**Ordinary Level Questions 2013**

1.

The points *P* and *Q* lie on a straight level road.

A car passes *P* with a speed of 28 m s−1 and decelerates uniformly for 6 seconds to a speed of 16 m s−1.

It then travels at a constant speed of 16 m s−1 for 8 seconds.

The car now accelerates uniformly from 16 m s−1 to a speed of 24 m s−1 and then passes *Q*.

The car travels 40 metres while accelerating.

Find

1. the deceleration
2. the acceleration
3. |*PQ*|, the distance from *P* to *Q*
4. the speed of the car 12 seconds before it passes *Q*
5. the average speed of the car between *P* and *Q*.

2.

A river is 57 metres wide and has parallel banks.

Boat B departs from point *P* on its northern bank and lands at point *Q* on its southern bank.

The actual velocity of the boat is 4 *i* − 3 *j* m s−1.



Car C travels due east at a constant speed of 7 m s−1 along the southern bank of the river.

Find

1. the velocity of C in terms of *i* and  *j*
2. the velocity of B relative to C in terms of *i* and *j*
3. the magnitude and direction of the velocity of B relative to C
4. the time it takes B to cross the river
5. |*PQ*|, the distance from *P* to *Q*.

3.

A particle is projected from the top of a straight vertical cliff of height 25 m with velocity 15 *i* + 20 *j*.

It strikes the horizontal ground at *B*.

Find

1. the time taken to reach the maximum height
2. the maximum height above ground level
3. the time of flight
4. |*AB*|, the distance from *A* to *B*
5. the speed of the particle as it strikes the ground.

4.

(a)

A particle of mass 2 kg is connected to another particle of mass 3 kg by a taut light inelastic string which passes over a smooth light pulley at the edge of a rough horizontal table.

The coefficient of friction between the 2 kg mass and the table is ½.

The system is released from rest.

1. Show on separate diagrams the forces acting on each particle.
2. Find the common acceleration of the particles.
3. Find the tension in the string.

(b)

Masses of 6 kg and 2 kg are connected by a taut light inelastic string which passes over a light smooth pulley as shown in the diagram.

The 6 kg mass lies on a smooth plane inclined at 30° to the horizontal.

The 2 kg mass hangs vertically.

The system is released from rest.

Find

1. the common acceleration of the particles
2. the tension in the string.

**Ordinary Level Questions 2012**

1.

A car travels along a straight level road.

It passes a point *P* with a speed of 8 m s−1 and accelerates uniformly for 12 seconds to a speed of 32 m s−1.

It then travels at a constant speed of 32 m s−1 for 7 seconds.

Finally the car decelerates uniformly from 32 m s−1 to rest at a point *Q*.

The car travels 128 metres while decelerating.

Find

(i) the acceleration

(ii) the deceleration

(iii) |*PQ*|, the distance from *P* to *Q*

(iv) the speed of the car when it is 72 m from *Q*.

2.

Ship A is positioned 80 km south of ship B.

A is moving north-east at a constant speed of 30 √2 kmh−1.

B is moving due west at a constant speed of 15 kmh−1.

Find

(i) the velocity of A in terms of *i* and *j*.

(ii) the velocity of B in terms of *i* and *j*.

(iii) the velocity of A relative to B in terms of *i* and *j*.

(iv) the shortest distance between A and B in the subsequent motion.

3.

(a)

A ball is kicked from a point *P* on horizontal ground with a speed of 20 m s−1 at 45° to the horizontal.

The ball strikes the ground at *Q*.

Find

(i) the time it takes the ball to travel from *P* to *Q*

(ii) │*PQ│* , the distance from *P* to *Q*.

(b)

A particle is projected with initial velocity 21 *i* + 50 *j* m s−1 from point *P* on a horizontal plane.

*A* and *B* are two points on the trajectory (path) of the particle.

The particle reaches point *A* after 3 seconds of motion.

The displacement of point *B* from *P* is *k i* + 80 *j* metres.

Find (i) the velocity of the particle at *A* in terms of *i* and *j*

(ii) the speed and direction of the particle at *A*

(iii) the value of *k*.

4.

(a)

Two particles of masses 2 kg and 3 kg are connected by a taut, light, inextensible string which passes over a smooth light pulley.

The system is released from rest.

Find

(i) the common acceleration of the particles

(ii) the tension in the string.

(b)

Masses of 9 kg and 12 kg are connected by a taut, light, inextensible string which passes over a smooth light pulley as shown in the diagram.

