**Section: A**

*Answer* **ALL** *the questions in this section. Select only* **ONE (1)** *answer for each question and write your answers clearly in the ( ) provided. Answers written anywhere else will* **NOT** *be marked. Workings need* **NOT** *be shown.*

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| **Q1:** | A copper tubing of uniform cross-section is 0.757 m in length. What is the length of this copper tubing in **inches**? (Note: 1 m = 39.37 in) | **Mark (1)** |
|  | 2.98 inch | |
|  | 0.034 inch | |
|  | 0.34 inch | |
|  | 29.80 inch | |

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| **Q2:** | Which of the following physical quantity has an equivalent SI base unit of **ms-1**? | **Mark (1)** |
|  | Mass | |
|  | Length | |
|  | Velocity | |
|  | Area | |

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| **Q3:** | An object falls freely from rest on a planet where the gravitational acceleration is 30 m/s2. Assuming no air resistance, after 3 seconds, the object will have a **velocity** of \_\_\_\_\_\_\_\_\_\_\_. | **Mark (1)** |
|  | 10 m/s | |
|  | 90 m/s | |
|  | 120 m/s | |
|  | 0.1 m/s | |

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| **Q4:** | Which of the following best describes the velocity-time graph as shown in Figure A4?  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_1119433306_1294301186.png | **Mark (1)** |
|  | Constant Deceleration | |
|  | Constant Acceleration | |
|  | Constant velocity | |
|  | No motion | |

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| **Q5:** | Which of the following best describes an object travelling in a **straight line path** at **constant velocity**? | **Mark (1)** |
|  | Object has a net force acting on it in the direction of motion. | |
|  | Object is moving with constant acceleration. | |
|  | Object must be moving in a vacuum or in the absence of air resistance. | |
|  | Object has zero acceleration. | |

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| **Q6:** | The **kinetic energy** of an object is the energy which it possesses due to its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | **Mark (1)** |
|  | motion | |
|  | shape | |
|  | state | |
|  | position | |

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| **Q7:** | Which of the following actions will definitely **INCREASE** the acceleration of a moving object? | **Mark (1)** |
|  | Increase net force with constant mass | |
|  | Decrease net force with constant mass | |
|  | No change in net force with increase mass | |
|  | Decrease net force with increase mass | |

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| **Q8:** | For an object in rotational equilibrium, the sum of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ moments about any chosen point must be equal to the sum of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ moments about the same point. | **Mark (1)** |
|  | clockwise; clockwise | |
|  | clockwise; anticlockwise | |
|  | anticlockwise; anticlockwise | |
|  | upward; downward | |

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| **Q9:** | A section of a non-uniform tube placed horizontally is completely filled with water as shown in Figure A9. The speed of the water at segment 1 and segment 2 are *v*1 and *v*2, respectively. Assume there is no leak along the tube.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-185834418_1345028813.png  Which of the following statements is **TRUE**? | **Mark (1)** |
|  | *v*1 has the same value as *v*2. | |
|  | The water pressure in segment 1 is higher than the water pressure in segment 2. | |
|  | *v*1 is higher than *v*2. | |
|  | Both the water pressure in segment 1 and segment 2 is the same. | |

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| **Q10:** | Which of the following represent **SCALAR** quantities? | **Mark (1)** |
|  | Length; speed; weight | |
|  | Volume; speed; mass | |
|  | Displacement; velocity; weight | |
|  | Area; mass; velocity | |

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| **Q11:** | A voltage of 20 V is applied across a resistor. The resistance in the resistor is 4 Ω. Calculate the **current** flowing through the resistor. | **Mark (1)** |
|  | 5 A | |
|  | 16 A | |
|  | 80 A | |
|  | 0.2 A | |

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| **Q12:** | The current flowing in a circuit is 0.4 A. Calculate the amount of **charge** that passes through any given point in the circuit in a period of 300 s. | **Mark (1)** |
|  | 0.4 C | |
|  | 120 C | |
|  | 750 C | |
|  | 0.0013 C | |

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| **Q13:** | The strength of magnetic field is also known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | **Mark (1)** |
|  | density | |
|  | point charge | |
|  | magnetic flux density | |
|  | force | |

