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| Section A: Composites | Marks |
| Explains uses of fibreglass  Any three reasonable uses of fibreglass | 3 |
| Explains how fibreglass is produced  Mats made of randomly placed glass fibres are bound together using resins. Fibreglass can also come in continuous strands. The resin and glass fibre composite is then left to cure. Fibreglass layers can be built up on top of each other to form more rigid materials. | 4 |
| Describes two strengths of fibreglass  Answers can include: Low maintenance, electrical insulator, weatherproof, relatively low cost, can be moulded into any shape. | 4 |
| Describes two weaknesses of fibreglass  Answers can include: degrades over time and needs to be resealed, irritant during manufacture. | 4 |
| Explains uses of carbon fibre  Answers can include, aerospace and automotive industries, sporting goods, wind turbines etc | 3 |
| Explains how carbon fibre is produced  Polyacrylonitrile (mostly) is drawn into long fibres. These fibres are then heated to change the chemical structure of the fibre in a process called stabilising. The fibres are then heated again, this time in anaerobic conditions to expel non-carbon atoms from the structure in a process called carbonisation. The fibres are then oxidised to enable their surface to better bind to resins. They are then wound onto rolls in order to be woven into fabrics. | 4 |
| Describes two strengths of carbon fibre  Answers can include: lightweight, corrosion resistant, high tensile strength etc, low thermal expansion. | 4 |
| Describes two weaknesses of carbon fibre  Recycling is difficult, high cost, high quality control requirements, health irritant (skin and respiration). | 4 |
| TOTAL | 30 |
| Section B: Safety Measures | Marks |
| Describes how Anti-lock Brake Systems work  When the brake pedal is pressed, valves repeatedly open and close, regulating the pressure in the brake lines in order to slow the vehicle down without the brakes being applied long enough for a loss of traction to occur. | 4 |
| Explains how Anti-lock Brake Systems improve the safety of occupants  ABS prevents the wheels of a car from locking up, thus preventing uncontrolled skidding. ABS can reduce the stopping distance of a vehicle when compared to regular braking systems and can reduce stopping distance in adverse weather conditions. | 4 |
| Describes how Side Curtain Airbags work  During a collision, sensors detect the location of the collision and trigger gas inflators for the airbags in that area. The airbag is rapidly inflated in order to protect the head of the occupant. The airbag then rapidly deflates after the accident. | 4 |
| Explains how Side Curtain Airbags improve the safety of the occupants  Side curtain airbags deploy during a side impact collision to protect the head and neck of the occupants of the car. In side impact collisions the force of the impact is directed through the sides of the car which results in the occupants striking the side pillars, windows, collision debris and foreign objects through the window. Side impact airbags reduce the risk to passengers sustaining injuries associated with a side on collision by reducing the risk of damage to head and neck. | 4 |
| Describes how Electronic Stability Control (ESC) works  ESC works through a combination of sensors within the vehicle that work to prevent the vehicle from entering an uncontrolled slide. When the sensors detect that the cars direction of travel is significantly different from the direction the wheels are facing, the computer sends a signal to the wheels and the brakes are applied at the required wheel in order to correct the slide. | 4 |
| Explains how electronic stability control improves the safety of the occupants  ESC prevents the car going into an uncontrolled slide. It corrects significant understeer and oversteer which could cause the driver to lose control of the car. | 4 |
| Lists the safety information for each vehicle  Jeep Wrangler: Electronic Stability Control, Traction Control, Front Airbags – Driver, Front Airbags – Passenger.  Mazda 3: Forward collision warning, low speed auto emergency braking, pedestrian auto emergency braking, front side curtain airbags, rear side curtain airbags, electronic stability control, traction control, front airbags – driver, front airbags – passenger. | 8 |
| Compares the 5-star Mazda 3 and the 1-star Jeep Wrangler  Similarities – both vehicles have ESC, traction control, front passenger and driver airbags. | 4 |
| Contrasts the 5-star Mazda 3 and the 1-star Jeep Wrangler  The Mazda 3 is the far safer vehicle as it also has side curtain air bags front and rear, forward collision warning and emergency braking for pedestrian and low speed impacts. | 4 |
| TOTAL | 40 |
| Section C: High-performance Vehicles | Marks |
| Describes the advantages of organic brake pads  Cost effective, made for everyday use, produce less noise and don’t put pressure on brake rotors. | 3 |
| Describes the disadvantages of organic brake pads  Don’t perform well at higher temperatures, perform poorly in extreme weather conditions, need to be replaced often and create a lot of brake dust. | 3 |
| Describes the advantages of carbon ceramic brakes  Suitable in extreme conditions, produce little dust, longer lifespan than organic brakes, material is softer on the brake rotors. | 3 |
| Describes the disadvantages of carbon ceramic brakes  Expensive, not good dispersers of heat, not best option for extreme weather conditions. | 3 |
| Compares similarities between organic brakes and carbon ceramic brakes  Both options are not the best option in extreme weather conditions, increased heat reduces braking capacity, | 3 |
| Contrasts differences between organic brakes and carbon ceramic brakes  Large difference in price, difference in amount of brake dust produced, carbon ceramic brakes are quieter than organic, carbon ceramic last longer. | 3 |
| Justifies the choice of brakes in the Formula 1 car  Formula 1 cars use disc brakes with hydraulic piston callipers. ABS is banned for use in Formula 1 cars so correct application of the brakes to prevent locking up is down to the skill of the driver. Brake pads are made from carbon and are designed to withstand temperatures in excess of 1000 degrees as the Formula 1 cars need to undergo large changes in speed over short distances. The brake pads are designed to have a high friction coefficient to increased braking ability. Current designs include many small holes in the brake disc in order to increase cooling capacity of the brakes. | **8** |
| TOTAL | **26** |
| TOTAL | **96** |