Year 12 Physics – Test 3 (Task 7)

**Electromagnetism  
Suggested Answers**

**Question 1**a.

|  |  |
| --- | --- |
| **Description** | **Marks** |
|  | 1 |

**b.**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Wires move apart (repel) | 1 |

**Question 2**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Field lines N🡪 S and do not cross  Repulsion & attraction shown correctly  Field lines leave and enter magnets perpendicular | 1  1  1 |

**Question 3**a.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| F = 1/4o q1q2/r2  9.00 x 109 x 2.00 x 10-5 x 1.60 x 10-4/ 0.1102 | 1 |
| 2.38 x 103 N Attraction (towards each other) | 1 |

**b.**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Total charge = 20.0 C + (-160.0 C) = -140.0 C (1)  Net charge on each = 70.0 C  9.00 x 109 x 7.00 x 10-5 x 7.00 x 10-5/ 0.1102 | 1 |
| 3.64 x 103 N Repulsion | 1 |

**Question 4  
a**

|  |  |
| --- | --- |
| **Description** | **Marks** |
|  | 1 |
| 3.01x10-6 T | 1 |

**b**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Fc = Fe  m = Bqr/v m = 5.5x10-2 x 3.2x10-19 x 0.094 / 1.71x104 | 1 |
| 9.67x10-26kg | 1 |

**Section 2**

**Question 1**a

|  |  |
| --- | --- |
| **Description** | **Marks** |
| E=V/d  1.75x103 / 0.04 | 1 |
| 4.38x104 V m-1 | 1 |

**b**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Positive | 1 |
| Gravity is providing the downward weight force on the drop, the drop is stationary so the electric force must be upwards | 1 |

**c**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| F=Eq q = 5 x 1.6x10-19  8.00x10-19 | 1 |
| F = 4.375x104 x 8.00x10-19 | 1 |
| 3.50x10-14 N | 1 |

**d**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Fe = mg  m= 3.50x10-14 / 9.8 | 1 |
| 3.57x10-15 kg |  |

**Question 2**a

|  |  |
| --- | --- |
| **Description** | **Marks** |
| τ = nFr⊥  τ= n (BI)r⊥ | 1 |
| 25 x 9.08 x 10-3 x 2.2 x (2 x 0.055) x (0.5 x 0.035) | 1 |
| 9.61 x 10-4 N m | 1 |

NB if diameter is used and torque not doubled correct answer can be obtained. Max 1 mark

**b**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Increasing the number of coils | 1 |
| Increasing the strength of the permanent magnets. | 1 |
| Increasing the current flowing through the coil | 1 |

**c**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Torque shown correctly (i.e. positive and max every 180o)  Maximum torque at 0, 180, 360 | 1  1 |

**Question 3**a

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Switch closed, current flows, magnetic flux from primary coil cuts the secondary coil | 1 |
| Current is induced in the secondary coil according to Lenz’s Law and the needle deflects | 1 |

**b**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| As current is DC the magnetic flux cuts the coil once deflecting the needle | 1 |
| As there is no further flux change current is no longer induced in the secondary coil | 1 |

**c**

|  |  |
| --- | --- |
| **Description** | **Marks** |
|  | 1-2 |
| emf = 0.392V | 1 |

**Section 3**

**Question 1**a.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Within a cycle the current flows back and to  2 x 50 Hz = 100 cycles per second1 | 1 |

**b.**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| so Vmax = 120 x = 169.7 V  so | 1 |
|  | 1 |

**c.**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Contacts to external circuit  Slip rings  Pulley that turns coil  Axle  **P**  **R**  **Q**  **S**  PQ rotates out of page  SR rotates into page  Current  Current  **S**  **N** | 1 |

**d.**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Current flows in a direction to establish a field that opposes the change in flux that created it. | 1 |

**e.**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| for 1 length, and | 1 |
| There are 2 lengths each with N turns so, | 1 |
| The radius r is the distance from the axle to each length so  , and by substitution | 1 |

**f.**

|  |  |
| --- | --- |
| **Description** | **Marks** |
| N = 600 f = 840/60 = 14 Hz B = 0.126 T A = 0.17 x 0.09 = 0.0153 m2 | 1 |
|  | 1 |
| = 101.7 = 102 V | 1 |