Name : _____( ) Class: _____

DAMAI SECONDARY SCHOOL
END OF YEAR EXAMINATION 2014

Secondary Two Express Level

Lower Secondary Science

Thursday 2nd October 2014 0815am – 1015am 2 hour

INSTRUCTIONS TO CANDIDATES

Write your full name, register number and class in the spaces provided on the cover of this question paper and on the answer booklet.

This paper consists of three sections:

Section A: Multiple choice questions
Answer **ALL** questions. Shade all answers on the OMR sheet provided.

Section B: Short answer questions
Answer **ALL** questions. Write all answers in the answer booklet provided.

Section C: Long structured questions
Answer **only 4 out of 5** questions. **Circle the questions** which you have attempted and write all answers in the answer booklet provided.

Hand in the OMR sheet, question paper and answer booklet separately at the end of the examination.

INFORMATION FOR CANDIDATES

The number of marks is given in the brackets [ ] at the end of each question.

Mistakes in spelling may be penalised in any part of the paper.

Electronic calculators may be used for this paper.

This question paper consists of 8 printed pages.

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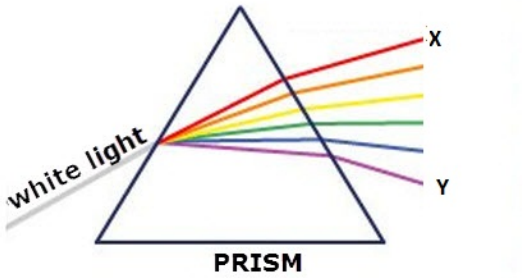
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Section A
(30 marks)
Answer all questions on the OMR sheet

A1 In Japan, the colours green and blue are considered to be different shades of the same colour "ao". A Japanese student mixed "ao" light with red light. How many resultant colours are possible?

A Two
B Three
C Four
D Five

A2 The diagram shows a ray of light entering a class prism.



What is the colour of the light at **X** and **Y** respectively?

	Colour at **X**	Colour at **Y**
A	Red	Red
B	Red	Violet
C	Violet	Red
D	Violet	Violet

A3 Divergent lens are used in _____.

A magnifying glasses
B photocopying machines
C spectacles to correct myopia
D overhead projectors of the classroom

A4 What type of image is formed through the lens of a photocopy machine?

A real andupright
B real and inverted
C virtual and upright
D virtual and inverted

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A5 Which of the following explains why coffee powder **cannot** be obtained from coffee by filtration?

A The heat of the coffee causes the filter paper to be unstable.
B The coffee powder had reacted to form a new liquid substance.
C The filter paper is not strong enough to hold the coffee powder.
D The coffee powder is small enough to enter through the pores of the filter paper.

A6 What is distillation most suitable for?

A To obtain sugar from soda.
B To obtain salt from sea water.
C To obtain milk powder from milk.
D To obtain water from salt solution.

A7 What can be deduced from the symbol $^{7}_{3}Li$?

A The lithium atom has 3 electrons.
B The lithium atom has 7 neutrons.
C The lithium atom has 10 protons.
D The lithium atom is electronically stable.

A8 How many types of elements are there in butanoic acid, C_3H_7COOH?

A Three
B Four
C Five
D Six

A9 Moving from the left to the right of the periodic table, the elements become more _____.

A acidic
B metallic
C non-metallic
D reactive

A10 Hydrogen peroxide has the chemical formula H_2O_2. Which of the following statements about hydrogen peroxide is correct?

A Hydrogen peroxide is an element.
B Hydrogen peroxide is a compound.
C Hydrogen peroxide is a mixture of elements.
D Hydrogen peroxide is a mixture of compounds.

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A11 Which of the following statements is true of isotopes?

A They have the same boiling points.
B They differ in the number of protons.
C They differ in the number of electrons.
D They have the similar chemical properties.

A12 Which of the following best describes ionic bonds?

A The sharing of electrons between non-metals.
B The transfer of electrons between non-metals.
C The sharing of electrons between metals and non-metals.
D The transfer of electrons between metals and non-metals.

A13 Four aqueous solutions has the following pH values

Solution	**P**	**Q**	**R**	**S**
pH	4	7	8	10

Which pair of solutions will always give an acidic solution when mixed?

A P and Q
B P and R
C Q and R
D R and S

A14 An alkali will change the colour of a litmus paper from _____.

A blue to green
B blue to red
C red to blue
D red to green

A15 Which of the following substance(s) is/are alkaline?

I: Chicken curry
II: Distilled water
III: Soft drinks
IV: Toothpaste

A I and II
B I and III
C II only
D IV only

A16 Which of the following involves a chemical change?

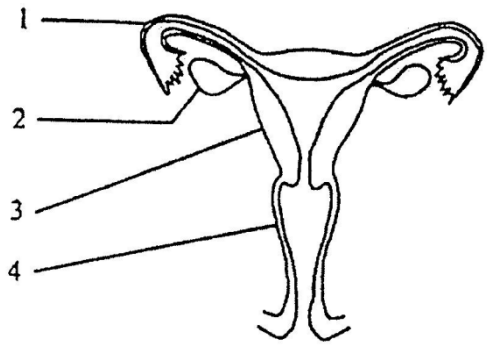
A Smashing of bricks into tiny pieces.
B Freezing of carbon dioxide into dry ice.
C Melting of ice cream under the hot sun.
D Burning of charcoal during a barbeque.

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A17 Which of the following is **not** unicellular?

A embryo
B ovum
C sperm
D zygote

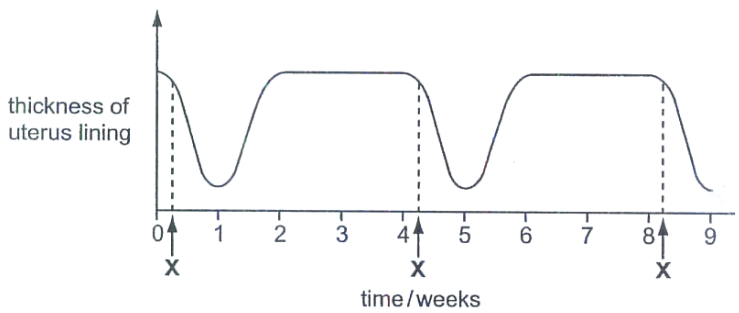
A18 The diagram below shows the reproductive system of a human female.



Where does fertilisation take place?

A 1 only
B 1 and 3
C 2 only
D 3 and 4

A19 The following graph shows changes in the thickness of the uterus lining of a lady over a period of 9 weeks.



What happens at **X**?

