# Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_ FORM: A

**IB Physics Year 1**

**Paper 1 – Midterm Exam 2022**

38 minutes

**Instruction to candidates**

* Answer all the questions.
* **NO CALCULATOR** is allowed.
* For each question, choose the answer you consider to be the best and indicated your choice on the answer sheet provided. Students must use PENCIL to draw a large "**X**" in the rectangle of the letter choice they like.
* A clean copy of the **physics data booklet** is required for this paper.
* The maximum mark for this examination paper is **[25 marks]**.

**1.** A list of four physical quantities is

* acceleration
* energy
* mass
* temperature

How many scalar quantities are in this list?

A. 1

B. 2

C. 4

D. 3

**2.** The uncertainty in reading a laboratory thermometer is 0.5 °C. The temperature of a liquid falls from 20 °C to 10 °C as measured by the thermometer. What is the percentage uncertainty in the change in temperature?

A. 10 %

B. 5 %

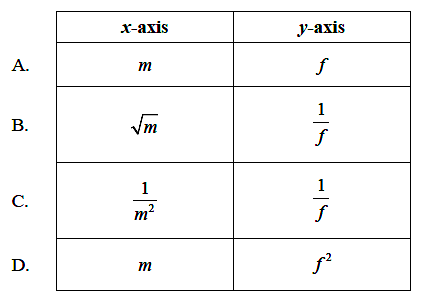
C. 7.5 %

D. 2.5 %

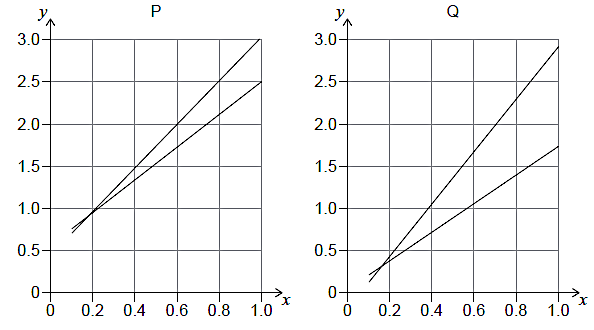
**3.** An object of mass *m* is hung from a spring. When the object is pulled downwards and then released, the frequency *f* of oscillation of the object is given by the expression

where *k* is a constant.

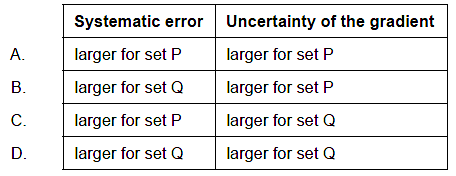
Which **one** of the following graphs would produce a straight-line for the variation with mass *m* of frequency *f*?



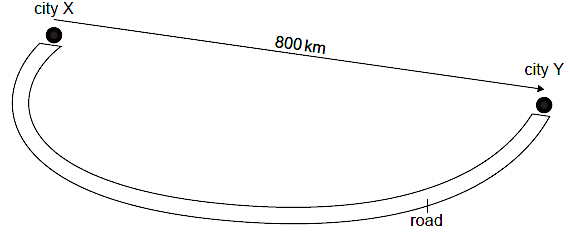
**4.** Two different experiments, P and Q, generate two sets of data to confirm the proportionality of variables and . The graphs for the data from P and Q are shown. The maximum and minimum gradient lines are shown for both sets of data.



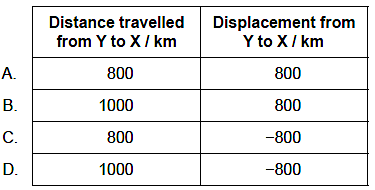
What is true about the systematic error and the uncertainty of the gradient when P is compared to Q?



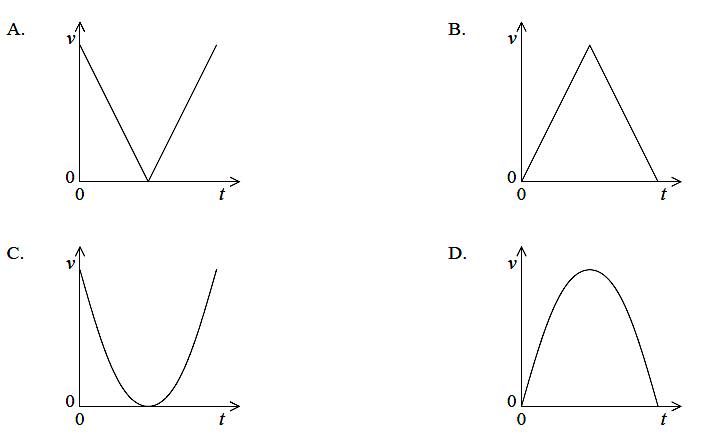
**5.** The road from city X to city Y is 1000 km long. The displacement is 800 km from X to Y.



What is the distance travelled from Y to X and the displacement from Y to X?



**6.** An object is thrown upwards leaving the thrower’s hand at time t = 0. Which graph shows how speed v varies with t as the object rises and falls?



**7.** A car accelerates uniformly from rest to a velocity  during time . It then continues at constant velocity from  to time .

What is the total distance covered by the car in ?