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| **Q14:** | A tensile force was applied to a wire of original length 3 m to pull it to a final length of 3.06 m. Calculate the **strain** on the wire. | **Mark (1)** |
|  | 0.98 | |
|  | 0.02 | |
|  | 1.02 | |
|  | 0.20 | |

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| **Q15:** | Calculate the **heat energy** required to increase the temperature of a steel block of mass 2.5 kg by 2ºC. Given that the specific heat capacity of the steel block is 490 J/(kg∙ºC). | **Mark (1)** |
|  | 392 J | |
|  | 612.5 J | |
|  | 2450 J | |
|  | 98 J | |

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| **Q16:** | Figure A16 shows a solenoid with a current passing through it, generating a magnetic field. What are the **polarities** generated at point X and point Y?  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_1663713999_7913028.png | **Mark (1)** |
|  | Point X is South; Point Y is North | |
|  | Point X is South; Point Y is South | |
|  | Point X is North; Point Y is South | |
|  | Point X is North; Point Y is North | |

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| **Q17:** | Which of the following sentences is **FALSE**? | **Mark (1)** |
|  | Voltage will be generated even when there is no change in magnetic field strength. | |
|  | When an electric current passes through a solenoid, it will generate a magnetic field. | |
|  | Any change in the magnetic environment of a coil of wire will cause a voltage to be induced in the coil. | |
|  | Voltage will be produced by moving a magnet toward or away from a coil of wire. | |

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| **Q18:** | Determine the **frequency** of the wave if the period of the wave is 0.025 s. | **Mark (1)** |
|  | 2.5 Hz | |
|  | 40 Hz | |
|  | 200 Hz | |
|  | 0.05 Hz | |

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| **Q19:** | Which of the following statements describing the relationship between the wavelength and frequency of an electromagnetic wave is **TRUE**? | **Mark (1)** |
|  | As frequency increases, wavelength increases. | |
|  | As frequency increases, wavelength decreases. | |
|  | Frequency and wavelength are independent of each other. | |
|  | Frequency is constant for all wavelengths. | |

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| **Q20:** | A ruby laser produces red light which has a wavelength of 500 nm. What is the amount of **energy** in Joules carried by one photon of the red light? Given that *h* = 6.63 × 10-34 J.s and *c* = 3 × 108 m/s. | **Mark (1)** |
|  | 1.80 × 10-19 J | |
|  | 1.11 × 10-48 J | |
|  | 2.26 × 1035 J | |
|  | 3.98 × 10-19 J | |

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**Section: B**

*Answer* **ALL** *the questions in this section. Write your answers clearly in the blanks provided. Answers written anywhere else will* **NOT** *be marked. Workings need* **NOT** *be shown.*

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| **Q21:** | (a) A man walks a distance of 80 m in 4 s. What is his **average speed** in metre per second?  Ans: m/s  (b) A bicycle is travelling at an initial velocity of 12 m/s.       (i) Calculate the **initial kinetic energy** of the bicycle if the mass of bicycle is 4 kg.       Ans:  J       (ii) Calculate the **final velocity** of the bicycle 3 seconds later if it is travelling at a constant acceleration of 2 m/s2.       Ans:  m/s | **Mark (3)** |

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| **Q22:** | Figure B2 shows a velocity-time graph of a lorry during part of a journey. The lorry travels from point O to point A, then to point B and finally to point C. Choose the most appropriate words from the box below to describe the motion in each section of the journey.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-1469034422_-1276923396.png  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-1469034422_558583385.png  (a) Point O-Point A:  The lorry is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Its velocity changes from 0 to 16 m/s in 8 seconds.  Ans:  (b) Point A-Point B:  The lorry is moving at a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of 16 m/s for 4 seconds.  Ans:  (c) Point B-Point C:  The lorry is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It is slowing down from 16 m/s to rest in 4 seconds.  Ans: | **Mark (3)** |

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| **Q23:** | In Figure B3, Jack has a weight of 400 N and sits 2.0 m from the pivot of see-saw. Ben has a weight of 450 N and sits 1.5 m from the other side of the pivot.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-2002673164_-632844508.png  (a) Calculate the **moment** about the pivot generated by **Jack**.  Ans:  Nm  (b) Calculate the **moment** about the pivot generated by **Ben**.  Ans:  Nm  (c) Hence, which person (**Jack** or **Ben**) will move downwards?  Ans: (**Jack** or **Ben**) | **Mark (3)** |

