



**DEPARTMENT OF
EDUCATION**

**UPPER SECONDARY
SCHOOL
CERTIFICATE
EXAMINATIONS**

**APPLIED
SCIENCE**

Monday

26 October 2015

Time allowed:

2 hours and 30 minutes

(11:00 am – 1:30 pm)

NO EXTRA TIME

(NO OTHER TIME)

Candidates are advised to
fully utilise the allocated
time

AS

INSTRUCTIONS TO CANDIDATES

(To be read by the external invigilator to all candidates)

1. The subject code for **Applied Science** is **9**.
2. There are **11** printed pages in the Question Booklet, One Part A Electronic Answer Sheet and **7** printed pages in the Part B Answer Booklet. There are two sections in this paper. Answer all questions.

Section A: Multiple Choice Questions - 30 marks

This section will be electronically marked.

Electronic Answer Sheet is provided. All answers to the Multiple Choice Section **MUST** be answered on this Answer Sheet.

Carefully following the instructions, fill in your Candidate Information and Subject Information.

Section B: Short Answer Questions - 70 marks

Write down your name, your school name and your 10 digit candidate number on the Section B Answer Booklet Provided.

3. You are required to only write the correct answer in the space provided.
4. Calculators may be used.
5. Answers written on the question paper will not be marked. Write answers neatly in spaces as allocated on the answer sheet. Answer **ALL** questions.
6. Answer all questions on the answer sheet. Answers on any other paper including rough work paper and the question paper **will not be marked**.
7. ALL working must be shown step by step to get full marks. Students may lose marks for writing down final answers only.
8. Enough spaces have been allocated for answers to every question. Questions must be answered in spaces as allocated. Answers all over the answer booklet may not be marked.
9. Correctional Fluid is not allowed on the answer sheet. Where you have made an error, cross out all the working and start on a new line.
10. Graphical Calculators are not permitted.

**PENALTY FOR CHEATING OR ASSISTING TO CHEAT IN
NATIONAL EXAMINATIONS IS NON-CERTIFICATION.**

DO NOT TURN OVER THE PAGE

AND DO NOT WRITE

UNTIL YOU ARE TOLD TO START.

SECTION A: MULTIPLE CHOICE**(QUESTIONS 1 to 30)****1 MARK EACH**

Answer each question by shading in with **HB pencil**, the circle directly under the correct alternative **A, B, C, or D**.

If you make a mistake, rub it out completely using an eraser rubber and shade the correct answer on the **Electronic Answer Sheet**.

QUESTION 1

Slaked lime is used to remove _____ from the waste gases produced in coal power stations.

- A. carbon monoxide B. nitrogen dioxide C. sulphur dioxide D. methane

QUESTION 2

Biotechnology can be defined as any application that uses _____ to make or modify _____ for specific use.

- A. biological systems, food B. living organisms, antibiotics
C. biological systems, products D. living organisms, body parts

QUESTION 3

Some food items today are not entirely grown or reared by natural means. These food items are universally labeled as GM Foods that are derived from GMO's.

What does GMO stand for?

- A. genetically modified organelles B. genetically mixed-up organelles
C. genetically modified organisms D. genetically mixed-up organisms

QUESTION 4

This fermentation equation represents _____ produced by micro-organisms.

- A. alcohol B. galactose C. lactose D. acetic acid

QUESTION 5

What is the safest and appropriate way to put out a flaming jar of alcohol in a laboratory experiment?

- A. Pour the alcohol into the sink. B. Pour some water into the jar
C. Cover the flaming jar with a lid D. Let the alcohol burn out.

QUESTION 6

DDT (dichlorodiphenyltrichlorethane) is

- A. a biodegradable pollutant.
- B. a non-biodegradable pollutant.
- C. an air pollutant.
- D. an antibiotic.

QUESTION 7

Which of these is the most significant cause of species extinction worldwide?

- A. water pollution
- B. habitat destruction
- C. alien species
- D. acid rain

QUESTION 8

Grassland biomass has been affected by human activity. The biggest impact is

- A. hunting.
- B. global warming
- C. making fires
- D. farming

QUESTION 9

The process of purifying seawater to obtain freshwater is called

- A. dehydration.
- B. desalination.
- C. hydrolysis.
- D. fractional distillation.

QUESTION 10

Fish die in water bodies polluted by sewage due to

- A. pathogens.
- B. bad smell.
- C. reduction in dissolved oxygen.
- D. clogging of gills by sewage material.

