DEPARTMENT OF EDUCATION

UPPER SECONDARY SCHOOL CERTIFICATE EXAMINATIONS

APPLIED SCIENCE

Monday

20 October 2014

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, **1** 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

What type of chemical reaction occurs in the **kiln process** during production of lime?

A. Synthesis B. Combustion C. Decomposition D. Hydration

QUESTION 2

The best source of virgin oil among the listed would be:

A. chicken fat B. boiled fish C. sun dried coconut D. oven dried coconut

QUESTION 3

What is the most likely pH of salt water?

A. 3 B. 7 C. 8 D. 10

QUESTION 4

Which of the following is the major source of electrical energy in the cities of Lae and Port Moresby?

A. Diesel B. Biogas C. Hydro D. Wind

QUESTION 5

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

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

QUESTION 6

Removal of water in foods by sun drying is due to

A. condensation. B. crystallization . C. evaporation. D. humidification.

QUESTION 7

Which activity will surely contribute to species loss in a specific location?

A. Large oil palm development

B. Agro forestry development

C. Selective logging operation

D. Eco-Tourism project

QUESTION 8

Which of the following statements is true about organically grown foods?

A. Artificial fertilizers are used.

B. Natural composts are used.

C. Insecticides are used to kill harmful insects.

D. Weedicides are used to kill weeds.

QUESTION 9

What would be the best preventative method one could do to avoid poisoning by old medicine tablets?

A. Store at the bottom most part of the storage cupboard.

B. Burry them under the ground.

C. Sell them.

D. Store in coloured bottles.

QUESTION 10

Which statement is true about methanol – ethanol distillation process which sees methanol separating out first.

A. Ethanol is more volatile than methanol

B. Methanol has a higher boiling point than ethanol.

C. Methanol has a lower boiling point than ethanol.

D. Both methanol and ethanol have same boiling points.

QUESTION 11

Which of the following products are produced by fermentation?

A. Biscuits, noodles and chicken feed.

B. Cheese, yoghurt and bread.

C. Instant coffee, virgin coconut oil and jam.

D. Orange juice, milk and wheat flour.

QUESTION 12

What definition best describes the condition of a diabetic person?

A. weak contraction of heart muscles

B. coronary arteries narrow.

C. blood glucose concentration higher than normal.

D. breathing difficulties

QUESTION 13

Which of the following gases can cause major depletion of the ozone layer?

A. O_2 B. NO_2 C. CO_2 D. CCl_3F

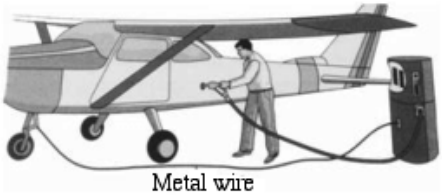
QUESTION 14

Commercial radios sold in Papua New Guinea have FM receivers (tuner circuit) that can operate within the frequency range of frequency;

A. 110KHz – 500KHz
B. 87KHz – 108 KHz
C. 87MHz – 108 MHz
D. 108MHz – 2.4GHz

QUESTION 15

The reason why it is important that before refueling starts, an aircraft is first connected to the fuel pump by metal wire as shown below is that



A. The fuel information the aircraft must first go to the pump to tell it exactly how much fuel is required by the aircraft.

B. The aircraft's internal electric fuel pump only operates when the aircraft's engine is on. Since the engine is off external power source is supplied through the wire to run the pump during refueling.

C. To ground or neutralize the static charges collected and stored by the aircraft's outer skin which can create sparks that can ignite the fuel causing explosion.

D. Metal wire is used as a harness to hold down the aircraft during refueling to prevent spillage.

QUESTION 16

Which statement is most likely to be true for a canning operation?

A. Sterilization process in an anaerobic environment.

B. Sterilization process in an aerobic environment.

C. Pasteurization process in an anaerobic environment.

D. Pasteurization process in an aerobic environment.

QUESTION 17

Which of the following is a measure of the salinity of water?

A. Hardness
B. Turbidity
C. Total dissolved solids
D. Biochemical oxygen demand

QUESTION 18

Which of the statement about radioactivity is incorrect?

A. The first element discovered which emitted high-energy particles was radium. The term "Radioactivity" was given to this process.

