**PHSC**



# ISEBE LEMFUNDO LEMPUMA KOLONI

EASTERN CAPE EDUCATION DEPARTMENT

OOS-KAAP ONDERWYSDEPARTEMENT

IIMVIWO ZEBANGA LOKUGQIBELA

NATIONAL SENIOR CERTIFICATE EXAMINATIONS

NASIONALE SENIOR SERTIFIKAAT-EKSAMEN

### SEPTEMBER 2009

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| **PHYSICAL SCIENCES – FIRST PAPER** |

##### IXESHA: 3 iiyure TIME: 3 hours TYD: 3 uur

**AMANQAKU: 150 MARKS: 150 PUNTE: 150**

*Write on the cover of your answer book, after the word “Subject” –*

**PHYSICAL SCIENCES – FIRST PAPER**

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| This examination paper consists of 12 pages, a 3 page data sheet, graph paper and an answer sheet. |

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| **INSTRUCTIONS AND INFORMATION** | |
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| 1. | Write your name and/or examination number (and centre number if applicable) in the appropriate spaces on the ANSWER SHEET and ANSWER BOOK. |
|  |  |
| 2. | Answer ALL the questions. |
|  |  |
| 3. | Answer SECTION A on the attached ANSWER SHEET and place the completed answer sheet inside your ANSWER BOOK. |
|  |  |
| 4. | Answer SECTION B in the ANSWER BOOK. |
|  |  |
| 5. | Non-programmable calculators may be used. |
|  |  |
| 6. | Appropriate mathematical instruments may be used. |
|  |  |
| 7. | Number the questions correctly according to the numbering system used in this question paper. |
|  |  |
| 8. | Data sheets are attached for your use. |
|  |  |
| 9. | Give brief motivations, discussions, etcetera where required. |
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| --- | --- | --- | --- | --- |
| **SECTION A** | | | | |
|  | |  |  |  |
| Answer this section on the attached ANSWER SHEET. | | | | |
|  | |  |  |  |
| **QUESTION 1: ONE-WORD ITEMS** | | | | |
|  | | | | |
| Give ONE word/term for EACH of the following descriptions. Write only the word/term  next to the question number (1.1 – 1.5) on the attached ANSWER SHEET. | | | | |
|  |  | |  |  |
| 1.1 | A car moves on a horizontal road at a constant velocity of 35 m.s-1. The car therefore has … energy. | | | (1) |
|  |  | | |  |
| 1.2 | The SI unit for the quantity determined by the product of force and velocity. | | | (1) |
|  |  | | |  |
| 1.3 | The principle that states that every point on a wave front acts as a new source of secondary wavelets that spread out in all directions. | | | (1) |
|  |  | | |  |
| 1.4 | The work done in moving a unit positive charge from a point of lower potential to a point of higher potential in an electric field. | | | (1) |
|  |  | | |  |
| 1.5 | The minimum energy required to remove an electron from a metal surface. | | | (1) |
|  |  | | | **[5]** |
|  |  | | |  |
| **QUESTION 2: FALSE ITEMS** | | | |  |
|  |  | | |  |
| The following statements given in questions 2.1 to 2.5 are FALSE. Write the correct statement to the question number (2.1 – 2.5) on the attached ANSWER SHEET. | | | |  |
|  |  | | |  |
| 2.1 | The quantity that represents the rate of change of momentum is measured in the SI unit of joule. | | | (2) |
|  |  | | |  |
| 2.2 | Newton’s First Law always applies to equal forces acting in opposite directions on the surface of each of the two objects that are in contact. | | | (2) |
|  |  | | |  |
| 2.3 | The Radar speed traps used by traffic officials to determine the speed of a vehicle, work on the principle of the photoelectric effect. | | | (2) |
|  |  | | |  |
| 2.4 | A transformer is the electrical device that is used to protect electronic equipment against a sudden surge of current by releasing the extra charge gradually. | | | (2) |
|  |  | | |  |
| 2.5 | The penetrating power of gamma rays is the same as that of ultra violet rays. | | | (2) |
|  |  | | | **[10]** |
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| **QUESTION 3: MULTIPLE-CHOICE QUESTIONS** | |  |
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| Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the best answer and make a  cross (X) in the correct block (A – D) next to the question number (4.1 – 4.5) on the attached ANSWER SHEET. | |  |
|  |  |  |
| 3.1 | Consider the following five iron ball bearings hanging on thin strings. One of the ball bearings is lifted to a certain height and released. It strikes the first ball, comes to a complete rest and the last ball in the row swings out to the exact height from which the original ball was released. |  |
|  | This is an example of an … |  |
|  |  |  |
|  | A elastic collision because energy and momentum is conserved.  B elastic collision because only momentum is conserved.  C inelastic collision because momentum is not conserved.  D inelastic collision because neither energy nor momentum is conserved. | (2) |
|  |  |  |
| 3.2 | Mary carries her school bag of mass 8 kg over a distance of 12 m. The work done by Mary on her school bag is … |  |
|  |  |  |
|  | A 78,4 J.  B 940,8 J.  C 96 J.  D 0 J. | (2) |
|  |  |  |
| 3.3 | The Argentinean national soccer team’s jersey is blue with white stripes on it. In red light the jersey will appear to have … |  |
|  |  |  |
|  | A white and red stripes.  B black and red stripes.  C black and blue stripes.  D blue and red stripes. | (2) |
|  |  |  |
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| 3.4 | The south pole of a magnet is placed on the left-hand side and the north pole of another magnet on the right-hand side as shown in the sketch. A conductor placed between the two magnetic poles carries conventional current into the plane of the paper. |  |
|  |  |  |
|  | The conductor would experience a force towards … |  |
|  |  |  |
|  | A J.  B K.  C N.  D S. | (2) |
|  |  |  |
| 3.5 | Eskom’s national electricity network provides alternating current because … |  |
|  |  |  |
|  | A alternating current is easier to generate.  B direct current voltage varies more than alternating current.  C transformers only work on alternating current.  D alternating current is necessary for computers and lighting. | (2) |
|  |  | **[10]** |
|  |  |  |
|  | **TOTAL SECTION A:** | **25** |
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| **SECTION B**  **INSTRUCTIONS AND INFORMATION** | |  |
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| 1. | Answer SECTION B in the ANSWER BOOK. |  |
|  |  |  |
| 2. | The formulae and substitutions must be shown in ALL calculations. |  |
|  |  |  |
| 3. | Round off your answers to TWO decimal places. |  |
|  |  |  |
| 4. | Start each question on a new page. |  |
|  |  |  |
| **QUESTION 4** | |  |
|  |  |  |
| Monty stands on the balcony of his house and throws a tennis ball downwards at a velocity of 4 m.s-1. The height of the balcony above the ground is 12,7 m. After striking the ground, the ball bounces to a height of 8,3 m. The effect of air resistance can be ignored. | |  |
|  |  |  |
| 4.1 | Determine the velocity at which the ball strikes the ground. | (4) |
|  |  |  |
| 4.2 | State the Principle of Conservation of Mechanical Energy. | (2) |
|  |  |  |
| 4.3 | What is the velocity at which the ball bounces off the ground? | (4) |
|  |  |  |