QUESTION 11

Wind energy relies on

- A. moon's gravitational pull.
- B. solar energy.
- C. geothermal energy.
- D. water power.

QUESTION 12

The presence of carbon monoxide (CO) in exhaust gas means

- A. high thermal efficiency.
- B. high excess air.
- C. poor combustion.
- D. carbon deficiency

QUESTION 13

What type of chemical reaction occurs in traditional practice of making lime from seashells?

- A. Combustion B. Synthesis C. Decomposition D. Precipitation

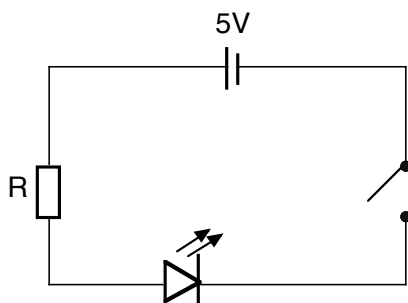
QUESTION 14

When a person receives a shock from using electrical appliance, the immediate thing one should **NOT** do is

- A. turn off the main power switch B. touch the person
C. call for help D. carefully unplug the electrical appliance

QUESTION 15

An LED rated at 5V is connected as shown.



What value of resistor will see the LED radiate the brightest?

- A. $333\text{K}\Omega$ B. $5\text{M}\Omega$ C. 333Ω D. $10\text{K}\Omega$

QUESTION 16

In a process called *close loop control*, oxygen sensors monitor the amount of oxygen in the exhaust and report this to a module. This module uses the information to adjust the air-to-fuel ratio in real-time.

What is the name of the module?

- A. Oxygen Detection Unit (ODU) B. Transmission Control Unit (TCU)
C. Engine Control Unit (ECU) D. Catalytic Converter Unit (CCU)

QUESTION 17

Food analysis methods used to determine various forms of carbohydrate include all of the following, except for

- A. triglycerides B. dietary fibre
C. available carbohydrates D. total carbohydrates

QUESTION 18

Which of these is **NOT** a benefit of having mangrove forests?

- A. acts as buffer zones between land and sea
- B. provide breeding and nursery grounds for marine organisms
- C. contribute to pollution by trapping rubbish
- D. provide good source of timber, fuel and fodder

QUESTION 19

An excessive amount of which two substances causes the eutrophication of water bodies?

- A. hydrogen ion and hydroxide ion
- B. magnesium ion and calcium ion
- C. oxygen and ozone
- D. phosphorous and nitrogen

QUESTION 20

Water is often treated with chlorine to

- A. increase oxygen content
- B. kill harmful bacteria
- C. cause sedimentation
- D. remove insoluble solids

QUESTION 21

A portable AC generator of 0.950 kW power rating in theory, can support the following appliances running simultaneously.

- A. a 1200 watt grinder and a 40 watt florescent light
- B. a 450 watt bar fridge and a 600 watt jug
- C. six 40 watt fluorescent lights and two 355 watt rice cookers
- D. a 450 watt bar fridge and a 600 watt HiFi stereo system

QUESTION 22

Which of the following gases is **NOT** a greenhouse gas?

- A. carbon monoxide
- B. carbon dioxide
- C. methane
- D. water vapour

QUESTION 23

Two FM transmitters, one with center frequency of 92.5MHz and bandwidth of 500 kHz; the other with a frequency of 92.6MHz and bandwidth of 500kHz, operate in close proximity to each other.

What is likely to happen in such a circumstance?

- A. The transmitters are on two different frequencies and so they will successfully transmit.
- B. The transmitters' bandwidths overlap therefore will interfere with each other such that successful transmission will not happen.
- C. The transmitters' frequencies sum up to give a new frequency at 185.1MHz
- D. The higher frequency transmitter will force the lower frequency transmitter to act as a receiver.

QUESTION 24

Biodiesel is a product of two natural compounds.

What are they?

- A. alcohol and ester
- B. alkene and ester
- C. alcohol and ketone
- D. ester and ketone

QUESTION 25

Natural oil is extracted from many parts of a plant. Which part of the sandal tree is natural oil extracted from?

- A. leaves
- B. flowers
- C. wood
- D. root

QUESTION 26

Select from the list below that which is **NOT** primarily used in recombinant DNA technology.

