JAMES RUSE AGRICULTURAL HIGH SCHOOL

PHYSICS

HIGHER SCHOOL CERTIFICATE

ASSESSMENT TASK 3

TERM 2, 2003

General Instructions

- Reading time – 5 minutes
- Working time – 80 minutes
- Board-approved calculators may be used
- Write using blue or black pen
- Draw diagrams using pencil
- A Data Sheet, Formulae Sheets and a Periodic Table are provided at the back of this paper
- Write your Student Number in the space provided.

Collection Instructions

Hand in all sections of the paper separately.

Section I

Total Marks (30)

This section has two parts, Part A and Part B

Part A
Total marks (8)

- Attempt Questions 1 – 8
- Allow about 12 minutes for this part

Part B
Total marks (22)

- Attempt Questions 9-14
- Allow about 28 minutes for this part

Section II – Data processing

Total marks (15)
20 minutes

Section III – Research

Total marks (15)
20 minutes

Student No. ……..……

SECTION 1 **PART A**

Use the multiple choice answer sheet on page 4.

1. When light with a frequency greater than f_0 ejects an electron, the excess energy (*x*) , becomes the (*y*).

   x and ***y*** correctly represent

	x	***y***
(a)	hf_0 - hf	potential energy of the photon
(b)	hf - hf_0	kinetic energy of the electron
(c)	hf	potential energy of the electron
(d)	hf_0	kinetic energy of the photon

2. Bragg diffraction is the diffraction by crystals of

   (a) electrons
   (b) neutrons
   (c) X-rays
   (d) radio waves

3. A student made the following statements concerning semiconductors. One of the statements is incorrect. Which is the *incorrect* statement?

   (a) At room temperature there are no free charge carriers in a pure semiconductor.
   (b) Semiconductors are generally found in Group IV of the periodic table.
   (c) The resistivity of semiconductors lies between that of conductors and insulators
   (d) Conductivity takes place by both electrons and holes.

4. Metallic conductors have a fairly constant resistance at specific temperatures. Which statement best explains why this resistance is usually low?

   (a) The conduction band has much higher energy than the valence band.
   (b) The valence band has much greater energy than the conduction band.
   (c) There are few electrons available for conduction.
   (d) There are many electrons available for conduction.

5. Which of the following situations would result in the production of a p-type semi-conductor?

   (a) Germanium doped with gallium.
   (b) Silicon doped with phosphorus.
   (c) Silicon doped with arsenic.
   (d) Germanium doped with silicon.

6. The Zeeman effect is concerned with the splitting of spectral lines due to

(a) gravitational fields
(b) electric fields
(c) relative motion
(d) magnetic fields

7. This question refers to the following diagram.

What was the equipment used for?

(a) To demonstrate the photoelectric effect
(b) Hertz' experiment with electromagnetic waves
(c) The first radio
(d) To demonstrate thermionic conduction.

8. The graph shows the electrical conductance of the metal mercury plotted against mercury.

The correct conclusion from the graph will be:

(a) Mercury is a superconductor of electricity above 4.2 Kelvin
(b) Mercury is a superconductor of electricity below 4.2 Kelvin
(c) The conductivity of mercury drops to zero below 4.2 Kelvin
(d) The electrical resistance of mercury can only be explained from the graph below 4.2 Kelvin

Student No. ……..……

SECTION 1 **PART A**

ANSWER SHEET

Place a cross in the correct space.

	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				

marks

Student No. ……..……

PART B QUESTION AND ANSWER BOOKLET **Marks**

Question 9 (4 marks)

(a) Max Planck hypothesised that energy is quantised. Describe the phenomenon that led Planck to this hypothesis.

(b) Outline the reason why Planck made this proposal.

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Question 10 (3 marks)

The cathode ray tubes of a conventional TV displays and oscilloscopes have three essential components. Outline the role of each of these essential components.

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Question 11 (3 marks) **Marks**

Describe how the spectrum of hydrogen can contain so many lines when hydrogen contains only one electron.

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Question 12 (2 marks)

Calculate the value of q/m for a particle that moves in a circle of radius 7.0 mm in a 0.86 T magnetic field if a 300 Vm^{-1} electric field placed perpendicularly will make the path straight.

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Question 13 (3 marks)

Describe how superconductors and the effects of magnetic fields are being used to develop the maglev train.

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Question 14 (7 marks) **Marks**

Critically assess the impact of the invention of transistors on society, with particular reference to their use in microchips and microprocessors.

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END OF EXAM