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| 4.4 | Ronald, Monty’s friend, draws a sketch graph of the motion of the tennis ball. He forgets to name the y-axis of the graph. Consider the graph and answer the questions that follow: |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | 4.4.1 | Write down what the y-axis represents. | (1) |
|  |  |  |  |
|  | 4.4.2 | Did Ronald regard the downward motion as POSITIVE or NEGATIVE? | (2) |
|  |  |  |  |
|  | 4.4.3 | What is the value of P on the graph? | (1) |
|  |  |  |  |
|  | 4.4.4 | What does the shaded area represent? | (2) |
|  |  |  | **[16]** |
|  |  |  |  |
| **QUESTION 5** | | |  |
|  |  |  |  |
| Dale Steyn bowls a cricket ball, mass 156 g, towards Jacques Kallis. The ball reaches Jacques at a velocity of 41 m.s-1 and he hits it straight past Dale at a velocity of 25 m.s-1 for a boundary. | | |  |
|  |  |  |  |
| 5.1 | Calculate the momentum of the ball just before Jacques hits it. | | (3) |
|  |  | |  |
| 5.2 | Determine the impulse of the ball on the bat. | | (4) |
|  |  |  |  |
| 5.3 | If the ball is in contact with the bat for 0,003 s, determine the magnitude of the force that the ball exerts on the bat. | | (3) |
|  |  |  |  |
| 5.4 | The captain advises the bowler to bowl a slow delivery. Use your knowledge of momentum and impulse to explain why the slow delivery is an effective alternative. | | (2) |
|  |  |  | **[12]** |
|  |  |  |  |