B. Three types of particles released during the radioactivity process are the alpha, beta and gamma particles.

C. Gamma rays are electromagnetic waves like radio waves.

D. Beta particles are the nuclei of helium atoms so they have a nucleon number of 4 and a proton number of 2.

QUESTION 19

Two major benefits relating to mangrove conservation are that

A. timber source and protection against sea erosion.

B. breeding habitat and protection against sea erosion.

C. breeding habitat and medicine.

D. air pollution stabilization and protection against sea erosion.

QUESTION 20

A resistance thermometer uses the fact that the electrical resistance of a platinum wire increases with temperature according to the equation given below.

$$\frac{\theta}{100} = \frac{R_\theta - R_0}{R_{100} - R_0}$$

where; θ = temperature of interest

R_θ = resistance of temperature of interest

R_0 = resistance at 0ºC

R_{100} = resistance at 100ºC

If at 1000ºC the resistance of platinum wire is 150kΩ and at 100ºC is 35kΩ, what is the wire's resistance at ice point?

A. 22.22Ω B. 162.77Ω C. 22.22kΩ D. 162.77kΩ

QUESTION 21

The process of producing tapa cloth involves pressing and drying under the sun. Pressing tapa cloth _____ moisture content and _____ surface area.

A. lowers, increases B. lowers, decreases

C. increases, increases D. increases, decreases

QUESTION 22

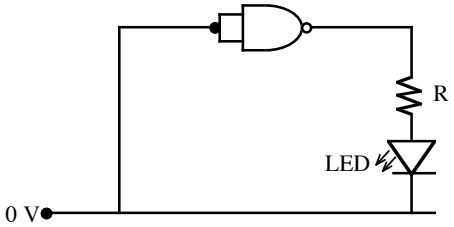
The amount of power produced by wind turbine is related to velocity. What is the major type of energy associated to wind turbines?

A. Thermal B. Hydro C. Potential D. Kinetic

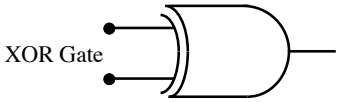
QUESTION 23

With the components as shown in the diagram below, the LED glows.

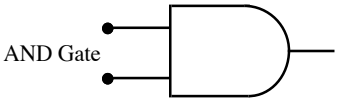
What gate could be used instead of the NAND gate?



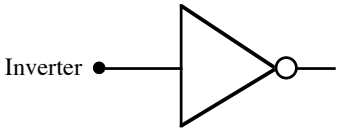
A.



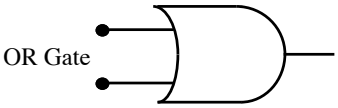
B.



C.

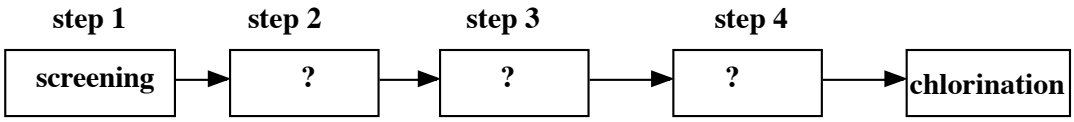


D.



QUESTION 24

Fill in the missing steps in the process for purifying drinking water.



	Step 2	Step 3	Step 4
A.	Coagulation and Sedimentation	Sand filtration	Aeration
B.	Sand filtration	Aeration	Coagulation and Sedimentation
C.	Sand filtration	Coagulation and Sedimentation	Aeration
D.	Aeration	Coagulation and Sedimentation	Sand filtration

QUESTION 25

Which of the oils or fats with caustic soda give the hardest soap?

A. sunflower oil + coconut oil

B. sunflower oil + fish oil

C. animal fat + coconut oil

D. sunflower oil + palm oil

QUESTION 26

When fossil fuels burn they produce a lot of heat called *heat of combustion*. Heat produced from combustion and other chemical reactions in the laboratory can be accurately measured in the laboratory using an instrument called a

A. thermometer.
B. bomb calorimeter
C. catalytic converter.
D. gas chromatography mass spectrometer (GCMS)

QUESTION 27

Urinalysis is a routine part of medical examinations. Lab tests of chemical composition of urine are able to reveal health problems or conditions. Which of the following **cannot** be revealed by urinalysis?