The 9 kg mass lies on a rough horizontal plane and the coefficient of friction between the 9 kg mass and the plane is .

The 12 kg mass lies on a smooth plane which is inclined at 30° to the horizontal.

The system is released from rest.

(i) Show on separate diagrams the forces acting on each particle.

(ii) Find the common acceleration of the masses.

(iii) Find the tension in the string.

**Ordinary Level Questions 2011**

**1.**

The points *P* and *Q* lie on a straight level road.

A car passes *P* with a speed of 10 m s-1 and accelerates uniformly for 6 seconds to a speed of 22 m s-1 .

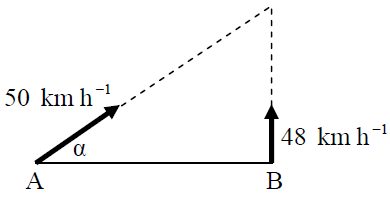
The car then decelerates uniformly to a speed of 18 m s-1 and travels 80 m during this deceleration.

The car now maintains a constant speed of 18 m s-1 for 3 seconds and then passes *Q*.

Find

1. the acceleration
2. the deceleration
3. |*PQ*|, the distance from *P* to *Q*
4. the average speed of the car, correct to one decimal place, as it moves from *P* to *Q*.

**2.**

Ship A is 126 km due west of ship B.

A is moving at a constant speed of 50 km h-1 in the direction east α north where tan α =

B is moving due north at a constant speed of 48 km h-1.

Find

1. the velocity of A in terms of *i* and *j*
2. the velocity of B in terms of *i* and *j*
3. the velocity of A relative to B in terms of *i* and *j*.

Ship A intercepts ship B after *t* hours.Find

1. the value of *t*
2. the distance each ship travels in this time *t*.

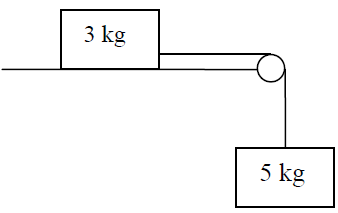
**3.**

A particle is projected from a point on horizontal ground with an initial speed of 58 m s-1 at an angle *β* to the horizontal, where tan *β* = .

1. Find the initial velocity of the particle in terms of *i* and *j*.
2. Calculate the time taken to reach the maximum height.
3. Calculate the maximum height of the particle above ground level.
4. Find the range.
5. Find the two times at which the height of the particle is 75 m.

**4.**

**(a)**

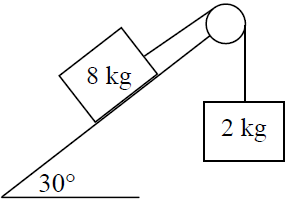
A particle of mass 3 kg is connected to a particle of mass 5 kg by a taut, light, inextensible string which passes over a smooth light pulley at the edge of a rough horizontal table.

The coefficient of friction between the 3 kg mass and the table is .

The system is released from rest.

1. Show on separate diagrams the forces acting on each particle.
2. Find the common acceleration of the particles.
3. Find the tension in the string.

**(b)**

Masses of 8 kg and 2 kg are connected by a light inelastic string which passes over a smooth light pulley as shown in the diagram.

The 8 kg mass lies on a smooth plane which is inclined at 300 to the horizontal.

The 2 kg mass hangs vertically.

The system is released from rest.

1. Find the common acceleration of the masses.
2. Find the tension in the string.

**Ordinary Level Questions 2010**

1

A car travels along a straight level road.

It passes a point *P* at a speed of 12 m s-1 and accelerates uniformly for 6 seconds to a speed of 30 m s-1.

It then travels at a constant speed of 30 m s-1 for 15 seconds.

Finally the car decelerates uniformly from 30 m s-1 to rest at a point *Q*.

The car travels 45 metres while decelerating.

Find

**(i)** the acceleration

**(ii)** the deceleration

**(iii)** |*PQ*|, the distance from *P* to *Q*

**(iv)** the average speed of the car as it travels from *P* to *Q*.

**2.**

A river is 100 metres wide and has parallel banks.

Boat B departs from point *P* on its western bank and lands at point *Q* on its eastern bank.

The actual velocity of the boat is 5 *i* + 12 *j* m s-1.

Cyclist C travels due north at a constant speed of 3 m s-1 along the eastern bank of the river.