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| **QUESTION 6** | | | | |  |
|  |  | |  | |  |
| Emmie pushes a trolley of mass 7,5 kg at a velocity of 0,8 m.s-1. She exerts a force on the trolley to increase the velocity of the trolley to 1,4 m.s-1.  C:\Documents and Settings\Greg\My Documents\My Scans\scan0040.tif | | | | |  |
|  |  | |  | |  |
| 6.1 | Calculate the net work done by Emmie on the trolley. | | | | (4) |
|  |  | |  | |  |
| 6.2 | Name and state the principle you used to answer QUESTION 6.1. | | | | (3) |
|  |  | |  | | **[7]** |
|  |  | |  | |  |
|  |  | |  | |  |
| **QUESTION 7** | | | |  | |
|  |  | |  |  | |
| On many farms windmills pump water out of boreholes which is then collected in a reservoir. One farmer uses an electric motor to pump water from the reservoir into a dam, 50 m above the reservoir at the rate of 1200 litres of water every one minute. The water is discharged into the dam at a speed of 6 m.s-1.  (Assume that the mass of 1 litre of water = 1 kg) | | | | | |
|  | |  |  |  | |
| 7.1 | | What source of environmentally friendly energy is used by the windmills to pump water out of the boreholes? | | (1) | |
|  | |  |  |  | |
| 7.2 | | Calculate the minimum power required for the electric motor to pump the 1200 litres of water from the reservoir into the dam. | | (6) | |
|  | |  |  | **[7]** | |
|  | |  |  |  | |

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| **QUESTION 8** | | | |  |
|  |  | |  |  |
| Boat B is anchored in the quiet, calm waters of the Indian Ocean of Algoa Bay while taking part in the Tuna Classic fishing competition. Boat A is moving at 12 m.s-1 towards boat B and sounds a siren with a frequency 850 Hz. Accept that the speed of sound in air is 340 m.s-1. | | | |  |
|  |  | |  |  |
| 8.1 | Calculate the frequency of the siren’s sound (of Boat A) that is heard by the captain of boat B. | | | (5) |
|  |  | |  |  |
| 8.2 | Boat A moves ahead of the stationery boat B. Boat A sounds the siren again. How will the frequency of the sound of the siren heard by the captain of boat B compare to the frequency at which the sound was emitted by boat A. **(**Choose one of the following: HIGHER, LOWER orthe SAME). | | | (2) |
|  |  | |  | **[7]** |
| **QUESTION 9** | | | |  |
|  |  | |  |  |
| During the demonstration of the diffraction of waves by a group of learners in a physics class, monochromatic red light of wavelength 675 nm is used. The red light that passes through the slit (width 6 µm), falls on a flat screen at a distance of 0,4 m away from the slit. | | | |  |
|  |  | |  |  |
| 9.1 | What is a monochromatic light? | | | (1) |
|  |  | |  |  |
| 9.2 | Calculate the angle at which the first minimum occurs. | | | (4) |
|  |  | |  |  |
| 9.3 | What do the dark bands on the screen represent? | | | (1) |
|  |  | |  |  |
| 9.4 | The red light is now replaced with a blue light. | | |  |
|  |  |  | |  |
|  | 9.4.1 | Compare the difference in the diffraction patterns observed when using the red and then the blue light. | | (4) |
|  |  |  | |  |
|  | 9.4.2 | Explain the reason for the difference in diffraction patterns in QUESTION 9.4.1. | | (2) |
|  |  |  | |  |
| 9.5 | What will the effect be on the magnitude of the angle in QUESTION 9.2, if the slit width is reduced?  (Choose one of the following:INCREASES, DECREASES or STAYS THE SAME). | | | (1) |
|  |  |  | | **[13]** |
|  |  |  | |  |