A Fertilisation
B Implantation
C Menstruation
D Ovulation

A20 Which of the following is a symptom of gonorrhoea?

A brain infection
B painless sores
C intestinal bleeding
D pus present in urine

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A21 How can AIDSbe spread?

A Sharing of food with an infected person.
B Being sneezed on by an infected person.
C Sharing of medical needles with an infected person.
D Resting on the same bed previously used by an infected person.

A22 Electrical current is due to the movement of _____.

A batteries
B electrons
C lightning
D protons

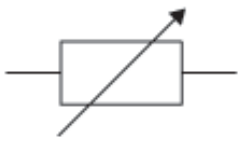
A23 Why should overloading of power sockets be avoided?

A It might break the circuit.
B It might overheat the circuit.
C It might expose faulty wires.
D It might cause the circuit to get wet.

A24 Which of the following is true of wires in a three-pin plug?

A The live wire is kept at zero voltage.
B All the wires are kept at high voltage.
C The earth wire is kept at high voltage.
D The neutral wire is kept at zero voltage.

A25 The following symbol shows an electrical component.



What does the symbol represent?

A Fuse
B Resistor
C Rheostat
D Switch

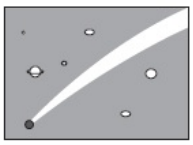
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A26 The diagram below shows three different events.

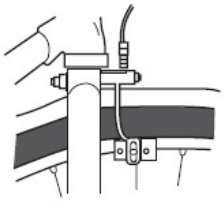
a parachutist reaching terminal velocity



a meteor glowing as it falls through the atmosphere



brakes slowing down a bicycle



What is the similar cause for all the three events?

A Heat
B Friction
C Gravity
D Radiation

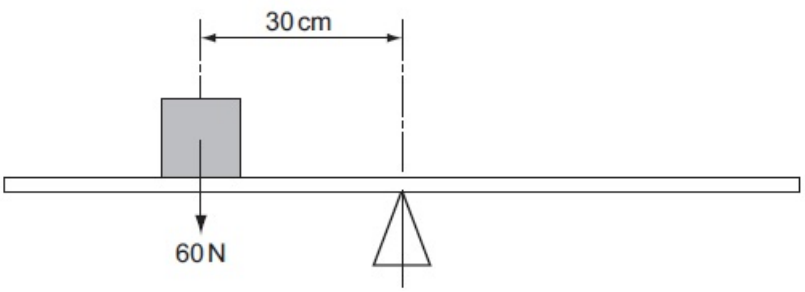
A27 Which of the following is a contact force?

A Electrostatic force
B Gravitational force
C Magnetic force
D Tension

A28 The reason why an astronaut can jump higher on the moon than on earth is because _____.

A his mass is lower moon on than on the earth.
B his mass is higher moonon than on the earth.
C his weight is lower on the moonthan on the earth.
D his weight is higher on the moonthan on the earth.

A29 A uniformed beam is balanced at its midpoint. An object is placed on the beam as shown in the diagram.

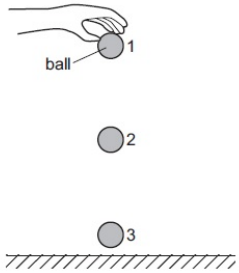


Which of the following forces will rebalance the system?

A 15 N acting upwards, 120 cm to the left of the pivot.
B 30 N acting upwards, 60 cm to the right of the pivot.
C 45 N acting downwards, 40 cm to the left of the pivot.
D 90 N acting downwards, 10 cm to the right of the pivot.

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A30 A ball drops from a height as shown in the diagram below.



Ignoring air resistance, the total energy of the ball is _____.

A greatest at point 1
B greatest at point 2
C greatest at point 3
D the same at all points

END OF SECTION A

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Name : _____( ) Class: _____

_____
Parent's Signature

DAMAI SECONDARY SCHOOL
END OF YEAR EXAMINATION 2014

Secondary Two Express

Thursday 2nd October 2014 0815am – 1015am 2 hour

ANSWER BOOKLET

For Teacher's Use only:

Section	Question No.	Marks
A	A1 – A30	
B	B1 – B6	
C Choose **4** Questions ONLY	C7	
	C8	
	C9	
	C10	
	C11	
	TOTAL	

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Section B
(30 marks)
Answer all questions

B1 A driver sees the image of the car behind him in a mirror as shown in **Fig 1.1**.

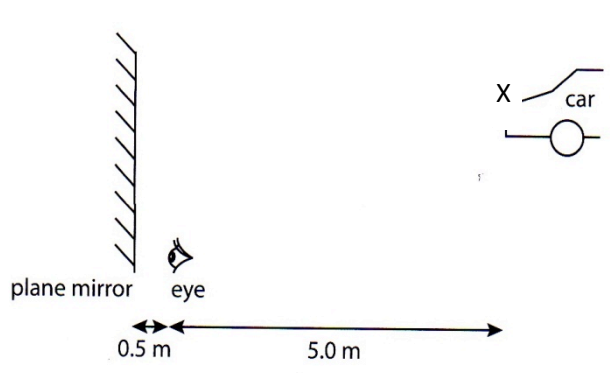


Fig 1.1

(a) (i) Complete the ray diagram in **Fig 1.1** to locate the image of the car at point X. Label the point Y. [2]

(ii) Calculate the horizontal distance between the eye and the image.

[1]

(iii) On **Fig 1.1**, complete the ray to show the path taken by light rays travelling from X to the driver's eye. [2]

(b) (i) **Fig 1.2** shows a ray of light entering a glass block. Complete the ray diagram by drawing the refracted ray and the emergent ray. You should show all the normals clearly. [2]

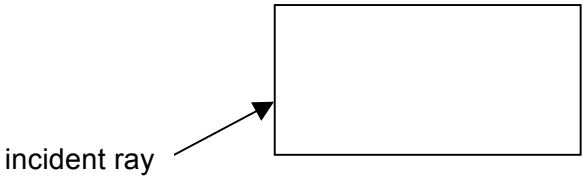


Fig 1.2

(ii) Explain your answer in **part (i)** for the direction of the refracted and emergent ray.

……...

……...

……..... [2]

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B2 **Fig 2** below shows five diagrams,**A to E**, of some students' drawings of gas particles.