A. urinary tract infection
B. pregnancy
C. HIV
D. damaged nephrons

QUESTION 28

The two most useful by-products of methagenic reaction in biogas production are _____ and organic fertilizers.

A. sulphur dioxide B. nitrogen C. methane D. ethanol

QUESTION 29

What is the percentage fat content on the 'total mass bases' if 4 grams of fat was extracted from 20 grams of fresh peanut.

A. 20% B. 25% C. 60% D. 4%

QUESTION 30

Secondary sewage treatment usually involves

A. filtering of large floating objects.
B. applying series of chemicals to remove specific pollutants.
C. allowing bacteria to decompose organic waste.
D. discharging treated liquid into river.

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

Write the answers to all the Questions on the spaces provided in the Section B Answer Booklet.

QUESTION 31

Water hardness is due to the presence of calcium and magnesium ions present in the water. These ions form insoluble compounds with soap ions, resulting in soap scum on water surface and around sink basins.

(a) Write chemical symbols for calcium and magnesium ions. (2 marks)

(b) Hard water can be treated by adding soda ash (Na_2CO_3) to precipitate calcium ion which is removed easily.

Write a balanced ionic equation for the reaction. (2 marks)

(c) What is the function of coagulants in water treatment? (1 mark)

(d) Give a reason why 'drinking water' is chlorinated. (1 mark)

(e) Name the element added in the form of a salt during water treatment in order to help fight tooth decay. (1 mark)

QUESTION 32

(a) There are two common sexually transmitted diseases (STD) in PNG, caused by bacteria.

(i) Name these two diseases (2 marks)

(ii) What is the common vaccine used to treat both of these diseases? (1 marks)

(b) What is the normal body temperature for a healthy person in degree celcius? (1 mark)

(c) Explain the difference between Acquired Immuno Deficiency Syndrome (AIDS) and Human Immuno deficiency Virus (HIV). (2 marks)

(d) Is there a cure for AIDS? (1 mark)

QUESTION 33

(a) (i) What is the green house gas that other green house gases are compared against? (1 mark)

(ii) What are the 2 distinct benefits of Carbon Trade? (2 marks)

(b) Differentiate between biodegradable and non-biodegradable materials. (2 mark)

(c) A village group along the side of a hilly grassland decided to grow drought resistant trees.

What would be the 2 most immediate benefits? (2 marks)

QUESTION 34

Limestone is made from a mixture of limestone, shale and selected clay minerals.

(i) Limestone is used to produce the quicklime required for cement.

Write the balanced equation for the reaction to obtain quicklime (2 marks)

(ii) The quicklime obtained in (i) is reacted with a clay mineral mostly aluminium silicate to produce cement. This mixture is called klinker.

How is klinker kept dry all the time? (2 marks)

(iii) If quicklime absorbs water what chemical substance is formed? (1 mark)

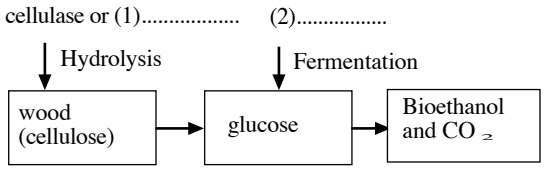
(iv) State <u>two</u> uses of quicklime in mining industry and building constructions. (2 marks)

QUESTION 35

(a) (i) Name the two ingredients that must be present in the presence of catalyst to produce bio-diesel. (2 marks)

(ii) Shown is a flow diagram of how bio-ethanol is produced from wood wastes. Fill in the spaces with the appropriate words.

Fill in the words; *acid,* or *yeast* in the blanks. (2 marks)



(b) (i) Name the best known antibiotic produced by moulds still being used today. (1 mark)

(ii) Most countries around the world use bio-fuels with fractions of fossil fuels. In bio-fuel fossil fuel fractions, what do B20 and E20 mean? (2 marks)

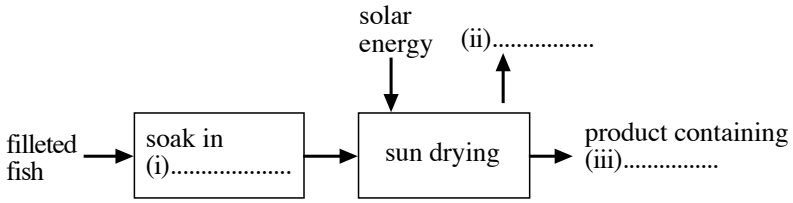
QUESTION 36

(a) Hot mushroom soup was equally poured into two similar pots, one made from clay and the other made from a metal to be served after an hour.