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| **QUESTION 10** | | |  |
|  |  |  |  |
| A group of learners investigated the change in potential difference over time while a  capacitor is being discharged. They were provided with the following apparatus to set up the circuit: | | |  |
|  |  |  |  |
| * Ammeter * Voltmeter * Capacitor * Switch * Connecting wires * Battery/Power source * Resistor | | |  |
|  |  |  |  |
| After the capacitor has been fully charged, the learner opens the switch and takes a reading every 20 seconds. The table below shows the results obtained during the investigation:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | V (volts) | 12 | 6,6 | 4,4 | 2,8 | 1,8 | 1,2 | 0,4 | 0,2 | | t (seconds) | 0 | 20 | 40 | 60 | 80 | 100 | 120 | 140 | | | |  |
|  |  |  |  |
| 10.1 | Draw a circuit diagram of the correct set-up of the apparatus for this investigation. | | (3) |
|  |  |  |  |
| 10.2 | Formulate an investigative question for the above investigation. | | (2) |
|  |  |  |  |
| 10.3 | Write down the independent variable. | | (1) |
|  |  |  |  |
| 10.4 | Draw a graph of the potential difference versus time on the attached graph paper. Draw the axes and choose an appropriate scale. Plot the points and then draw the graph. | | (4) |
|  |  |  |  |
| 10.5 | Calculate the potential difference of the capacitor when the charge on the capacitor is 1,35 x 10-3 C and the capacitance is 150 µF. | | (3) |
|  |  |  |  |
| 10.6 | Technicians that repair electronic devices are advised not to open the devices while in operation. Use your knowledge of capacitors to explain this safety measure. | | (2) |
|  |  |  | **[15]** |

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| **QUESTION 11** | | | |  |
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| In the circuit represented below, the battery has an emf of 10 V and an unknown internal resistance. Voltmeter V1 is connected across the battery and voltmeter V2 is connected across the open switch S. The resistance of the connecting wires and ammeter can be ignored.  **3 Ω**  **6 Ω**  **1 Ω**  **emf = 10 V; r = ?** S **V2** A **V1** | | | |  |
| Switch S is open | | | |  |
|  |  | |  |  |
| 11.1 | What is the reading on V1? | | | (1) |
|  |  | |  |  |
| 11.2 | What is the reading on V2?  When the switch S is closed, the reading on V1 drops to 7,5 V. | | | (1) |
|  |  | |  |  |
| 11.3 | What is the reading on V2? | | | (1) |
|  |  | |  |  |
| 11.4 | Calculate the reading on the ammeter. | | | (8) |
|  |  | |  |  |
| 11.5 | Calculate the internal resistance of the battery. | | | (5) |
|  |  | |  | **[16]** |
|  |  | |  |  |
| **QUESTION 12** | | | |  |
|  |  | |  |  |
| During an investigation, a learner is provided with a simple DC electric motor and an AC dynamo. He is then asked to provide information concerning certain similarities and differences between these two electrical devices. | | | |  |
|  |  | |  |  |
| 12.1 | What should his answer be concerning … | | |  |
|  |  | | |  |
|  | 12.1.1 | the type of commutators used in each device? | | (2) |
|  |  |  | |  |
|  | 12.1.2 | the direction of magnetic flux? | | (2) |
|  |  | |  |  |
| 12.2 | Which industrial version of these two devices would the learner most likely find if he visits a hydro-electric power station? | | | (2) |
|  |  | |  | **[6]** |

|  |  |  |  |
| --- | --- | --- | --- |
| **QUESTION 13** | | |  |
|  |  |  |  |
| The peak value of the AC voltage across a speaker from a music system is 17 V and the speaker has a resistance of 10 Ω. | | |  |
|  |  |  |  |
| 13.1 | Calculate the root mean square voltage (Vrms). | | (3) |
|  |  |  |  |
| 13.2 | Calculate the peak value for the current. | | (3) |
|  |  | |  |
| 13.3 | Calculate the average power dissipated in this circuit. | | (6) |
|  |  |  |  |
| 13.4 | Draw a sketch graph of the current versus time for this circuit. Indicate Ipeak and Irms on the graph. | | (4) |
|  |  |  | **[16]** |
|  |  |  |  |
| **QUESTION 14** | | |  |
|  |  |  |  |
| A laser operates when electrons are stimulated to fall back from a higher energy level to a lower energy level as shown in the diagram below.  **-1,47 x 10-19 J**  ⬤  **-5,16 x 10-19 J** | | |  |
|  |  |  |  |
| 14.1 | Calculate the energy of the photon that is emitted when the electron drops to the lower energy level. | | (2) |
|  |  | |  |
| 14.2 | Calculate the wavelength of the radiation that is emitted. | | (6) |
|  |  | |  |
| 14.3 | Consider your answer in QUESTION 14.2 and use the table given below to determine the colour of the laser that was used.   |  |  | | --- | --- | | **Colour** | **Wavelength** | | Red | 660 nm | | Green | 540 nm | | Blue | 470 nm | | | (2) |
|  |  | | **[10]** |
|  |  | |  |
|  | **TOTAL SECTION B:** | | **125** |
|  |  | |  |
|  | **GRAND TOTAL:** | | **150** |