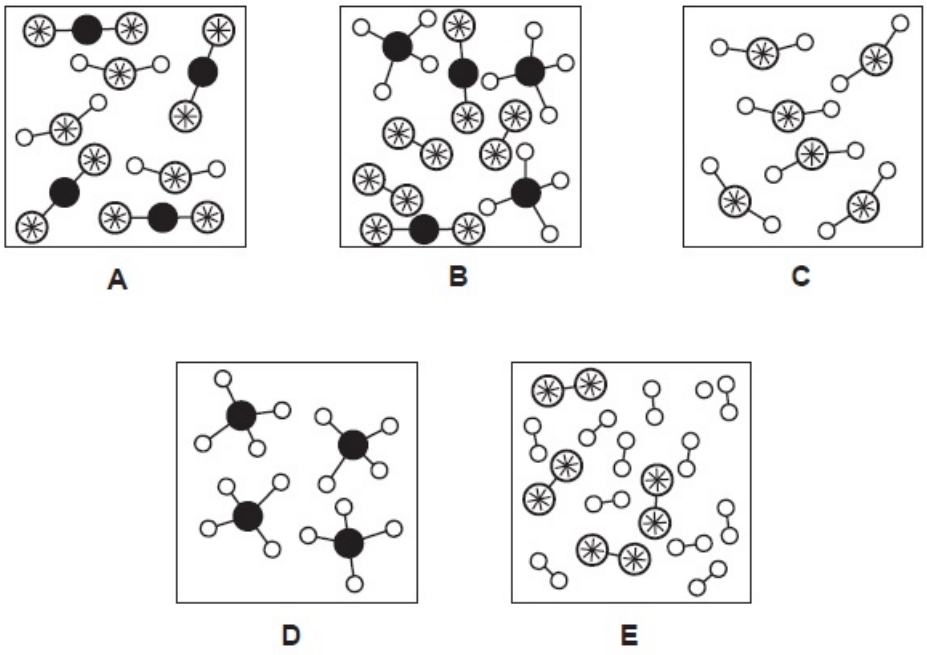


Fig 2

(a) Which of the following drawings (**A**, **B**, **C**, **D** or **E**) best represent

(i) molecules of methane (CH_4)? .....

(ii) molecules of water? .....

(iii) a mixture of elements? ..... [3]

(b) (i) State the type of bonding present in methane.

..... [1]

(ii) Give an example of a mixture shown in **A**.

..... [1]

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B3 Paper chromatography can be used to identify food dyes. The results of a chromatogram done on different food samplesis shown in **Fig 3**.

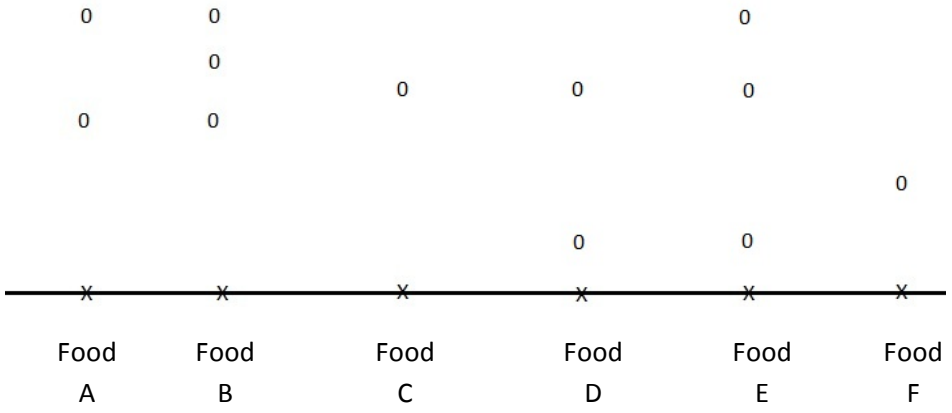


Fig 3

(a) Which samples of food contain a single dye?

…… [1]

(b) How many types of dyes were identified in Food B?

…… [1]

(c) A toxic dye was identified in Food E, but not in Food D. Suggest which other food sample(s) is/are toxic.

…… [1]

B4 Balance the following chemical equations.

(a) ___Na + ___O_2 --> ___Na_2O

(b) ___ NaOH + ___H_2SO_4 --> ___Na_2SO_4 + ___H_2O

(c) ___Li + ____H_2O --> ___LiOH + ___H_2

[3]

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B5 HIV is one of the more deadly STIs known.

(i) What does HIV stand for?

…… [1]

(ii) Explain why HIV is one of the more severe STIs.

……

……

…… [3]

B6 **(a)** **Fig 6.1** shows an incandescent light bulb.

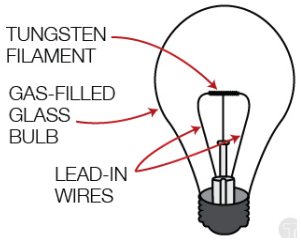


Fig 6.1

(i) Suggest why tungsten is used instead of copper.

……

…… [2]

(ii) Recommend a gas to fill the light bulb with, and explain your choice.

……

……

…… [2]

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(b) A student sets up a circuit as shown in **Fig 6.2** to measure potential difference and current across a light bulb.

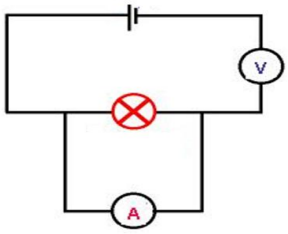


Fig 6.2

Identify **two** mistakes the student made in setting up the experiment.

.....

..... [2]

END OF SECTION B

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Section C
(40 marks)
Answer four out of five questions
Cancel out the question not answered

C7 **Fig 7.1** shows a claw hammer being used to pull a nail out of a piece of wood.

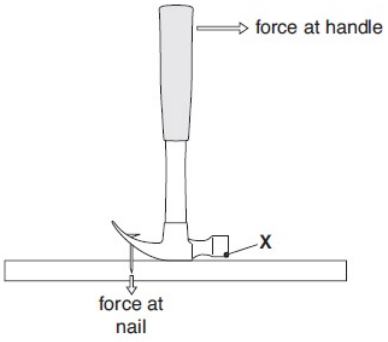


Fig 7.1

(a) (i) Describe how moments can be calculated.

.....

..... [2]

(ii) Explain why the force at the nail is greater than the force exerted at the handle of thehammer.

.....

..... [2]

(b) For his 16th birthday, Klose's parents bought him a new pair of football shoes. He noted that there were protrusions (called "studs") at the sole of his shoes as shown in **Fig 7.2**.



Fig 7.2

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(i) Klose has a mass of 45 kg. The total surface area of the studs in contact with the football pitch is 30 cm^2, calculate the pressure (in terms of Pa) exerted by Klose on the pitch when he wears his football shoes. (Assume g = 10 m/s^2)

Pressure = ... [2]

(ii) Feeling uncomfortable in his new shoes, Klose decided to manually unscrew the studs from his shoes. Assuming the studs occupied 10% of the shoes' total surface area, calculate the new pressure (in terms of Pa) exerted by Klose on the pitch with his unstudded shoes.