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| **Q24:** | Resistor A and resistor B are connected in parallel with a battery as shown in Figure B4. Both resistors have the same resistance of 1.8 Ω with a current of 3.5 A flowing through each of it.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_1892990855_-1727360342.png  (a) Calculate the **voltage** across resistor A.  Ans: V  (b) Calculate the **power** dissipated by resistor B.  Ans: W  (c) Calculate the **current** flowing through the battery.  Ans: A | **Mark (3)** |

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| **Q25:** | Figure B5 shows different voltages applied across three wires (P, Q and R) made of different materials. The three wires have the same length and cross-sectional area.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-2016070601_1781708902.png  (a) Which of the wires (**P**, **Q** or **R**) has the **lowest** **resistance**?  Ans: (**P**, **Q** or **R**)  (b) Which of the wires (**P**, **Q** or **R**) will dissipate the **least** **power** for a **fixed voltage** applied across the three wires?  Ans: (**P**, **Q** or **R**) | **Mark (2)** |

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| **Q26:** | Figure B6 shows two positive charges, P and Q, of +3 µC and +4 µC placed at a distance of 0.2 m apart. There are no other charges in the vicinity of the two charges.  Given that *π =* 3.14 and *εo =* 8.85 × 10-12 C2/N.m2.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_135321278_1161211910.png  (a) What is the direction of the force (**left**/ **right**) experienced by **P due to Q**?  Ans:  (b) What is the direction of the force (**left**/ **right**) experienced by **Q due to P**?  Ans:  (c) What is the magnitude of the **force** experienced by P due to Q? Give your answer correct to 2 decimal places.  Ans: N | **Mark (3)** |

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| **Q27:** | (a) Calculate the **speed** of the wave given that the wavelength is 30 m and frequency is 12 Hz.  Ans: m/s  (b) A tensile stress of 5000 Pa is applied to a wire with a uniform cross-sectional area of 2 × 10-6 m2. Calculate the **force** acting on the wire.  Ans: N  (c) Figure B7 shows the stress-strain graph of a material.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_1863143255_-1323025971.png  Determine whether the material undergoes **elastic** or **plastic** deformation.  Ans:  (**elastic** or **plastic**) | **Mark (3)** |

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**Section: C**

*Answer* **ALL** *the questions in this section*. *Write your answers clearly and show your working clearly in the boxes provided*. *Answers written anywhere else will* **NOT** *be marked*. *Give your answer correct to 2 decimal places whenever appropriate.*

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| **Q28:** | A skydiver jumping out of a plane first accelerates towards the ground. After 6 s, the skydiver travels at a constant velocity (known as terminal velocity) towards the ground. Assume the gravitational acceleration is 10 m/s2.  (a) Explain why the skydiver first accelerates towards the ground after jumping out of a plane.  (b) Explain why the person travels at a constant velocity after some time. | **Mark (4)** |
|  |  | |
|  | Word Count: 52 | Max Words: 200 |

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| **Q29:** | Figure C2 shows a block of mass 50 kg placed on a smooth frictionless slope inclined at 35° to the horizontal. A rope is tied to one end of the block to prevent the block from sliding down the slope. Assume the gravitational acceleration is 10 m/s2. Give your answer correct to 2 decimal places.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-562043268_1110537909.png  (a) Calculate the **reaction force**, ***FN***(in N).  (b) Calculate the **tensional force**, ***T*** (in N) in the rope. | **Mark (5)** |
|  |  | |
|  | Word Count: 28 | Max Words: 200 |

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| **Q30:** | Figure C3 shows a person of mass 70 kg standing inside an elevator of mass of 1250 kg. The lift is hung by a cable which is supported by a counterweight of mass 900 kg. Ignore the mass of the cable. Assume the gravitational acceleration is 10 m/s2.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_232732711_-1777968200.png  (a) Will the elevator **move up**, **move down** or remain **stationary**? Explain your answer.  (b) Determine the **acceleration** (in m/s2) of the elevator (with person) and also the **tension** (in N) in the cable. Show your workings clearly. | **Mark (5)** |
|  |  | |
|  | Word Count: 84 | Max Words: 200 |