- A. restriction endonucleases
- B. DNA ligase
- C. plasmid.
- D. lipase

QUESTION 27

Incineration method of waste disposal involves

- A. burying of solid wastes underground.
- B. burning of solid wastes in an enclosed space.
- C. biological decomposition of liquid waste in a sedimentation tank.
- D. settling and chemical treatment of liquid in a pond.

QUESTION 28

Biodegradable materials are decomposed by the _____ activity of fungi, bacteria and other organisms in the presence of air and _____.

- A. denaturing; moisture
B. denaturing; sunlight
C. enzymatic; moisture
D. enzymatic; sunlight

QUESTION 29

Which one of these is not used in chemical preservation methods?

- A. sulfites
B. propionettes
C. sorbates
D. ionizing radiation

QUESTION 30

What is the correct nuclear equation for alpha decay of ${}^{234}_{94}\text{Pu}$?

- A. ${}^{230}_{92}\text{Pu} \rightarrow {}^{234}_{94}\text{P} + {}^0_{-1}\text{e} + \text{V}$
B. ${}^{230}_{92}\text{U} \rightarrow {}^{234}_{94}\text{Pu} + {}^4_2\text{He}$
C. ${}^{234}_{94}\text{Pu} \rightarrow {}^{230}_{92}\text{U} + {}^4_2\text{He}$
D. ${}^{234}_{94}\text{Pu} \rightarrow {}^{230}_{92}\text{U} + {}^0_{-1}\text{e} + \text{V}$

SECTION B: SHORT ANSWERS**(QUESTIONS 31 to 40)****70 MARKS**

There are 10 questions in this section. Each question is worth 7 marks. Write the answers to ALL the Questions on the spaces provided in the Section B Answer Booklet.

QUESTION 31

- (a) What term is used to describe the technology and use of living systems and organisms to make products?
(1 mark)
- (b) What is the name of the fuel obtained by reacting vegetable oil or animal fats and oils with alcohols?
(1 mark)
- (c) In PNG three important plant based oils are locally and internationally marketed. Name them.
(3 marks)
- (c) What are the two major raw material reactants in the soap making process?
(2 marks)

QUESTION 32

- (a) Lead is extracted by heating its oxide (lead oxide) with carbon to produce lead metal and carbon monoxide.
- (i) Write the balanced chemical equation for this reaction. (2 marks)
- (ii) Which substance is a reducing agent? (1 marks)
- (b) Sodium is extracted from rock salt (sodium chloride) by electrolysis of molten sodium chloride
- (i) Write the balanced chemical equation for this reaction. (2 marks)
- (ii) State which ion is oxidized and which ion is reduced. (2 marks)

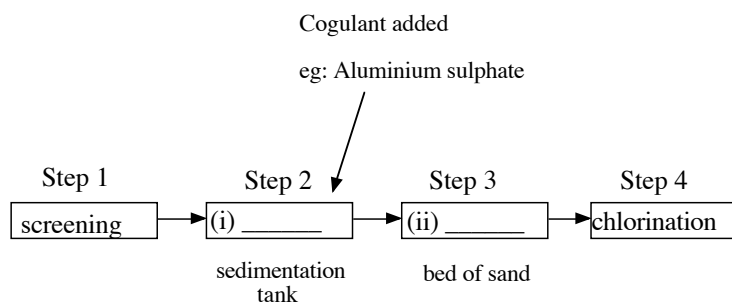
QUESTION 33

- (a) Ozone is an important chemical compound in the ozone layer which protects us from the sun's harmful ultraviolet (UV) radiation.
- (i) Write the chemical formula for ozone. (1 mark)
- (ii) Name the man-made pollutant that reacts with ozone contributing to the depletion of the ozone layer.
(1 mark)
- (iii) Name one serious human health problem of overexposure to ultraviolet radiation. (1 mark)
- (b) (i) Define global warming. (1 mark)
- (ii) Name the main gas and identify the human activity that produces this gas thus leading to global warming.
(2 marks)
- (iii) How does deforestation contribute to global warming? (1 mark)

QUESTION 34

(a) The flow diagram shows steps involved in purifying drinking water.

(i) Fill in the blank spaces to complete the diagram. (2 marks)



(ii) What is a coagulant and what is it used for? (2 marks)

(iii) Name one human disease caused by drinking untreated drinking water. (1 mark)

(b) What causes temporary hardness in water and how can it be softened? (2 marks)

QUESTION 35

(a) Explain the statement. **“Mangroves act as buffer zones between land and sea.”** (2 marks)

(b) (i) Define ‘Sustainable Forestry’ (1 mark)

(ii) In Sustainable Forestry Practices, what are the two key things forest managers should do before harvesting the forest? (2 marks)

(d) In the guidelines for Best Practices of Waste Management, after registering source, type of waste and registered waste carrier, what are the next two things that are done? (2 marks)

QUESTION 36

(a) HIV and AIDS have a number of effects on society from different contexts.