Pressure = ... [2]

(iii) Without the studs, Klose frequently found himself slipping and falling while participating in football matches. Explain why playing with studs would be a better option for Klose.

.....

.....

..... [2]

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C8 The flowchart in **Figure 8** shows a series of chemical reactions involving acid **X**.

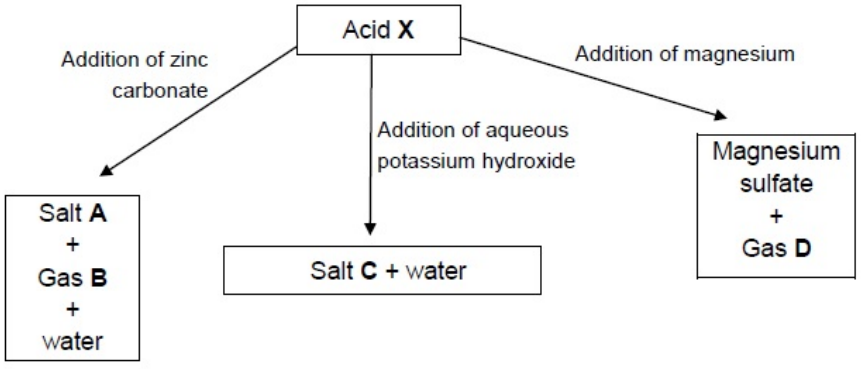


Figure 8

(a) (i) Identify **A**, **B**, **C** and **D**.

A ..... **B** .....

C ..... **D** ..... [4]

(ii) Describe a test to confirm the identity of Gas **D**.

.....

..... [2]

(b) (i) Identify Acid **X** and explain how you arrived at that conclusion.

.....

..... [2]

(ii) Explain why the reaction between acids and carbonates is considered a chemical reaction.

.....

..... [2]

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C9 **(a)** **Table 9** is a calendar that shows some events in Joan's menstrual cycle in January 2012.Menstruation starts on 5th of January, and she has a 28-day cycle.

January 2012						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Table 9

(i) What substance(s) is/are being discharged from Joan's body together with blood during the start of her menstrual cycle?

……

…… [2]

(ii) What would happen to the uterus wall lining in the days leading to ovulation?

……

…… [1]

(iii) Predict the **date** which Joan's next menstrual cycle is expected to start.

…… [1]

(iv) Between which dates would it be most likely for sexual intercourse to result in fertilization?

…… [1]

(b) One of the ways to treat a female patient suffering from ovarian cancer is to remove the womb (uterus). Can this female patient have children after the removal of her uterus? Give areason.

……

……

……

…… [3]

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(c) List **two** physical changes a male will experience when he goes through puberty.

.....

..... [2]

C10 **Fig 10** shows a lady holding a basket that weighs 30 N.



Fig 10

(a) Draw, on **Figure 10**, the force that the girl acts on the basket. Label this force **F**. [1]

(b) The lady moves 10 m to the left. Calculate the work done by force **F**.

Work done = ... [1]

(c) (i) State the principle of conservation of energy.

.....

..... [3]

(ii) Starting at the first floor, the lady climbed four flights of stairs to reach the fifth floor. Assuming each floor has a height of 3 m, calculate the work done by force **F**.

Work done = ... [2]

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(iii) State the gain in gravitational potential energy of the basket.

..... [1]

(iv) The lady accidentally drops the basket onto the floor and a loud 'thud' is heard. List the changes in energy in this event.

.....

..... [1]

(d) List two renewable sources of energy.

..... [1]

C11 Two dry cells of 5V each was connected to a circuit with three identical resistors of 1Ω resistance each and a bulb of 2Ω resistance.**Fig 11** shows a circuit set up.

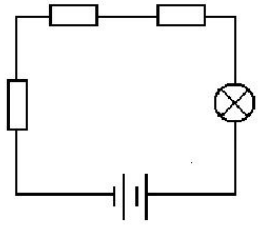


Fig 11

(a) (i) Calculate the voltage across the two dry cells.

Voltage = ... [1]

(ii) Calculate the total resistance of the circuit.

Resistance = ...[1]

(iii) Calculate the current flowing through the bulb.

Current = ...[1]

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(b) **Without adding or removing** any electrical components from the circuit, redraw the circuit diagram such that the total resistance of the circuit is **3.5Ω**.

[2]

(c) A 1400W oven was used for 150 mins to thaw a Christmas turkey.

(i) Calculate the electrical energy used in kWh.

Electrical energy used = ... [2]

(ii) Given 1 unit of energy costs $0.30, calculate the cost of energyused in thawing the Christmas turkey.

Costs = ... [1]

(d) Mr Wong buys a refrigerator that is rated 1.0 kW for $750, instead of one that is rated 0.8 kW for $800. Suggest why Mr Wong's decision is more expensive in the long run.

.....

.....

..... [2]

END OF SECTION C

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The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series

†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendeleviu m 101	– No nobelium 102	– Lr lawrencium 103

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

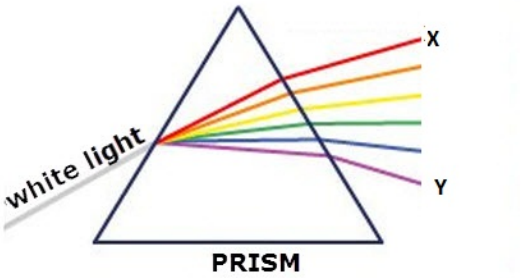
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Section A - MCQ (50 marks)
Answer all questions on the OMR sheet

A1 In Japan, the colours green and blue are considered to be different shades of the same colour "ao". A Japanese student mixed "ao" light with red light. How many resultant colours are possible?

A Two
B Three
C Four
D Five

A2 The diagram shows a ray of light entering a class prism.



What is the colour of the light at **X** and **Y** respectively?

	Colour at **X**	Colour at **Y**
A	Red	Red
B	Red	Violet
C	Violet	Red
D	Violet	Violet

A3 Divergent lens are used in _____.

A magnifying glasses
B photocopying machines
C spectacles to correct myopia
D overhead projectors of the classroom

A4 What type of image is formed through the lens of a photocopy machine?

A real and upright
B real and inverted
C virtual and upright
D virtual and inverted

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A5 Which of the following explains why coffee powder cannot be obtained from coffee by filtration?