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| **Q31:** | Figure C4 shows two infinitely long current carrying wires placed 0.05 m apart in a parallel arrangement. Wire A carries a current of 3 A and wire B carries a current of  4 A.  Given that *π =* 3.14 and permeability of free space, *μ*o = 4π × 10−7 T·m/A.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-2008559285_-763815776.png  (a) Determine the direction of the magnetic field (**into the paper or out of paper**) acting on **wire A due to wire B**.  (b) Determine the direction of the magnetic force (**left or right**) acting on **wire A due to wire B**.  (c) Determine the magnitude of the **magnetic force** (in N) experienced by 60 cm section of wire A due to wire B. Show your workings clearly. | **Mark (5)** |
|  |  | |
|  | Word Count: 46 | Max Words: 200 |

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| **Q32:** | (a) Four different samples (W, X, Y and Z) were subjected to a tensile force until fracture. Their stress-strain graphs are shown in Figure C5a.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-524011639_1331564626.png      (i) State which sample (**W**, **X**, **Y** or **Z**) is the stiffest.      (ii) Identify which sample (**W**, **X**, **Y** and **Z**) is most suitable to be used as the body of an automobile car. Justify your answer.  (b) Figure C5b shows a large crane with a cable of uniform cross-sectional area that is made of carbon steel. The Young modulus of the carbon steel cable is 220 GPa and the radius of the cylindrical carbon steel cable is 8 mm. The original length of cable is 20 m. Calculate the **load** (in kN) that can be lifted by the crane if the extension of the cable is 35 mm. Show your workings clearly. Give your answer correct to 2 decimal places. Given that *π* = 3.14.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-524011639_248110805.png | **Mark (6)** |
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|  | Word Count: 79 | Max Words: 200 |

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| **Q33:** | Figure C6 shows water flowing through a horizontal pipe from a broad segment to a narrow segment. Take density of water to be 1000 kg/m3. Assume there is no leak along the tube.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_1458763245_-1897887209.png  (a) The velocity of water flowing in the broad segment is 1.5 m/s and the cross section area of the broad and narrow segments of the pipe is 0.40 m2 and 0.25 m2,respectively. Calculate the **velocity** (in m/s) of water flowing in the narrow segment.  (b) Given that the pressure at the narrow segment is 6000 Pa, calculate the **pressure** (in Pa) at the broader segment. | **Mark (4)** |
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|  | Word Count: 61 | Max Words: 200 |

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| **Q34:** | Figure C7 shows the energy level diagram of an atom and the colour of the visible spectrum together with their corresponding wavelengths.  Given the following: Speed of light in vacuum, *c* = 3 × 108 m/s; Planck’s constant, *h* = 4.14 × 10-15 eV·s  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-376801773_350890891.png  (a) An excited electron emits a photon as it moves from *E3 to E2*. Calculate the **energy** (in eV) of the photon emitted.  (b) By referring to the table of colours and their corresponding wavelengths in Figure C7, determine the **colour** that this photon will emit as photon moves from *E3 to E2*. Show your working and units clearly.  (c) Determine the energy level transition (from **E?** to **E?**) that will result in a photon emitting blue light. Explain your answer by showing the appropriate workings. | **Mark (6)** |
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|  | Word Count: 72 | Max Words: 200 |

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| **Q35:** | (a) 0.2 kg of ice at an initial temperature of 0°C is mixed with 4 kg of ethanol at an initial temperature of 45°C. Calculate the **final temperature** (in °C) of the final mixture. Assume that no heat is lost to the surroundings. Give your answer correct to 2 decimal places.  Given that the specific latent heat of fusion of ice = 334,000 J/kg, specific heat capacity of water is 4184 J/(kg∙ºC)) and the specific heat capacity of ethanol is 2000 J/(kg∙ºC)).  (b) Figure C8 shows a piece of copper and a piece of wood of equal masses. They are both heated in an oven from 25°C to 80°C and subsequently placed onto identical large blocks of ice each. Assume no heat is lost to the surroundings, will **copper** or **wood** melt more ice before cooling down to the temperature of the ice at 0oC? Explain your answer.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-266019620_-34800098.png | **Mark (5)** |
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|  | Word Count: 103 | Max Words: 200 |

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