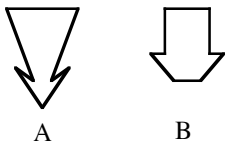
In which is the soup likely to be warm and explain why. (2 marks)

(b) Shown is a flow diagram showing how salted fish are sun dried for later use.

Fill in the words; *salt, water vapour* or *seawater* in the blanks. (3 marks)



(c) A hunter has 2 arrow-heads to use as shown.



With the same force on the bow string which arrow is likely to penetrate the flesh and explain why? (2 marks)

QUESTION 37

(a) In food analysis, mass of nutrients can be expressed over the total mass "Total mass bases" or expressed over the total solid mass "Dry mass base".

Through analysis experiments, a food having total weight of 100grams had 10grams of protein. Moisture content of the food was 60%.

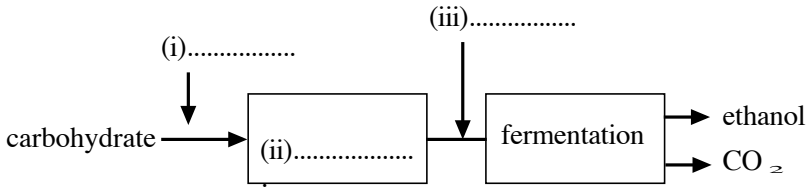
(i) What is the total mass of solid? (1 mark)

(ii) What is the protein content expressed as percentage on total mass base? (1 mark)

(iii) What is the protein content expressed as percentage on dry mass base? (1 mark)

(b) Shown is a flow diagram of *Ethanol Fermentation* process.

Fill in the words; *glucose*, *yeast* or *amylase* in the blanks. (3 marks)



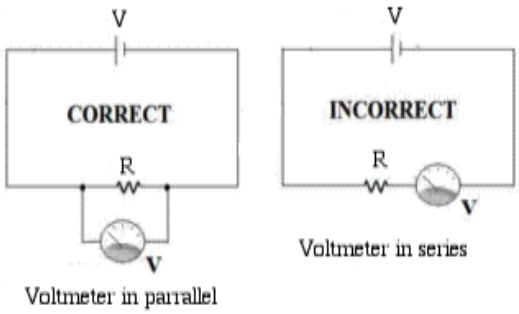
(c) Name the tiny building blocks that make up a protein polymer. (1 mark)

QUESTION 38

(a) If someone brought in a vehicle and complains that the horn stopped working where would be one possible place in the vehicle to check for faults, apart from the horn itself? (1 mark)

(b) Explain why it is not safe to communicate over mobile phone or any wireless radios using electromagnetic waves during an electric storm. (1 mark)

(c) The 2 diagrams shown show the correct and incorrect way of connecting voltmeters.

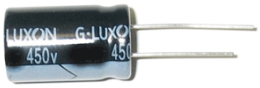


(i) Explain why connecting it in series is incorrect. (1 mark)

(ii) How would the needle behave in the incorrect circuit arrangement? (1 mark)

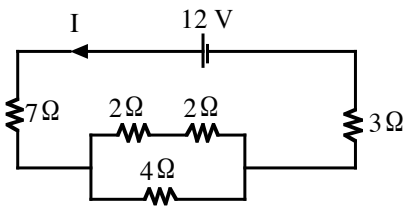
(d) State the 2 major roles performed by printed circuit boards in any electric appliance. (2 marks)

(e) What is the name given to the electronic component shown below that is commonly found in all electrical appliances? (1 mark)



QUESTION 39

(a) Use the circuit shown to answer (i) and (ii).