A The heat of the coffee causes the filter paper to be unstable.
B The coffee powder had reacted to form a new liquid substance.
C The filter paper is not strong enough to hold the coffee powder.
D The coffee powder is small enough to enter through the pores of the filter paper.

A6 What is distillation most suitable for?

A To obtain sugar from soda.
B To obtain salt from sea water.
C To obtain milk powder from milk.
D To obtain water from salt solution.

A7 What can be deduced from the symbol $^{7}_{3}Li$?

A The lithium atom has 3 electrons.
B The lithium atom has 7 neutrons.
C The lithium atom has 10 protons.
D The lithium atom is electronically stable.

A8 How many types of elements are there in butanoic acid, C_3H_7COOH?

A Three
B Four
C Five
D Six

A9 Moving from the left to the right of the periodic table, the elements become more _____.

A acidic
B metallic
C non-metallic
D reactive

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A10 Hydrogen peroxide has the chemical formula H_2O_2. Which of the following statements about hydrogen peroxide is correct?

A Hydrogen peroxide is an element.
B Hydrogen peroxide is a compound.
C Hydrogen peroxide is a mixture of elements.
D Hydrogen peroxide is a mixture of compounds.

A11 Which of the following statements is true of isotopes?

A They have the same boiling points.
B They differ in the number of protons.
C They differ in the number of electrons.
D They have the similar chemical properties.

A12 Which of the following best describes ionic bonds?

A The sharing of electrons between non-metals.
B The transfer of electrons between non-metals.
C The sharing of electrons between metals and non-metals.
D The transfer of electrons between metals and non-metals.

A13 Four aqueous solutions has the following pH values

Solution	P	Q	R	S
pH	4	7	8	10

Which pair of solutions will always give an acidic solution when mixed?

A P and Q
B P and R
C Q and R
D R and S

A14 An alkali will change the colour of a litmus paper from _____.

A blue to green
B blue to red
C red to blue
D red to green

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A15 Which of the following substance(s) is/are alkaline?

I: Chicken curry
II: Distilled water
III: Soft drinks
IV: Toothpaste

A I and II
B I and III
C II only
D IV only

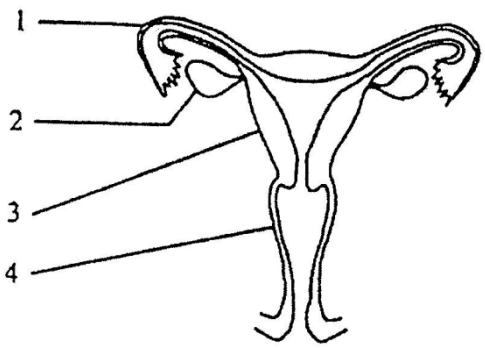
A16 Which of the following involves a chemical change?

A Smashing of bricks into tiny pieces.
B Freezing of carbon dioxide into dry ice.
C Melting of ice cream under the hot sun.
D Burning of charcoal during a barbeque.

A17 Which of the following is not unicellular?

A embryo
B ovum
C sperm
D zygote

A18 The diagram below shows the reproductive system of a human female.

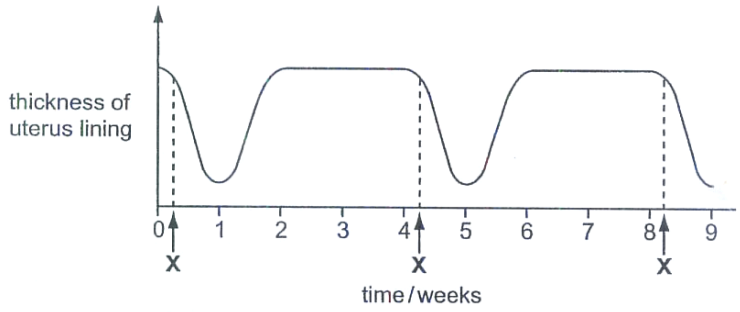


Where does fertilisation take place?

A 1 only
B 1 and 3
C 2 only
D 3 and 4

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A19 The following graph shows changes in the thickness of the uterus lining of a lady over a period of 9 weeks.



What happens at **X**?

A Fertilisation
B Implantation
C Menstruation
D Ovulation

A20 Which of the following is a symptom of gonorrhoea?

A brain infection
B painless sores
C intestinal bleeding
D pus present in urine

A21 How can AIDS be spread?

A Sharing of food with an infected person.
B Being sneezed on by an infected person.
C Sharing of medical needles with an infected person.
D Resting on the same bed previously used by an infected person.

A22 Electrical current is due to the movement of _____.

A batteries
B electrons
C lightning
D protons

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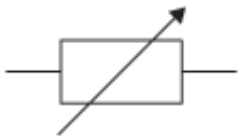
A23 Why should overloading of power sockets be avoided?

A It might break the circuit.
B It might overheat the circuit.
C It might expose faulty wires.
D It might cause the circuit to get wet.

A24 Which of the following is **TRUE** of wires in a three-pin plug?

A The live wire is kept at zero voltage.
B All the wires are kept at high voltage.
C The earth wire is kept at high voltage.
D The neutral wire is kept at zero voltage.

A25 The following symbol shows an electrical component.



What does the symbol represent?

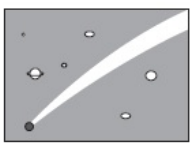
A Fuse
B Resistor
C Rheostat
D Switch

A26 The diagram below shows three different events.

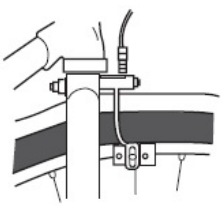
a parachutist reaching terminal velocity



a meteor glowing as it falls through the atmosphere



brakes slowing down a bicycle



What is the similar cause for all the three events?

A Heat
B Friction
C Gravity
D Radiation

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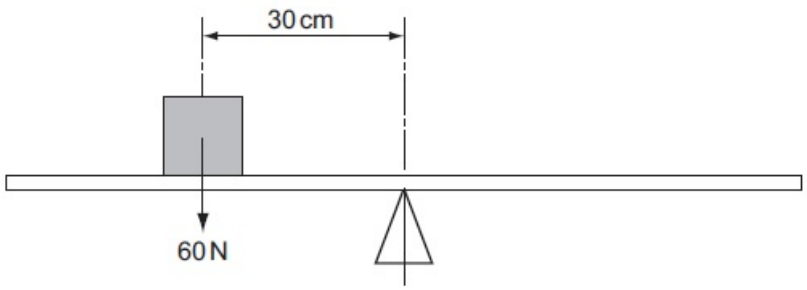
A27 Which of the following is a contact force?