Find

**(i)** the velocity of C in terms of *i* and *j*

**(ii)** the velocity of B relative to C in terms of *i* and *j*

**(iii)** the magnitude and direction of the velocity of B relative to C

**(iv)** the time it takes B to cross the river

**(v)** |*PQ*|, the distance from *P* to *Q*.

**3.**

A particle is projected with initial velocity 72 *i* + 30 *j* ms-1 from the top of a straight vertical cliff of height 35 m.

It strikes the horizontal ground at *P*.

Find

**(i)** the time taken to reach the maximum height

**(ii)** the maximum height of the particle above ground level

**(iii)** the time of flight

**(iv)** |*OP*|, the distance from *O* to *P*

**(v)** the speed of the particle as it strikes the ground.

**4.**

**(a)**

Two particles of masses 5 kg and 7 kg are connected by a taut, light, inextensible string which passes over a smooth light pulley.

The system is released from rest.

Find

**(i)** the common acceleration of the particles

**(ii)** the tension in the string.

**(b)**

Masses of 8 kg and 10 kg are connected by a taut, light, inextensible string which passes over a smooth light pulley as shown in the diagram.

The 8 kg mass lies on a rough horizontal plane and the coefficient of friction between the 8 kg mass and the plane is ½.

The 10 kg mass lies on a smooth plane which is inclined at 30° to the horizontal.

The system is released from rest.

**(i)** Show on separate diagrams the forces acting on each particle.

**(ii)** Find the common acceleration of the masses.

**(iii)** Find the tension in the string.

**Ordinary Level Questions 2009**

**1.**

3 points *p*, *q* and *r* lie on a straight level road.

Two cars, A and B, are moving towards each other on the road.

Car A passes *p* with speed 3 m/s and uniform acceleration of 2 m/s2 and at the same instant car B passes *r* with speed 5 m/s and uniform acceleration of 4 m/s2.

A and B pass each other at *q* seven seconds later.

Find

**(i)** the speed of car A and the speed of car B at *q*.

**(ii)** |*pq*| and |*rq*|, the distances A and B have moved in these 7 s.

**(iii)** Car A stops accelerating at *q* and continues on to *r* at uniform speed.

Find, correct to one place of decimals, the total time for car A to travel from *p* to *r*.

**2.**

A ship P is moving north at a constant speed of 20 km/h.

Another ship Q is moving south-west at a constant speed of 10 2 km/h.

At a certain instant, P is positioned 50 km due west of Q.

Find

**(i)** the velocity of P in terms of *i* and *j*

**(ii)** the velocity of Q in terms of *i* and *j*

**(iii)** the velocity of P relative to Q in terms of *i* and *j*

**(iv)** the shortest distance between P and Q in the subsequent motion.

**3.**

**(a)**

A particle is projected with initial velocity 40*i* + 50*j* m/s from point *p* on a horizontal plane.

*a* and *b* are two points on on the trajectory (path) of the particle.

The particle reaches point *a* after 2 seconds of motion.

The displacement of point *b* from *p* is 360*i* + *kj* metres.

Find

**(i)** the velocity of the particle at *a* in terms of *i* and *j*

**(ii)** the speed and direction of the particle at *a*

**(iii)** the value of *k*.



**(b)**

A straight vertical cliff is 45 m high.

A projectile is fired horizontally with an initial speed of *x* m/s from the top of the cliff.

It strikes the level ground at a distance of 30√3 m from the foot of the cliff.

Find the value of *x*, correct to one decimal place.

**4.**

**(a)**

Two particles of masses 3 kg and 2 kg are connected by a taut, light, inextensible string which passes over a smooth light pulley at the edge of a smooth horizontal table.

The system is released from rest.

(i) Show on separate diagrams the forces acting on each particle.

(ii) Find the common acceleration of the particles.

(iii) Find the tension in the string.

**(b)**

A particle of mass 2 kg is released from rest and slides down a rough plane which is inclined at an angle α0 to the horizontal, where tan α = 4/3.

The coefficient of friction between the particle and the plane is ½ .

(i) Show on a diagram the forces acting on the particle.

(ii) Find the acceleration of the particle.

**Ordinary Level Questions 2008**

**1.**

Four points *a*, *b*, *c* and *d* lie on a straight level road.

A car, travelling with uniform retardation, passes point *a* with a speed of 30 m/s and passes point *b* with a speed of 20 m/s.

The distance from *a* to *b* is 100 m. The car comes to rest at *d*.

Find

(i) the uniform retardation of the car

(ii) the time taken to travel from *a* to *b*

(iii) the distance from *b* to *d*

(iv) the speed of the car at *c*, where *c* is the midpoint of [*bd*].

