



Year 10 Science

Semester One Examination - 2009

TIME ALLOWED
15 MINUTES READING
1 HOUR AND 15 MINUTES WRITING

Instructions to candidates:

- 1) Do not write or mark the examination booklet in any way during reading time.
- 2) Please check that, aside from this test booklet, you also have a multiple choice answer sheet.
- 3) There are 12 pages in this booklet including this one. Please check to ensure that this is so.
- 4) Note that the time allocated for the examination is 75 minutes and that 75 marks have been allocated: this should give you a guide as to how much time you should spend on each section.
- 5) There are 4 sections in this booklet: multiple choice, true/false, definitions and extended questions.
- 6) **Graphic calculators with the memory cleared may be used. Dictionaries must not be used.**
- 7) If you finish early please do not waste your time: you only get examination time once so it should not be wasted. Check your work thoroughly: calculations, grammar and spelling. Re-read the questions and check your answers to ensure that you have actually answered the questions asked.
- 8) When the signal to write is given fill in your name, form and teacher details on this booklet (below) **and** on the multiple choice answer sheet before you begin answering any questions.
- 9) **All answers in this booklet must be completed in pen.**

Name.....

Form.....

Teacher.....

Section 1: Multiple Choice

Write your selections on the answer sheet supplied. Please place the answer sheet in this booklet when you hand in this exam. This section is worth 25 marks.

1. In humans the diploid number of chromosomes is:
 - a) 23.
 - b) 46.
 - c) X and Y.
 - d) found in the gametes.

2. The DNA found in the nucleus of a human muscle cell is:
 - a) identical to that person's parents.
 - b) unique to that cell.
 - c) identical to all cells in that human.
 - d) identical to only the diploid cells of that human.

3. The colour of flowers in a variety of tropical orchid is determined by incomplete dominance. A cross of white & pink flowers would result in an average of:
 - a) 100% white flowers.
 - b) 100% pink flowers.
 - c) 75% white & 25% red flowers.
 - d) 50% white & 50% pink flowers.

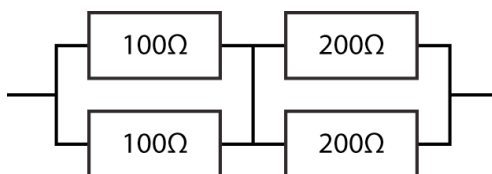
4. The sex of a child is determined:
 - a) by a pair of chromosomes found in each gamete.
 - b) by a pair of chromosomes found in the fertilised ovum.
 - c) by the type of bases found in the DNA of the mother.
 - d) by the type of bases found in the DNA of the father.

5. Blood group is determined by the co-dominance of the A & B alleles over the O allele. An O group male has children with a female and produces children of blood groups A and B. The genotype of the mother must be:
 - a) BB.
 - b) BO.
 - c) OO.
 - d) AB.

6. The probability of the offspring of parents each with heterozygous genotypes for a particular homozygous characteristic:
 - a) is 25%
 - b) is 50%
 - c) can't be determined without knowing the phenotype.
 - d) is 75%

7. A couple have 8 children, all of whom are boys who have a large number of freckles on their face. We can conclude from this that:
 - a) the allele that codes for this characteristic must be dominant.
 - b) this is a sex linked characteristic.
 - c) at least one parent must have the allele that codes for this characteristic.
 - d) if the next child is a boy, he will have the same characteristic.

8. Meiosis is the process of cell division that produces:
- two gametes with a diploid number of chromosomes.
 - four gametes with a diploid number of chromosomes.
 - two gametes with a haploid number of chromosomes.
 - four gametes with a haploid number of chromosomes.
9. Blue (b) eye colour in humans is recessive to brown (B). For a child to have blue eyes:
- both parents must have blue eyes.
 - at least one parent must have blue eyes.
 - neither parent needs to have blue eyes.
 - the parents genotypes need to be Bb & bb.
10. The expression of a genetic trait is due to:
- genetic considerations only.
 - a combination of genetic and environmental considerations.
 - the presence of dominant genes.
 - the interactions of a number of DNA molecules.
11. The device used to measure the number of coulombs of charge that pass a measuring point per second is known as the:
- voltmeter.
 - transistor.
 - ammeter.
 - resistor.
12. Which shows the correct symbol for each term?
- current (A), voltage (V), resistance (Ω), energy (J)
 - current (I), voltage (V), resistance (R), energy (E)
 - current (Ω), voltage (V), resistance (A), energy (J)
 - current (A), voltage (V), resistance (J), energy (Ω)
13. This fragment of circuit shown below could be replaced with one resistor of value:



- 0.0067Ω .
 - 150Ω .
 - 600Ω .
 - $80,000\Omega$.
14. The resistance of variable resistor increases:
- when heated.
 - when in dark.
 - by turning the dial.
 - by increasing the voltage.
15. Which of the following statements about transistors is **incorrect**?
- Transistors act as electronic switches.
 - Transistors can act as current amplifiers.
 - Transistors must always be placed in series with an LED to prevent damage.
 - Transistors have three connections, labelled as collector, emitter and base.

The following information is relevant to questions 16 – 19.

A keen science student has pulled apart his little brother's toy torch and is analysing the circuit inside, as is shown in figure 1 below. The student is keen to measure what happens in the circuit, so he connects a number of voltmeters and ammeters to the circuit, then closes the switch to complete the circuit as is shown in figure 2.

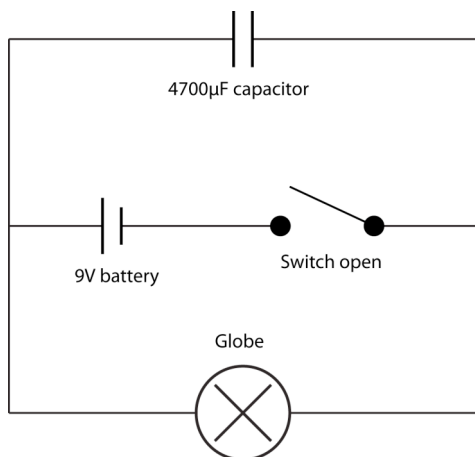


Figure 1

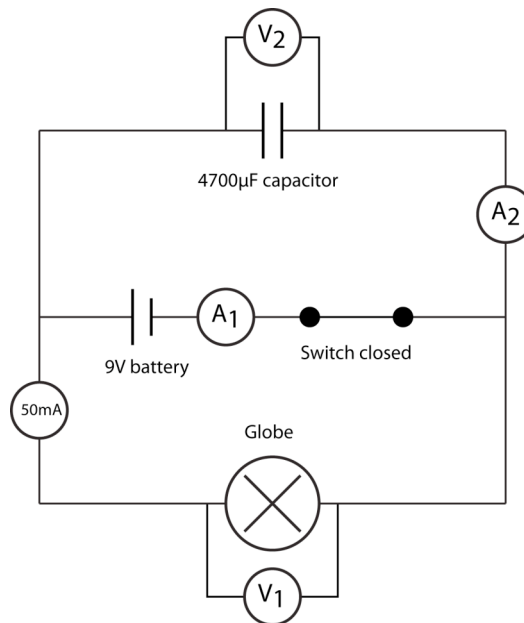


Figure 2

16. What happens to the globe once the switch is closed?
 - a) The globe turns on brightly and stays at the same brightness.
 - b) The globe turns on slowly, then brightens over a number of seconds.
 - c) The globe starts bright, then dims down over time and eventually turns off.
 - d) The globe remains off.

17. Once the switch is closed, and the capacitor fully charged, what are the readings on the meters?
 - a) $A_1: 0\text{mA}$, $A_2: 0\text{mA}$, $V_1: 9\text{V}$, $V_2: 9\text{V}$
 - b) $A_1: 50\text{mA}$, $A_2: 0\text{mA}$, $V_1: 9\text{V}$, $V_2: 9\text{V}$
 - c) $A_1: 50\text{mA}$, $A_2: 50\text{mA}$, $V_1: 9\text{V}$, $V_2: 0\text{V}$
 - d) $A_1: 100\text{mA}$, $A_2: 50\text{mA}$, $V_1: 0\text{V}$, $V_2: 0\text{V}$

18. After a period of time, the student decides to open the switch again. What happens to the globe once the switch is opened?
 - a) The globe remains bright.
 - b) The globe turns off instantly
 - c) The globe dims down over time and eventually turns off.
 - d) The globe starts to flash.