A Electrostatic force
B Gravitational force
C Magnetic force
D Tension

A28 The reason why an astronaut can jump higher on the moon than on earth is because _____.

A his mass is lower moon on than on the earth.
B his mass is higher moon on than on the earth.
C his weight is lower on the moon than on the earth.
D his weight is higher on the moon than on the earth.

A29 A uniformed beam is balanced at its midpoint. An object is placed on the beam as shown in the diagram.

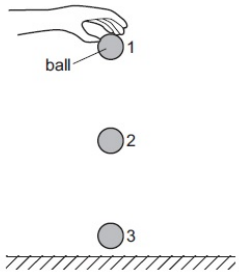


Which of the following forces will rebalance the system?

A 15 N acting upwards, 120 cm to the left of the pivot.
B 30 N acting upwards, 60 cm to the right of the pivot.
C 45 N acting downwards, 40 cm to the left of the pivot.
D 90 N acting downwards, 10 cm to the right of the pivot.

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A30 A ball drops from a height as shown in the diagram below.



Ignoring air resistance, the total energy of the ball is _____.

A greatest at point 1
B greatest at point 2
C greatest at point 3
D the same at all points

END OF SECTION A

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Section B – Structured questions (30 marks)
Answer all questions

B1 A driver sees the image of the car behind him in a mirror as shown in the diagram below

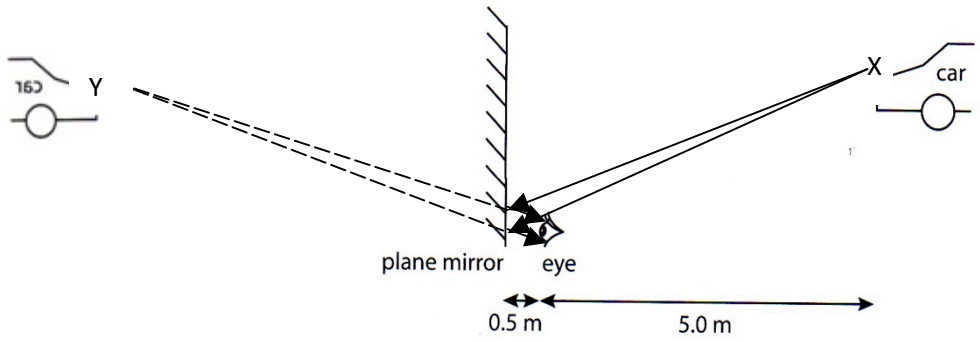


Figure 1.1

(a) (i) Complete the ray diagram in **Figure 1.1** to locate the image of the car at X. Label the image Y.
Right distance [1]
Label Y [1]

(ii) Calculate the horizontal distance between the eye and the image.
Distance = 5.0 + 0.5 + 0.5 = **6.0m** [1]

(iii) Complete the ray diagram above to show the path taken by light rays travelling from X to the driver's eye.
Proper light rays from mirror to eye and car to mirror with arrows [1]
Correct virtual lines [1]

(b) (i) **Figure 1.2** shows a ray of light entering a glass block. Complete the ray diagram by drawing the refracted ray and the emergent ray.

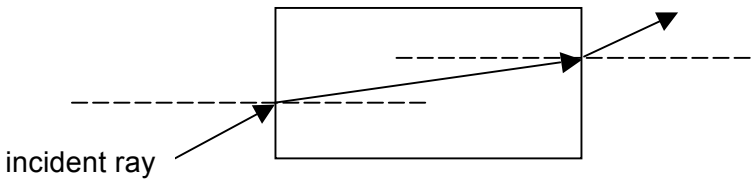


Figure 1.2

correct refracted ray [1]
correct emergent ray [1]

(ii) Explain your answer in **part (i)** for the direction of the refracted ray.

The light rays bend towards the normal as it enters the glass as it is **optically denser**. [1]
The light rays bend away from the normal as it re-enters air as it is **optically less dense**. [1]
OR
The light rays bend towards the normal as **it slows down** after entering the glass [1]
The light rays bend away from normal as **its speed is increased** after leaving the glass. [1]

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B2 **Figure 2** below shows five diagrams,**A to E**, of some students' drawings of gas particles.

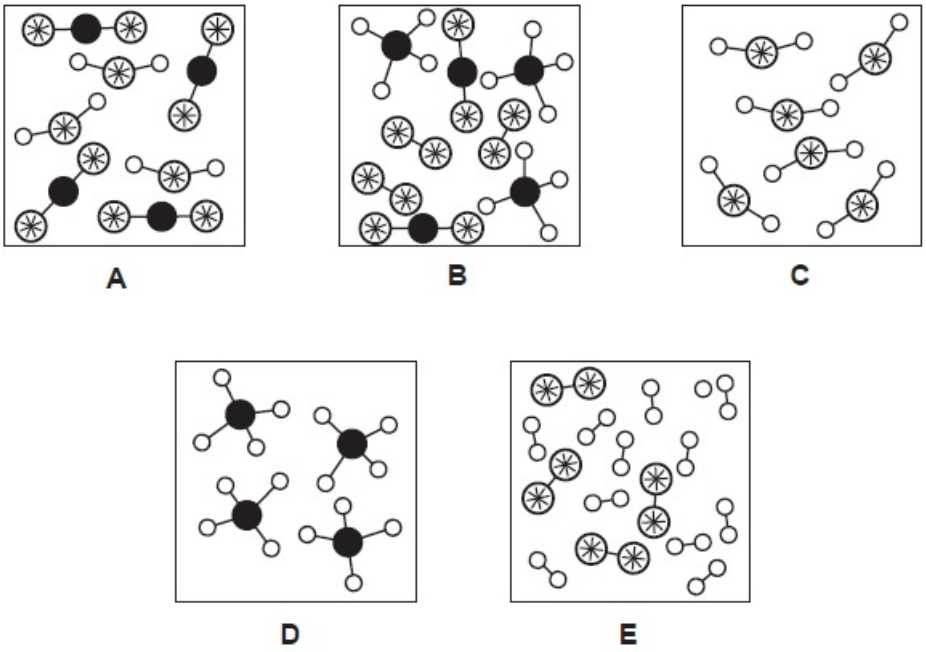


Figure 2

(a) Which of the following drawings (**A**, **B**, **C**, **D** or **E**) best represent

(i) molecules of methane (CH_4)? **D** [1]

(ii) molecules of water? **C** [1]

(iii) a mixture of elements? **E** [1]

(b) (i) State the type of bonding present in methane.

