**M1.**(a)    (i)    D

1

(ii)    friction

1

(iii)    any **two** from:
- the speed / velocity
- the radius of the bend

  *the radius is insufficient*

  *accept curvature of the road*

  *size of the bend is insufficient*

  *accept distance of car from centre (of bend)*
- the mass (of the car).

  *accept weight for mass*

2

(b)    the car has a wide base

*accept any description of a wide base e.g. the wheels are far apart*

*accept wide wheel base*

*do **not** accept long wheel base*

*a large surface area is insufficient*

*wide tyre(s) is insufficient*

1

the car has a low centre of mass / gravity

*accept any description of low centre of mass e.g. mass is close to the ground*

*a down force is insufficient*

1

**[6]**

**M2.**(a)    gravitational attraction (between the satellite and the Earth)

*allow gravity*

*allow weight of the satellite*

1

(b)    any **two** from:
- mass of satellite
- speed / velocity (of satellite)

- radius of orbit / circle

    *allow height above the Earth*

    *radius / height alone is insufficient*

       **2**

(c)   (i)   increasing the height (above the Earth's surface) increases the time (for one orbit)

      *allow a positive correlation*

      *allow as one gets bigger, the other gets bigger, or vice versa*

      *ignore they are directly proportional*

       **1**

    (ii)   there is no relationship / correlation

       **1**

(d)   Isaac Newton was a respected scientist who had made new discoveries before

       **1**

       **[6]**

**M3.**   (a)   (i)   towards the centre of the circle

      *accept inwards*

      *accept a correct description*

      *'along the string' is insufficient*

       **1**

    (ii)   tension (in the string)

      *accept pull of the string*

      *'the string' is insufficient*

    **or** weight (on the end of the string)

      *'the student' is insufficient*

      *'turning action' is insufficient*

       **1**

(b)   (i)   each may (also) affect the speed

      *accept results for speed*

       **1**

    so only one independent variable

      *accept only one variable affects dependent variable*

*'fair test' is insufficient*
*'they are control variables' is insufficient*

    **1**

    (ii)    continuous
        *both required*

    dependent

    **1**

    (iii)    reduces (absolute) timing error (for one rotation)
        *accept too fast to time one*
    **or** increases / improves reliability / accuracy (for one rotation)
        *ignore checking for anomalous results*
        *to work out an average is insufficient*

    **1**

(c)    speed increases with centripetal force
        *accept positive correlation*
        *do **not** accept proportional*

    **1**

(d)    (i)    gravitational pull (of the Earth)
        *accept gravity*

    **1**

    (ii)    **No**

        *both parts required – however this may have been*
        *subsumed within the reason*

    geostationary orbits once every 24 hours
        *accept a correct comparative description*

    **1**

    **[9]**

**M4.**     (a)     (i)     arrow from centre of the ball **and** at right angles to the string
                     **and** in the correct direction

> *arrow should point to the student's belt*
> *accept free-hand 'straight' line*
> *do **not** accept curved line*

**1**

(ii)     increase

> *accept 'be stronger / bigger'*

**1**

increase

> *accept 'be stronger / bigger'*

**1**

increase

> *accept 'be stronger / bigger'*

**1**

(b)     speed
        velocity
        direction

> *all **three** correct*
> *any two correct for **1** mark*
> *otherwise **0** marks*

**2**

(c)     (i)     centripetal

> *accept 'centripedal' and other minor misspellings*
> *do **not** accept anything which could be 'centrifugal'*

**1**

(ii)     gravity

> *accept 'weight'*
> *accept 'force of attraction due to mass(es) (of the Moon and the Earth)'*

**1**

(iii)     electron(s)

**1**

(iv)    electrostatic

*accept 'electrical'*
*do **not** accept just 'centripetal'*

**1**

**[10]**

**M5.**    (i)    towards Earth

*for 1 mark*

**1**

(ii)    gravity

*for 1 mark*

**1**

(iii)    changes direction

*for 1 mark*

**1**

(iv)    polar orbit;
closer

*for 1 mark each*

**2**

(v)    speed constant (1)
mass constant (1)

*for 1 mark each*

**2**

**[7]**