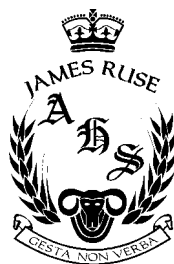


# JAMES RUSE AGRICULTURAL HIGH SCHOOL



## 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

**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 semiconductor?

- (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

**SECTION 1****PART A****ANSWER SHEET**

Place a cross in the correct space.

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>1</b>				
<b>2</b>				
<b>3</b>				
<b>4</b>				
<b>5</b>				
<b>6</b>				
<b>7</b>				
<b>8</b>				

marks

**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  $300 \text{ Vm}^{-1}$  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**