Covalent bonds [1]

(ii) Give an example of a mixture shown in A.

Carbon dioxide and water [1] (accept other possible answers)

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B3 Paper chromatography can be used to identify food dyes. The results of an experiment is shown in **Figure 3**.

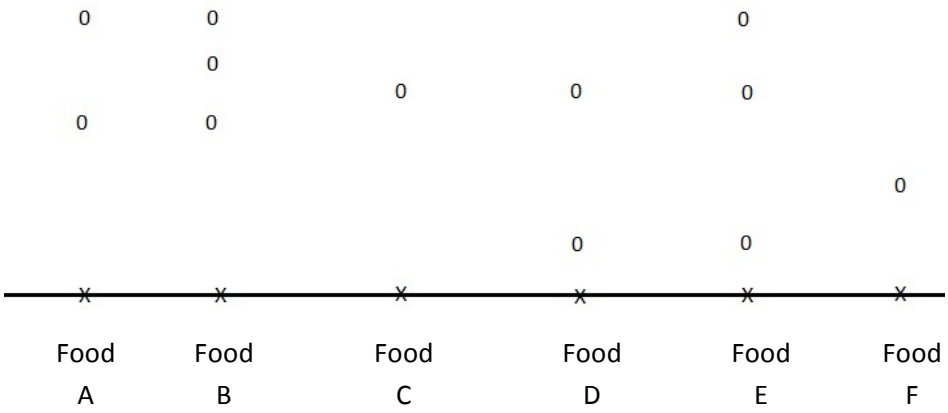


Figure 3

(a) Which samples of food contain a single dye?

C and F [1]

(b) How many types of dyes were identified in Food B?

3 [1]

(c) A toxic dye was identified in Food E, but not in Food D. Suggest which other food sample(s) is/are toxic.

A and B [1]

B4 Balance the following chemical equations.

(a) **4** Na + O_2 --> **2**Na_2O

(b) **2**NaOH + H_2SO_4 --> Na_2SO_4 + **2**H_2O

(c) **2**Li + **2**H_2O --> **2**LiOH + H_2

[3]

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B5 HIV is one of the more deadly STIs known.

(i) What does HIV stand for?

Human Immunodeficiency Virus [1]

(ii) Explain why HIV is one of the more severe STIs.

HIV causes AIDS which **incurable** and **fatal** [1]
(one mark for either **incurable** or **fatal**)
AIDS attack **white blood cells and the immune system** [1]
Patient will lose immunity and will be **open to other infections** [1]

B6 Figure 6.1 shows an incandescent light bulb.

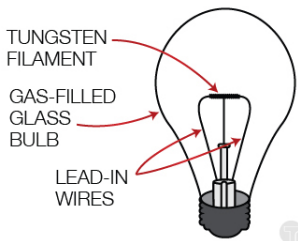


Figure 6.1

(a) (i) Suggest why tungsten is used instead of copper.

Tungsten has a **higher resistance** than copper [1]
More energy will be converted into light energy with tungsten [1]

(ii) Recommend a gas to fill the light bulb with, and explain your choice.

Any noble gas [1]
The gas is **unreactive** and will not react with the heated tungsten [1]

A student sets up a circuit as shown in **Figure 6.2** to measure potential difference and current across a light bulb.

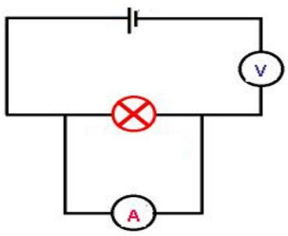


Figure 6.2

(b) Identify **two** mistakes the student made in setting up the experiment.

The ammeter is connected in parallel/should be connected in series [1]

The voltmeter is connected in series/should be connected in parallel [1]

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END OF SECTION B

Section C - Free-response questions (40 marks)
Answer four out of five questions

C7 **Figure 7.1**shows a claw hammer being used to pull a nail out of a piece of wood.

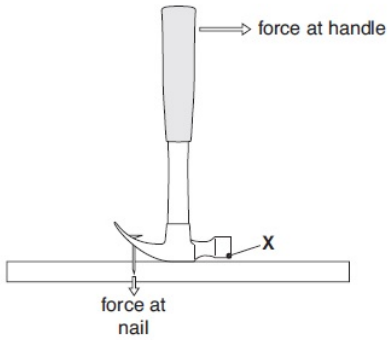


Figure 7.1

(a) (i) Define moments.

It is the **product** [1] of the **force and its perpendicular distancefrom the force to thepivot** [1].

(ii) Explain why the force at the nail is greater than the force exerted at the handle of thehammer.

The distance from the effort to the pivot is **larger** than the distance from the force to the pivot [1]
Hence a small force at the handle would provide a **large moment clockwise**.[1]

(b) For his 16th birthday, Klose's parents bought him a new pair of football shoes. He noted that there were protrusions (called "studs") at the sole of his shoes as shown in **Figure 7.2**.

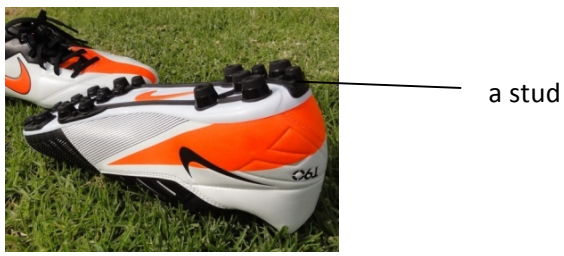


Figure 7.2

(i) Klosehas a mass of 45 kg. The total surface area of the studs in contact with the football pitch is 30 cm^2, calculate the pressure (in terms of Pa) exerted by Klose on the pitch when he wears his football shoes. (Assume g = 10 m/s^2)

Weight of Klose = 45 X 10 = 450 N
Surface area of shoe = **30 X 1/10000 = 0.003 m^2** [1]
Pressure **= 450 / 0.003 = 150 000 Pa** [1]

Pressure = **15000Pa**

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(ii) Feeling uncomfortable in his new shoes, Klose decided to manually unscrew the studs from his shoes. Assuming studs occupied 10% of the shoes total surface area, calculate the new pressure (in terms of Pa) exerted by Klose on the pitch with his unstudded shoes.

Surface area = 100/10 X 0.003 = 0.03 m^2 [1]
Pressure = **450/0.03 = 15 000 Pa** [1]

Pressure = **1500 Pa**

(iii) Without the studs, Klose frequently found himself slipping and falling while participating in football matches. Explain why playing with studs would be a better option for Klose.