19. The resistance of the globe while at full brightness is:
 - a) 0.0056Ω .
 - b) 0.18Ω .
 - c) 5.6Ω .
 - d) 180Ω .

20. An atom of the element aluminium has an atomic number of 13 and a mass number of 26. The electron configuration of an aluminium ion is
- 2,8,10,6.
 - 2,8,14,2.
 - 2,8,3.
 - 2,8.
21. Which of the following elements is from group I of the Periodic Table of elements?
- copper
 - helium
 - sodium
 - chlorine
22. When compared to the base metal, which statement about alloys is incorrect. Alloys are:
- Less lustrous
 - Less malleable
 - more durable
 - less corrosive
23. Lithium can be made to react with oxygen in the air to produce a material called lithium oxide. The correct chemical formula for this material would be:
- LiO.
 - Li₂O.
 - LiO₂.
 - Li₂O₂.
24. Which of the following observations about zinc **cannot** be explained by the metallic bonding model?
- Zinc becomes dull on exposure to air.
 - Zinc melts at very high temperatures.
 - Zinc is lustrous.
 - Zinc can form an alloy with copper.
25. Which of the following statements is **untrue** of thermoplastic polymers?
- Thermoplastics can be recycled.
 - Thermoplastics tend to melt.
 - Thermoplastics tend to have covalent bonding between chains.
 - Thermoplastics can be blow moulded.

Section 2: True and False

Indicate whether the following statements are true or false by placing 'T' for true or 'F' for false in the boxes following each statement. This section is worth 5 marks.

1. The base adenine bonds with the base thymine.
2. Y chromosomes code for sperm and X chromosomes for ova.
3. Capacitors can be used to amplify resistance.
4. When measuring voltage across a component using a multimeter, the battery should be disconnected.
5. The transition metals are highly reactive.

Section 3: Definitions

Part A. Give a term to fit each of the following definitions. This section is worth 2 marks.

1. A section of a chromosome that is responsible for the determination of an individual characteristic.
2. A genotype containing two of the same allele.
3. The term for unreactive metals.
4. The general name for molecules that bond in large numbers during polymerisation reactions.

Part B. Give a clear definition of each of the following terms together with an example, which illustrates the meaning of the term. This section is worth 3 marks.

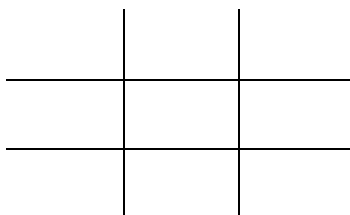
1. gamete
2. ductile
3. activity series

Section 4: Extended Questions

Give detailed answers to each question in the spaces provided. Answers that do not show all required mathematical working will not obtain full marks. This section is worth 40 marks.

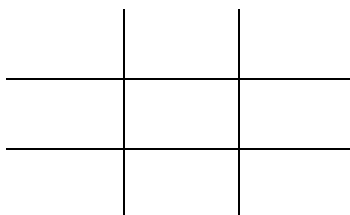
1. The height of pea plants (as studied by Gregor Mendel) is determined by a single gene with two alleles; the dominant tall (**T**) & the recessive short (**t**). A heterozygous tall plant is to be crossed with a short plant.

- a) Draw a punnet square showing the possible genotypes of the first generation of offspring:



- b) What percentage of offspring would you expect to be short?

- c) Two heterozygous plants from this first generation are to be crossed. Draw a punnet square showing the possible genotypes of the second generation of offspring:



- d) What percentage of offspring would you expect to be tall?

(1 + 0.5 + 1 + 0.5 = 3 marks)

2. In a land far, far away lives a princess who is heterozygous for a sex-linked recessive gene that causes premature baldness. She marries a 25yr old prince from another kingdom. He is very handsome and has a full head of hair. She doesn't meet his parents, but is told they both have lots of hair on their heads.

a) What is the genotype of the princess?

b) Assuming that the information the princess has been given is correct, use punnet squares and explain the likelihood that the prince will become bald?

c) Assuming that the prince will not become bald, what is the likelihood that their daughters will be prematurely bald?

d) Assuming that the prince will not become bald, what is the likelihood that their sons will be prematurely bald?

e) What other evidence would the princess need to examine to ensure her children won't go bald? (Note: in a land far, far away there is no genetic testing!)

f) After having four children, two boys and two girls, the princess discovers that not only the prince, but also her mother-in-law, wears a wig because they are completely bald, and have been since the age of 22. With this new knowledge, what can the princess expect to happen to her children's hair?

