2.4.2.1, 9.2.4.2.2, 9.2.4.2.3	H8
8	1	9.3.3.2.6, 9.3.3.2.7	H6, H9
9	1	9.4.1.2.1	H10
10	1	9.3.4.2.1, 9.3.4.3.1	H9
11	1	9.3.2.2.4	H7, H10
12	1	9.3.2.3.1, 9.3.4.3.2	H9, H14
13	1	9.2.4.3.1, 9.2.5.2.3, 11.2c	H7, H8, H9, H11
14	1	9.3.4.3.2, 13.1e, f	H13
15	1	9.4.2.2.2, 9.4.3.2.3	H10
16	1	9.2.5	H7, H8, H14
17	1	9.4.3, 12.3C, 14.1f	H10, H12
18	1	9.2.3.2.2	H7, H8
19	1	9.4.4.2.1	H10, H14
20	1	9.4.6.2.1, 9.4.6.2.2	H10, H14

Section I Part B

Question	Marks	Content	Syllabus outcomes
21 (a)	2	9.2.1.3.1	H8
21 (b)	2	9.2.1.3.1, 9.2.2.2.5	H4, H8
22 (a)	2	9.4.1.3.2	H4, H10
22 (b)	4	9.4.1.2.6, 9.4.2.2.1	H10
23 (a)	2	9.2.1.2.4, 9.2.1.2.4.5, 9.2.1.3.4	H8
23 (b)	3	11.2c, 11.2d	H11
24	6	9.3.4.2.1, 9.3.4.2.2	H9
25 (a)	1	9.2.3.2.5	H8
25 (b)	3	9.2.3.2.2, 9.2.3.2.3, 9.2.3.2.4, 9.2.3.3.2	H8, H9
26 (a)	4	9.3.2.3.1, 12.3c, 13.1f	H9, H12, H13
26 (b) (i)	1	9.3.2.3.1, 14.3c	H14
26 (b) (ii)	3	9.3.2.3.1, 11.2	H9, H11, H12

Question	Marks	Content	Syllabus outcomes
27 (a)	2	9.4.1.2.1, 9.4.1.3.2, 12.1a, 14.2, 14.3a	H10, H12, H14
27 (b)	3	9.4.6.2.1, 9.4.6.2.2, 9.4.6.3.1	H10
28	6	9.3.3.2.4-10, 9.3.3.3.6	H8, H9
29 (a)	2	9.3.3.2.2, 9.3.3.3.2	H9
29 (b)	3	9.3.3.3.3	H9
30	6	9.4.1.2.6, 9.4.2.2.2-3, 9.4.3.2.1	H10

Section II

Question	Marks	Content	Syllabus outcomes
Question 31		Polymers	
(a) (i)	2	9.5.1.3.2	H12.1b, d
(a) (ii)	4	9.5.1.2.3-4, 9.5.1.3.2	H11.2
(b)	3	9.5.4	H4, H8
(c)	4	9.5.4	H4, H8
(d) (i)	2	9.5.3.2.2-3	H8
(d) (ii)	4	9.5.3.2.2, 9.5.3.2.4	H6, H8
(e)	6	9.5.2	H4, H8
Question 32		Preservatives and Additives	
(a) (i)	2	9.6.2.3.2	H12.1b, d
(a) (ii)	4	9.6.2.3.2	H11.2
(b)	3	9.6.5.2.3, 9.6.5.2.4, 14.3b	H4, H14
(c)	4	9.6.3.2.2, 9.6.4.3.1	H3, H8
(d) (i)	2	9.6.2.2.4	H8
(d) (ii)	4	9.6.2.2.4	H4, H8
(e)	6	9.6.2.3.7	H4
Question 33		Pharmaceuticals	
(a) (i)	2	9.7.4.3.2	H12.1b, d
(a) (ii)	4	9.7.4.3.2	H11.2
(b)	3	9.7.2.2.4	H9
(c)	4	9.7.3.2.1-4, 9.7.3.3.1	H9
(d) (i)	2	9.7.3.2.6	H8, H9
(d) (ii)	4	9.7.1.2.6, 9.7.3.2.5/7	H9
(e)	6	9.7.4.2.5/6	H4, H8, H9
Question 34		Disasters	
(a) (i)	2	9.8.3.3.6	H12.1b, d
(a) (ii)	4	9.8.3.3.6	H11.2

Question	Marks	Content	Syllabus outcomes
(b)	3	9.8.4.3.1	H8
(c)	4	9.8.3.2.1/2	H10
(d) (i)	2	9.8.2.2.1/3	H10
(d) (ii)	4	9.8.2.2.5	H1, H10
(e)	6	9.8.3.2.5/7/8, 9.8.2	H1, H10
Question 35		Space Science	
(a) (i)	2	9.9.3.3.1	H12.1b, d
(a) (ii)	4	9.9.3.3.1	H11.2
(b)	3	9.9.1.2.3, 9.9.1.3.1	H14
(c)	4	9.9.5.2.1, 9.9.5.3.5	H3
(d) (i)	2	9.9.5.3.3	H1
(d) (ii)	4	9.9.5.2.4, 9.9.5.3.3	H3
(e)	6	9.9.4.3.1, 9.9.4.3.2	H3, H5