(i) Find the total resistance of the circuit. (2 marks)

(ii) How much power will dissipate across the 4Ω resistor? (3 marks)

(b) You are given the following components; – **a diode, a lamp, a 12V voltage supply** and **connecting wires**. Sketch a circuit using all these components showing the diode in reverse bias mode. (1 mark)

(c) A transistor is part of this unknown electrical circuit that takes in a 1volt signal and delivers an output of 10 volts.

What is the name of this electrical circuit? (1 mark)

QUESTION 40

(a) The Power generated by a wind turbine can be expressed as; (2 marks)

$P = \frac{1}{2} A\rho v^3$ where; A = area of turbine blade (m^2)

ρ = density of air (kg/m^3)

v = velocity of air (m/s)

P = Power (watts)

Area of turbine blade and density of air are constants so let $k = \frac{1}{2} A\rho$.

Thus; $P = \frac{1}{2} A\rho v^3 = kv^3$

If $k = 10$ and $v = 5m/s$ will the power generated be sufficient to operate a kettle with a power rating of 1000Watts?

(b) With reference to the discovery of natural gas in Hela province.

(i) What is the name of the useful gas that is being harnessed? (1 mark)

(ii) What happens to the natural gas in a gas conditioning plant? (1 mark)

(iii) Explain why it is important to condition gas before transportation? (1 mark)

(c) A ceiling fan with a power rating of 200 watts is to run for 10 hours.

(i) How much power will be consumed in 10 hours? (1 mark)

(ii) What will be the cost of running the fan for 10 hours if PNG Power charges 50 toea per kilowatt hour? (1 mark)

END OF EXAMINATION

APPLIED SCIENCE

S..ECTION 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	4								

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) (ii) calcium ion _____ (ii) magnesium ion _____	2	
b) _____	2	
c) _____		
_____	1	
d) _____	1	
e) _____	1	
For Markers Use Only **Q 31 Total**	**7**	

QUESTION 32	Mark/ Question	Mark Scored
a) (i) _____ and _____	2	
(ii) _____	1	
b) _____	1	
c) _____		
_____	2	
d) _____	1	
For Markers Use Only **Q 32 Total**	**7**	

QUESTION 33	Mark/ Question	Mark Scored
a) (i) _____	1	
(ii) 1._____	1	
2. _____	1	
b) _____	1	
_____	1	
c) 1. _____	1	
2. _____	1	
For Markers Use Only **Q 33 Total**	**7**	

QUESTION 34	Mark/ Question	Mark Scored
i) _____	2	
ii) _____	2	
iii) _____	1	
iv) 1. _____	1	
2. _____	1	
For Markers Use Only **Q 34 Total**	**7**	

QUESTION 35	Mark/ Question	Mark Scored
a) (i) _____ and _____	2	
(ii) 1. _____ 2. _____	2	
b) (i) _____	1	
(ii) B20 _____	1	
E20 _____	1	
For Markers Use Only **Q 35 Total**	**7**	

QUESTION 36	Mark/ Question	Mark Scored
(a) _____		
_____	2	
(b) i) _____	1	
ii) _____	1	
iii) _____	1	
(c) _____	2	
_____		
For Markers Use Only **Q 36 Total**	**7**	

QUESTION 37	Mark/ Question	Mark Scored
(a) (i) _____	1	
(ii) _____	1	
(iii) _____	1	
(b) (i) _____	1	
(ii) _____	1	
(iii) _____	1	
(c) _____	1	
For Markers Use Only **Q 37 Total**	**7**	

QUESTION 38	Mark/ Question	Mark Scored
(a) _____	1	
(b) _____	1	
(c) (i) _____	1	
(ii) _____	1	
(d) 1. _____	1	
2. _____	1	
(e) _____	1	
For Markers Use Only **Q 38 Total**	**7**	

QUESTION 39	Mark/ Question	Mark Scored
(a) (i) Total Resistance_____	2	
(ii) Power dissipated across 4Ω resistor _____	3	
(b)	1	
(c) _____	1	
For Markers Use Only **Q 39 Total**	**7**	

QUESTION 40	Mark/ Question	Mark Scored
(a)	2	
(b) (i) _____	1	
(ii) _____	1	
(iii) _____	1	
(c) (i)		
_____	1	
(ii)		
_____	1	
For Markers Use Only **Q 40 Total**	**7**	