(1 + 2 + 1 + 1 + 1 + 2 = 8 marks)

3. Shapes like the ones below can be used to represent the chemical components (phosphate, sugar, bases) in a section of DNA.



- a. Place an appropriate letter within each shape to identify the name of the component
- b. Use these shapes to carefully draw a section of a DNA molecule. Each shape should be used more than once.

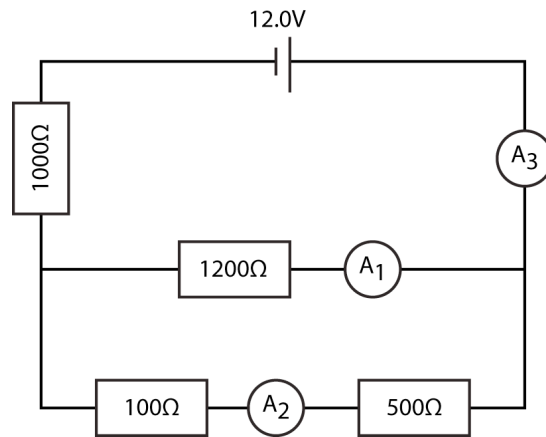
- c. Complete the following by adding the missing words:

DNA (full name): is found tightly
 coiled in found in the nucleus of cells. The DNA molecule, which has a
 shape, is made up of thousands of genes.

Genes code for large molecules called.....

(1 + 2 + (4 x 0.5) = 5 marks)

4. A year 10 student constructed the circuit shown below.



a) Calculate the total resistance of the circuit.

b) Calculate the reading on ammeter A₃.

c) Calculate the voltage drop over the 1000Ω resistor.

d) The student realised he did not need to use Ohm's Law to determine the voltage drop across the 1200Ω resistor. Explain his reasoning and give this voltage.

e) What is meant by the term “voltage drop?”

f) Would you expect the reading on ammeter A_1 to be higher, the same or lower than the reading on the A_2 ammeter? Justify your answer.

(2 + 2 + 2 + 2 + 2 + 2 = 12 marks)

5. The following table shows the colour coding for resistors

Colour	Value	Colour	Value
black	0	green	5
brown	1	blue	6
red	2	purple	7
orange	3	grey	8
yellow	4	white	9
gold	5%	silver	10%

a) What three coloured bands indicate a 150Ω resistor?

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b) If this resistor had a silver band, what resistance range would be expected from two 150Ω resistors in series?

Minimum:		Maximum:	
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(0.5 + 0.5 = 1 marks)

6. In an experiment, a piece of lithium metal is put into sulfuric acid and reacts, forming a gas and a salt. Name the two products.



(2 marks)

7. Polymers can be described as being either thermoplastics or thermosetting.

a) Which kind would you expect to be more flexible? (Circle the correct answer)

thermoplastics thermosetting

b) Which kind has molecules with a lot of bonding between its molecular chains? (Circle the correct answer)

thermoplastics thermosetting

c) Which kind would you expect to be most suitable for recycling? Why?

(1 + 1 + 2 = 4 marks)

8. Lead was used by the ancient Romans to make pipes to supply water to homes. The people employed to construct and lay these pipes were called Plumbarii, from the Latin word for lead. This is also the derivation of the English word “plumber”. Plumbers still sometimes use lead for capping roofs.

a) List a physical property that makes lead suitable for these purposes and explain this property in terms of the structure of lead. Your explanation of the structure should include a **labelled diagram**.

Property	Explanation for property
	<p>.....</p> <p>.....</p>

b) Over time, the lead becomes a dull grey colour due to a powdery substance forming on the surface. Give the name and chemical formula for the substance formed. (Lead forms 2+ ions)

Name..... Formula

(1 + 3 + 0.5 + 0.5 = 5 marks)

END OF PAPER

Answers

Section 1

- 1 b 2 d 3 d 4 b 5 d 6 a 7 c 8 d
 9 c 10 b 11 c 12 ^{a or} b 13 b 14 c 15 c 16 a
 17 b 18 c 19 d 20 d 21 c 22 a 23 b 24 a
 25 c

Section 2

1	2	3	4	5
T	F	F	F	F

Section 3 part A

1. Gene or Allele 2. Homozygous 3. inert (or native) 4. monomers

Section 3 part B (0.5 marks def + 0.5 marks eg)

- Gamete:** A sex cell eg a sperm or an ovum.
- Ductile:** The ability to draw into a wire eg copper is ductile and can be made into a wire.
- Activity series:** A list of elements (metals) in order of chemical reactivity eg sodium is above gold because it is more reactive

Section 4.