**2.**

Ship A is 432 km due west of ship B.

Ship B is 135 km due west of lighthouse L.

A is travelling at a constant speed of 52 km/h in the direction east α0 north, where tan α =5/12.

B is travelling due north at a constant speed of 20 km/h.

Find **(i)** the velocity of A in terms of *i* and *j*

**(ii)** the velocity of B in terms of *i* and *j*

**(iii)** the velocity of A relative to B in terms of *i* and *j*.

Ship A intercepts ship B after *t* hours.

**(iv)** Find the value of *t*.

**(v)** Find the distance from lighthouse L to the meeting point.

**3.**

A particle is projected from a point on horizontal ground with an initial speed of 25 m/s at an angle β0 to the horizontal where tan β = 4/3.

**(i)** Find the initial velocity of the particle in terms of *i* and *j*.

**(ii)** Calculate the time taken to reach the maximum height.

**(iii)** Calculate the maximum height of the particle above ground level.

**(iv)** Find the range.

**(v)** Find the speed and direction of the particle after 3 seconds of motion.



**4.**

**(a)** Two particles of masses 9 kg and 5 kg are connected by a taut, light, inextensible string which passes over a smooth light pulley.

The system is released from rest.

Find

**(i)** the common acceleration of the particles

**(ii)** the tension in the string.

**(b)**

Masses of 3 kg and 6 kg are connected by a taut, light, inextensible string which passes over a smooth light pulley as shown in the diagram.

The 3 kg mass lies on a rough horizontal plane and the coefficient of friction between the 3 kg mass and the plane is *μ.*

The 6 kg mass lies on a smooth plane which is inclined at 300 to the horizontal.

When the system is released from rest each mass travels 1 metre in 2 seconds.

Find

**(i)** the common acceleration of the masses

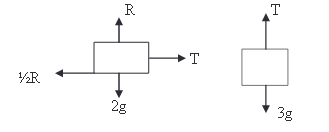
**(ii)** the tension in the string

**(iii)** the value of *μ.*

**Answers**

2013

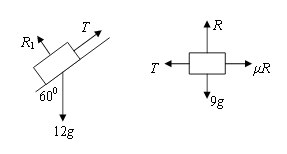
1. 1. 1. -2 m s-2
      2. 4 m s-2
      3. 300 m
      4. 20 m s-1
      5. 18.75 m s-1
      6. 7i-0i
      7. -3i-3j
      8. S45W
      9. 19 s
      10. 95 m
      11. 2s
      12. 45 m
      13. 5 s
      14. 75 m



* + 1. 4
    2. 18 N
  1. 1. 1.25 m/s^2
     2. 22.5 N

2012

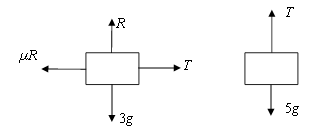
1. 1. 1. 2 m s-2
      2. -4 m s-2
      3. 592 m
      4. 24 m s-1
2. * 1. 30i+30j
     2. -15 i + 0j
     3. 45 i +30j
     4. Angle=33.69, d=66.56 km
3. 1. 1. 40m
   2. 1. 21i+20j
      2. v=29 m/s and angle 43.6
      3. k=168m
4. 1. 1. a=2 m/s
      2. 24 N



* + 1. 1.4 m/s
    2. 42.9 N

2011

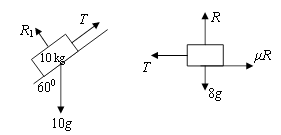
1. 1. 1. 2 m/s
      2. -1 m/s^2
      3. 230 m
      4. 17.7 m/s
2. * 1. 14i+48j
     2. 0i+48j
     3. 14i+0j
     4. 9h
     5. 450 km, 432 km
3. * 1. 42i+40j
     2. T=4s
     3. 80m
     4. 336 m
     5. t=3, t=5 s



* + 1. 3g/8 or 15/4
    2. 31.25N
    3. a = 2 m/s
    4. 24 N

2010

1. * 1. 3 m/s
     2. -10 m/s
     3. 621 m
     4. 25.875 m/s
2. * 1. 0i+3j
     2. 5i+9j
     3. 10.3 N dir E60.9N
     4. 20sec
     5. 260 m
3. * 1. 3 s
     2. 80m
     3. 7 s
     4. 504 m
     5. V=82.4 m/s
4. * 1. 5/3 m/s2
     2. T=58.3 N



* + 1. 5/9 m/s
    2. 44.4 N