Describe two ways in which the family/society can be affected. (2 marks)

(b) What does the term ‘Crisis Management’ mean? (2 marks)

(c) Counseling practices for behavioral problems are usually carried out by medical specialists called _____. (1 mark)

(d) Name two natural disasters that have been known to occur in PNG. (2 mark)

QUESTION 37

- (a) There are 3 ways in which diabetes develop in humans. Lack of insulin production is one reason.
State the other two. (2 marks)
- (b) Complete the following by filling in the gaps with words in (i) and completing the statements in (ii) and (iii).
- (i) A _____ occurs when _____ to a part of the brain is cut off. (2 marks)
- (ii) Normal adult blood pressure ranges between 120/80 – 140/90 mmHg. If a person's blood pressure is elevated and stays above their normal, the person is said to have _____. (1 mark)
- (iii) Blood pressure readings typically record 2 numbers; eg, 120/80mm/Hg
120 measures _____ (1 mark)
80 measures _____ (1 mark)

QUESTION 38

- (a) Filtration methods are heavily used in the beverage industry. Explain why filters of pore sizes $\leq 0.45\mu\text{m}$ are used. (1 mark)
- (b) Why is it that the beverage industry uses filtration methods and not any form of heating to sterilize the beverages? (2 marks)
- (c) How does the effect of salting or soaking food in brine solutions affect potential food spoilage microbes? (1mark)
- (d) How do the following methods preserve food? (3 marks)
- (i) Pasteurization
- (ii) Chilling
- (iii) non-ionizing radiation

QUESTION 39

- (a) Two brand new cars with identical engine capacity (horse power, fuel tank) were selected for Range Test. Car A uses petrol while Car B uses diesel and both tanks were filled to maximum. Both cars were driven non-stop until their tanks were empty.
Explain why Car B which runs on diesel covered the longest distance. (2 marks)
- (b) Fossil fuels were formed over millions of years. What fossil fuel was formed from hard plant matter? (1 mark)

- (c) In a nuclear reactor, assume that the number of uranium rods removed is directly proportional to the drop in the temperature of the reactor.

The table below shows a portion of the data collected.

Temperature Drop (°F)	5	10	15	20	25	30	35	40	45
Rods removed	2	4	6	8	10	12	14	16	18

- (i) How many rods would have to be pulled out of the reactor if we were to lower the temperature from 1000°F to 800°F? (1 mark)
- (ii) Sketch the graph of ‘Temperature versus Number of Rods’ correctly labeling it. (2 marks)
- (iii) Write the equation of the graph using appropriate variables. (1 marks)

QUESTION 40

- (a) An oscillating circuit outputs a 2.4GHz resonating frequency governed by the equation

$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

where; f_0 is the resonance frequency in Hertz
L is the inductance in Henry
C is the capacitance in Farad

The circuit was constructed using a capacitor of unknown value, an inductor of $0.01\mu\text{H}$, and other components.

Calculate the value of the capacitor required for this circuit. (2 marks)

- (b) In cell phone technology a certain technique used that allows several callers to send information simultaneously (at the same time) over a single communication channel.

What is this technique called? (1 mark)

- (c) Connecting a wire from the negative to the positive of a battery will produce a _____.

(1 mark)

- (d) A technician connects a DC fan to a battery but notices that the fan blades are rotating in reverse direction, which is wrong. What should he do to get the fan rotating in the correct direction?

(1 mark)

- (e) Some electronic circuits require a power supply that can deliver negative voltage, positive voltage and zero volts which is also known as ground.

You are given two batteries of the same current rating and voltage rating of 12V. Draw a diagram of how you would connect the two batteries to obtain -12V, 0V and +12V and indicate which terminals carry negative, positive and zero volts.

(2 marks)

END OF EXAMINATION

APPLIED SCIENCE

SECTION B – ANSWER BOOKLET

Write your name, province and school codes and your candidate number correctly and clearly in the spaces provided below.