The studs would allow him to **exert higher pressure** on the field. [1]
AND
This allows his studs to **sink into to ground** [1]
OR
Providing a **firm grip** on the ground[1]
(**Pressure** must be mentioned)

C8 The flowchart in **Figure 8** shows a series of chemical reactions involving acid **X**.

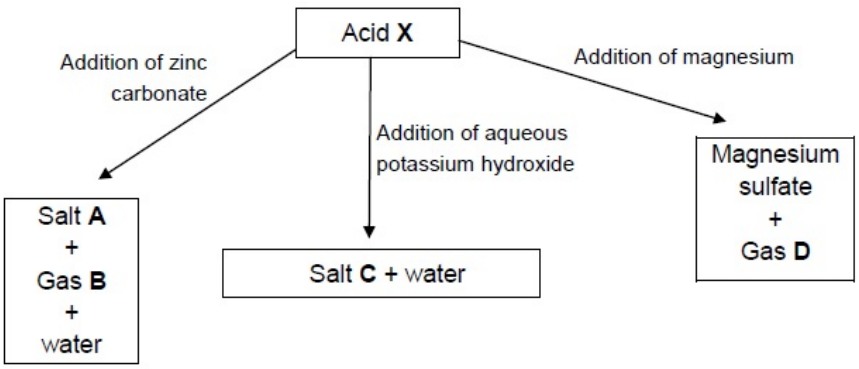


Figure 8

(a) (i) Identify **A**, **B**, **C** and **D**.

A	**zinc sulfate**	**B**	**Carbon dioxide**	
C	**potassium sulfate**	**D**	**Hydrogen gas**	[4]

(ii) Describe a test to confirm the identity of Gas **D**.

Place a **lighted splint** at the gas. [1]
If splint is **extinguished with a pop sound**, hydrogen is present. [1]

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(b) (i) Identify Acid **X** and explain how you arrived at that conclusion.

Sulfuric acid [1]
Magnesium sulfate is produced when magenisum is added to X, showing that the **sulfate ion had to come from X**. [1]

(ii) Explain why the reaction between acids and carbonates is considered a chemical reaction.

A **new substance (new substance must be named)** is formed. [1]
The **properties of the products differ from the reactants**. [1]
(accept other possible answers)

C9 **Table 9** is a calendar that shows some events in Joan's menstrual cycle in January 2012.Menstruation starts on 5th of January.

January 2012						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Table 9

(a) (i) What substance(s) is/are being discharged from Joan's body together with blood during the start of her menstrual cycle?

The **unfertilised egg/ovum/dead ovum**. [1]
Blood and tissue from the uterine lining [1]

(ii) What would happen to the uterus wall lining in the days leading to ovulation?

It will **be maintained/ not be broken down/thickened** [1]

(iii) Predict the date on which Joan's next menstrual cycle is expected to start.

2nd February [1]

(iv) Between which dates would it be most likely for sexual intercourse to result in fertilization?

15th January to 22nd January [1]

(b) One of the ways to treat a female patient suffering from ovarian cancer is to remove the womb (uterus). Can this female patient have children? Give a reason.

No [1]
Even though fertilisation may take place, there is no **uterine lining** [1] for the zygote to be **implanted** in. [1]

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(c) List two physical changes a male will experience when he goes through puberty.

Breaking of voice/ body becoming more muscular/ growing of hair on pubic areas/ enlargement of sexual organs. [2]

C10 **Figure 10** shows a lady holding a basket that weighs 30 N.



Figure 10

(a) Draw, on **Figure 10**, the force that the girl acts on the basket. Label this force **F**. (see diagram) [1]

(b) The lady moves 10 m to the left. Calculate the work done by force **F**.

Work done = 0 X 10 = 0J [1]

Work done = 0 J

(c) (i) State the principle of conservation of energy.

Energy **cannot be created or destroyed** [1]
It can be **converted** from one form to another [1]
The **total sum of energy remains the same** [1]

(ii) Starting at the first floor, the lady climbed four flights of stairs to reach the fifth floor. Assuming each floor has a height of 3 m, calculate the work done by force **F**.
Total distance = 3 X 4 = 12 m [1]
Work done = 30 X 12 = 360 J [1]

Work done = **360 J** [1]

(iii) State the gain in gravitational potential energy of the basket.

360 J [1]

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(iv) The lady accidentally drops the basket onto the floor and a loud 'thud' is heard. List the changes in energy in this event.

Gravitational potential energy to **kinetic** energy to **sound and heat** energy [1]

(d) List two renewable sources of energy.

Geothermal/hydroelectric/wind/biofuels [1; both answers needed]

C11 Two dry cells of 5V each was connected to a circuit with three identical resistors of 1Ω resistance each and a bulb of 2Ω resistance.**Fig 11** shows a circuit set up.

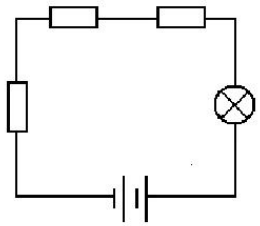


Figure 11

(a) (i) Calculate the voltage across the two dry cells.

Total voltage = 5X2 = 10V

Voltage = **10V** [1]

(ii) Calculate the total resistance of the circuit.

Total resistance = **3 X1 + 2 = 5 Ω** [1]

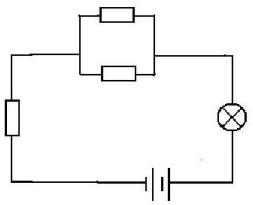
Resistance = **5Ω**[1]

(iii) Calculate the current flowing through the bulb.

Current = **10/5 = 2 A**

Current = **2 A** [1]

(b) **Without adding or removing** any electrical components from the circuit, redraw the circuit diagram such that the total resistance of the circuit is **3.5Ω**.



Correct combination of resistors [1]
All electrical components [1]

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(c) A 1400W oven was used for 150 mins to thaw a Christmas turkey.

(i) Calculate the electrical energy used in kWh.

Time used = **150 / 60 = 2.5h** [1]
Energy = **1400 X 2.5 = 3.5 kWh** [1]

Electrical energy used = **3.5kWh**

(ii) Given 1 unit of energy costs $0.30, calculate the cost if energyused in thawing the Christmas turkey.

Costs = **3.5 X 0.30 = $1.05** [1]

Costs = **$1.05**

(d) Mr Wong buys a refrigerator that is rated 1.0 kW for $750, instead of one that is rated 0.8 kW for $800. Suggest why Mr Wong's decision is more expensive in the long run.

The 1.0 kW refrigerator uses **more energy** than the other one. [1]
Refrigerators are **switched on all the time/ for long periods of time** [1]

END OF SECTION C

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