1 (a acceleration = $\dfrac{v - u}{t}$ OR $\dfrac{\Delta v}{t}$ (symbols used to be explained)

   OR change of velocity ÷ time
   OR rate of change of velocity
   OR change of velocity per second / in 1 sec (allow 'in a certain time')   B1
   accept speed for velocity

   (b)   use of any area under graph   C1
             750 m   A1

      (ii) time = change of speed ÷ acceleration   OR   30/0.60   C1
               = 50 (s)   A1
             if working for *t* = 50 s not shown, allow 2 marks for correct use of 50 s
             graph: along *y*-axis to 180 s / rise starts at 180 s   B1
                    from *x*-axis rises to 30 m/s at 230 s / candidate's calculated time   B1
                    horizontal from top of slope to 280 s   B1   [8]
             allow ½ square tolerance at 180 s where relevant
             allow ecf from wrong *t*

2 **(a**   all points plotted correctly ±½ small square   B1
           smooth curve through points, by eye   B1

   (b)   decreasing OR idea of greater at greater heights   NOT decelerating   B1

      (ii) increasing OR idea of slower at greater heights   NOT accelerating   B1

   (c) idea of resultant force becomes zero   B1

   (d) decreasing/slowing down, ignore deceleration   NOT accelerating   B1

   (e) *F* = *ma* in any form, letters, words, numbers   C1
           (*a* =) 3.6 (m/s^2) c.a.o.   C1
           (*F* =) 216 N / 220 N   A1

                                                                              [Total: 9]

3   check zero on stopwatch OR repeat OR other sensible precaution   B1
     start stopwatch at some recognisable point in the cycle   B1
     stop stopwatch after at least 10 cycles OR count no. of cycles in at least 10 s   B
     divide time by number of cycles   B1   [4]

4   (a   micrometer OR screw gauge OR vernier scale NOT vernier callipers   B1

     (b) 2.73 mm   B1

     (c) check/set zero   )
          close instrument on to paper   )
          not too tight/use ratchet   ) any 3   B1 × 3
          take reading of both scales   )
          use several sheets   )
          divide reading by no. of sheets   )

                                                                                        [5]

5   (a   mention of distance AB OR distance between highest points of weight
          OR distance along arc AB of circle OR angle between extreme positions of string   C1

          idea of half of one of the above   A1

     (b) use of protractor / ruler   )
          note value of max angle/distance or its double   ) any 3   B1 × 3
          from vertical or halve   )
          avoidance of parallax   )

                                                                                        [5]

6 **(a)**   time a number of swings (if number stated, >5)   M1
            time divided by [2 x number of swings]   A1   **2**

   (b)   weight of gravity and tension   B1
        (ii) force towards centre of circular motion or towards support point   B1   **2**

   (c)   p.e. = mgh or 0.2 x 10 x 0.   C1
               = 0.1 J   A1   **2**
                                                                                                    [6]