Year		Province		School			Candidate		
1	5								

Candidate Name: _____

School Name: _____

ANSWERS WRITTEN ON THE QUESTION PAPER OR ANY OTHER PAPER WILL NOT BE MARKED.

WRITE ANSWERS NEATLY IN THE SPACES PROVIDED IN THIS ANSWER BOOKLET

FOR MARKERS USE ONLY

	Score	Markers' Initials	
		Marker 1	Marker 2
SECTION B			
QUESTION 31			
QUESTION 32			
QUESTION 33			
QUESTION 34			
QUESTION 35			
QUESTION 36			
QUESTION 37			
QUESTION 38			
QUESTION 39			
QUESTION 40			
	70		

START YOUR WORK ON THE NEXT PAGE

SECTION B - ANSWERS

Write your answer in the space provided below. Your answers must be clear and precise.

QUESTION 31	Mark/ Question	Mark Scored
a) _____	1	
b) _____	1	
c) i. _____		
ii. _____	3	
iii. _____		
d) i. _____		
ii. _____	2	
For Markers Use Only	Q 31 Total	7

QUESTION 32	Mark/ Question	Mark Scored
a) (i) _____	2	
(ii) _____	1	
b) i) _____	2	
(ii) oxidized ion _____		
reduced ion _____	2	
For Markers Use Only	Q 32 Total	7

QUESTION 33	Mark/ Question	Mark Scored
<p>a) (i) _____</p> <p>(ii) _____</p> <p>(iii) _____</p> <p>b) (i) _____</p> <p>_____</p> <p>(ii) main gas: _____</p> <p>human activity: _____</p> <p>_____</p> <p>(iii) _____</p> <p>_____</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	
<p>For Markers Use Only</p> <p style="text-align: right;">Q 33 Total</p>	<p>7</p>	

QUESTION 34	Mark/ Question	Mark Scored
<p>a) i) step 2 _____</p> <p>step 3 _____</p> <p>ii) _____</p> <p>_____</p> <p>iii) _____</p> <p>(b) _____</p> <p>_____</p>	<p>2</p> <p>2</p> <p>1</p> <p>2</p>	
<p>For Markers Use Only</p> <p style="text-align: right;">Q 34 Total</p>	<p>7</p>	

QUESTION 35	Mark/ Question	Mark Scored
a) _____ _____ _____	2	
b) i) _____	1	
ii) 1. _____ 2. _____	2	
c) 1. _____ 2. _____	2	
For Markers Use Only Q 35 Total	7	

QUESTION 36	Mark/ Question	Mark Scored
a) 1. _____ 2. _____	2	
b) _____ _____	2	
c) _____	1	
d) 1. _____ 2. _____	2	
For Markers Use Only Q 36 Total	7	

QUESTION 37	Mark/ Question	Mark Scored
<p>(a) 1. _____</p> <p>2. _____</p> <p>(b) (i) A _____ occurs when _____ to a part of the brain is cut off.</p> <p>(ii) _____</p> <p>(iii) 120 is a measure of _____</p> <p>_____</p> <p>80 is a measure of _____</p> <p>_____</p>	<p>1</p> <p>1</p> <p>2</p> <p>1</p> <p>1</p> <p>1</p>	
<p>For Markers Use Only</p> <p style="text-align: right;">Q 37 Total</p>	<p>7</p>	

QUESTION 38	Mark/ Question	Mark Scored
<p>(a) _____</p> <p>(b) _____</p> <p>_____</p> <p>(c) _____</p> <p>(d) Methods of preserving food</p> <p>pasteurization _____</p> <p>chilling _____</p> <p>non-ionizing radiation _____</p>	<p>1</p> <p>2</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	
<p>For Markers Use Only</p> <p style="text-align: right;">Q 38 Total</p>	<p>7</p>	

QUESTION 39	Mark/ Question	Mark Scored
<p>a) _____ _____ _____</p> <p>b) _____</p> <p>c) i) _____</p> <p>ii) <u>Number of Rods Versus Temperature Graph</u></p> <p>iii) Equation of the graph:</p>	<p>2</p> <p>1</p> <p>1</p> <p>2</p> <p>1</p>	
For Markers Use Only	Q 39 Total	7

QUESTION 40	Mark/ Question	Mark Scored
<p>(a)</p> <p>(b) _____</p> <p>(c) _____</p> <p>(d) _____</p> <p>(e) (Draw diagram in space below)</p>	<p>2</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p>	
For Markers Use Only	7	
Q 40 Total		