**GENERAL INTEGRATED SCIENCE– UNIT 2**

**TASK 14 – Motion & Energy test**

**MARKING KEY**

**Part A - Multiple Choice**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| b | a | a | c | d | d | c | a | b | c |

**Part B – Short Answer**

**Question One**

1. Explain how you would increase the gravitational potential energy of a book on the floor. *(1 mark)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Lift the book higher above the ground | 1 |
| **Total** | **1** |

1. If a 0.457kg book is sitting 2.04m above the ground, how much gravitational potential energy does it have? *(3 marks)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Answer correct (9.15J) - award FT * Unit correct (joules) * Working it/conversions correct | 1-3 |
| **Total** | **3** |

1. The book from Part (b) was knocked off of the shelf by a poorly aimed soccer ball. The soccer ball weighed 0.4kg. It travelled 6m, from where it was kicked to where the book was sitting, in 3 seconds. How much kinetic energy did the ball have? *(4 marks)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Answer correct (0.8J) - award FT * Unit correct (joules) * Working it/conversions for kinetic energy included * Working out for velocity calculation included | 1-4 |
| **Total** | **4** |

1. Describe the difference between an energy transformation and an energy transfer. *(2 marks)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Energy transfer involves energy moving from object to another * Energy transformation means the energy is changing form | 1-2 |
| **Total** | **2** |

**Question Two**

1. Create an energy flow diagram to show how energy **transforms** from the sun into the runner moving. *(2 marks)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Correct energy forms (light – chemical potential – kinetic) * Arrows going the right way | 1-2 |
| **Total** | **2** |

1. Using this athlete as an example, explain the difference between a vector and a scalar quantity

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Scalar – value with just magnitude * Vector – value with magnitude and direction | 1-2 |
| **Total** | **2** |

1. If the runner jogs at 1.5m/sec for 2 minutes, what distance have they covered? *(3 marks*)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Answer correct (180m) award FT * Unit correct (m) * Working it/conversions correct | 1-3 |
| **Total** | **3** |

1. One day, the runner decides to test how far they can run at a full sprint. They begin their sprint at the start line of a 450m oval. After running at 10m/s for 40 seconds, the runner collapses. What is the displacement of the runner from the start line? *(3 marks)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Answer correct (50m [from the start line] or 400m[around the track]- award FT * Unit correct (m[direction]) * Working it/conversions correct | 1-3 |
| **Total** | **3** |

**Question Three** .

1. State the type of energy found in the battery. **Chemical potential (1)** *(1 mark)*
2. Draw the energy flow diagram for the energy transfer that occurs when the toy car is working normally.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Correct objects (battery – wires – wheels) * Arrows going the right way | 1-2 |
| **Total** | **2** |

1. Explain what is meant by the term useful energy? *(1 mark)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Energy that is used for the purpose of the object (or gives an example like light from a light globe) | 1 |
| **Total** | **1** |

1. Imagine that the car battery contains 260 Joules of energy. If the toy car is only 35% efficient, calculate how much useful energy the car engine will produce? *(3 marks)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Answer correct (91J) * Unit correct (joules) * Working out included | 1-3 |
| **Total** | **3** |

1. If instead the toy car was receiving an input of 180 joules and produced a useful output of 129 joules of kinetic energy, how energy efficient was the car?  *(3 marks)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Answer correct (71.6%) * Unit correct (%) * Working out included | 1-3 |
| **Total** | **3** |

**Question Four**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| At which **TWO** points does the car have **NO** kinetic energy? - A and F | 2 |
| At which point does the car have the **MOST** gravitational potential energy? - A | 1 |
| At which point does the car have **SOME** kinetic energy and the **LEAST** gravitational potential energy? - E | 1 |
| **Total** | **4** |

1. Justify why there needs to be the moat of water at the end of the ride rather than just the bumper using your knowledge of forces, types of energy and Newton’s Laws. *(2 marks)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Moat will allow car to slow down slower * Less likely to hurt the passengers | 1-2 |
| **Total** | **2** |

1. The rollercoaster weighs 1200kg. The combined weight of the riders is 620kg. If the rollercoaster is accelerating at 4.5m/s/s at point B, what is the total force of the rollercoaster at point B? *(3 marks)*

|  |  |
| --- | --- |
| **Description** | **Marks** |
| * Answer correct (8190 Newtons) * Unit correct (N) * Working out included | 1-3 |
| **Total** | **3** |