Only half marks if no working is shown!

1. a)

	T	t
t	Tt	tt
t	Tt	tt

 (1 mark – 0.5 for correct parents, 0.5 for offspring from parents)

- b) 50 % (or consequential from table) (0.5)

- c)

	T	t
T	TT	Tt
t	Tt	tt

 (1 mark – 0.5 for correct parents, 0.5 for offspring from parents)

- d) 75 % (or consequential from table) (0.5)

2. a) $X^N X^N$ (1 mark)
 b) (We don't know if the prince's mother is heterozygous or homozygous)

	X^n	X^N			X^N	X^N
X^N	$X^n X^N$	$X^N X^N$		X^N	$X^n X^N$	$X^N X^N$
Y	$X^n Y$	$X^N Y$		Y	$X^n Y$	$X^N Y$

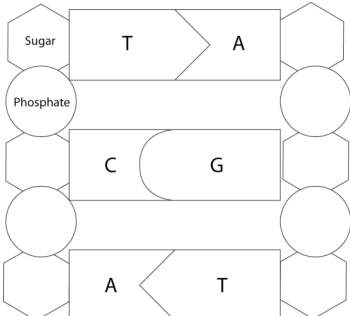
Therefore there is a 50% chance if the prince's mum is heterozygous ($X^n X^N$) or 0% chance if she is homozygous ($X^N X^N$)

(0.5 marks for each punnet sq. and 0.5 marks for each % chance = 2 marks)

- c) 0% chance – Daughters will be carriers or unaffected. See first punnet sq. (1 mark)
 d) 50% chance – Sons will either get the baldness or not. See first punnet sq. (1 mark)
 e) A pedigree chart (family tree) of the prince's family. (2 marks)
 f) As the prince is $X^n Y$, there is a 50% chance of the daughters being bald and 50% chance of the sons being bald. (1 mark for each % chance = 2 marks)

3. a) Hex shape: P or S, oval shape: S or P. Other shapes labelled A,T,C or G with A fitting T etc

(0.5 marks for correct labelling of S and P; 0.5 marks for correct labelling of bases)

- b)  Two long chains of alternating phosphate and sugar shapes, (1 mark) with appropriate bases linking the two chains. (0.5 mark) The bases must be attached to the shapes labelled sugar (0.5 mark)

- c) Deoxyribonucleic acid; chromosomes; double helix; proteins (4 x 0.5 = 2 marks)

4. a)
$$R = \frac{1}{\frac{1}{1200\Omega} + \frac{1}{100\Omega + 500\Omega}} + 1000\Omega = 1400\Omega \quad (2)$$

b)
$$I = \frac{V}{R} = \frac{12V}{1400\Omega} = 0.00857A \quad (2 - \text{pay consequential})$$

c)
$$V = IR = 0.00857A \times 1000\Omega = 8.57V \quad (2 - \text{pay consequential})$$

- d) The voltage drop across the 1200Ω resistor is the difference between 12V and the voltage drop calculated above ie $V = 12 - 8.57 = 3.43V$ (2 – pay consequential)

Or

$$V_1 = V_{in} \left[\frac{R_1}{R_1 + R_2} \right] = 12V \times \frac{400\Omega}{1400\Omega} = 3.43V \quad (2)$$

- e) The voltage drop is the amount of electrical energy “used up” (1) or transformed into another form of energy by the component (1).

(Please note that the term **potential difference** is preferable.)

- f) Reading on A₁ would be lower due to higher resistance along this path (1) with the same potential difference (1).

5. a) Brown green brown (0.5)

- b) 270 - 330Ω (0.5)

6. Sulfuric acid + lithium → lithium sulfate + hydrogen

(1 for each correct product. = 2 marks)

7. a) Thermoplastic (1).

- b) Thermosetting (1)

- c) Thermoplastic due to ability to melt & be remoulded (2)

8. a) Malleable: (1). delocalised sea of electrons able to move therefore they still surround the positive ions so electrostatic forces of attraction maintained. (2). Appropriate diagram showing Pb²⁺ ions (0.5) in a sea of delocalised electrons and appropriate labels (0.5).

- b) Lead oxide, PbO (0.5 for each = 1 mark)