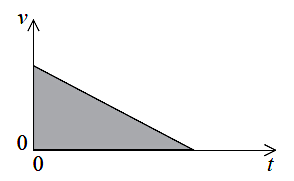
A.

B.

C.

D.

**8.** The graph below shows how velocity v varies with time t for a ball thrown vertically upwards from the Earth’s surface.



The shaded area is equal to the

A. displacement.

B. change in velocity.

C. final velocity.

D. acceleration.

**9.** A boy throws a ball horizontally at a speed of 20 m s-1 from the top of a cliff that is 80 m above the surface of the sea. Air resistance is negligible.

What is the distance from the bottom of the cliff to the point where the ball lands in the sea?

A. 60 m

B. 80 m

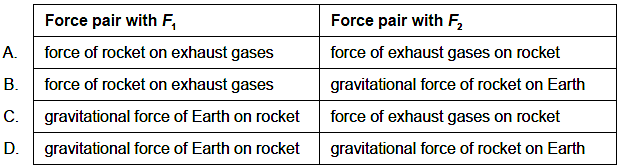
C. 320 m

D. 40 m

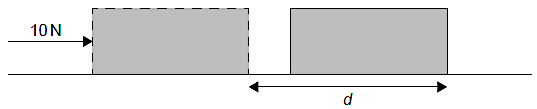
**10.** A rocket has just been launched vertically from Earth. The image shows the free-body diagram of the rocket. *F*1 represents a larger force than *F*2.



Which force pairs with *F*1and which force pairs with *F*2, according to Newton’s third law?

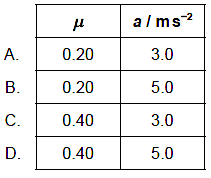


**11.** An object of mass 2.0 kg rests on a rough surface. A person pushes the object in a straight line with a force of 10 N through a distance *d*.



The resultant force acting on the object throughout *d* is 6.0 N.

What is the value of the sliding coefficient of friction between the surface and the object and what is the acceleration *a* of the object?



**12.** An object is pushed from rest by a constant net force of 100 N. When the object has travelled 2.0 m the object has reached a velocity of 10 m s−1.

What is the mass of the object?

A. 200 kg

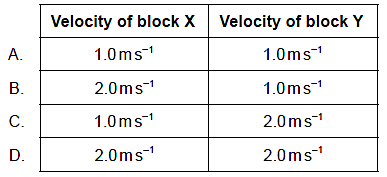
B. 2 kg

C. 4 kg

D. 40 kg

**13.** Two blocks of different masses are released from identical springs of elastic constant k = 100 Nm−1, initially compressed a distance Δx = 0.1 m. Block X has a mass of 1 kg and block Y has a mass of 0.25 kg.

What are the velocities of the blocks when they leave the springs?



**14.** Object A of mass m is lifted through a height h. Object B of mass 2m is lifted through a height 4h.

The gravitational field is constant over the height interval. What is the ratio

?

A. 4

B. 2

C. 1

D. 8

**15.** Two trolleys of equal mass travel in opposite directions as shown.



The trolleys collide head-on and stick together.

What is their velocity after the collision?

A. 10 m s−1

B. 5 m s−1

C. 1 m s−1

D. 2 m s−1

**16.** A mass of a liquid of specific heat capacity flows every second through a heater of power . What is the difference in temperature between the liquid entering and leaving the heater?

A.

B.

C.

D.

**17.** When 40 kJ of energy is transferred to a quantity of a liquid substance, its temperature increases by 20 K. When 600 kJ of energy is transferred to the same quantity of the liquid at its boiling temperature, it vaporizes completely at constant temperature.

What is for this substance?

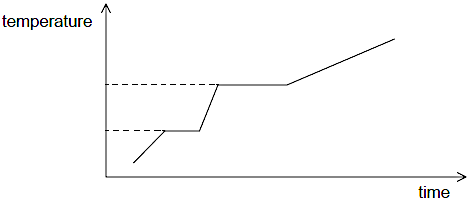
A. 300 K

B. 15 K−1

C. 15 K

D. 300 K−1

**18.** Energy is supplied at a constant rate to a fixed mass of a material. The material begins as a solid. The graph shows the variation of the temperature of the material with time.



The specific heat capacities of the solid, liquid and gaseous forms of the material are cs, cl and cg respectively. What can be deduced about the values of cs, cl and cg?

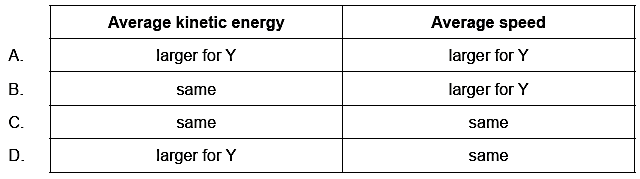
A. cg > cs > cl

B. cl > cg > cs

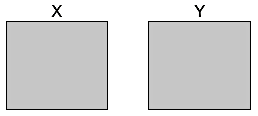
C. cl > cs > cg

D. cs > cg > cl

**19.** Two ideal gases X and Y are at the same temperature. The mass of a particle of gas X is larger than the mass of a particle of gas Y. Which is correct about the average kinetic energy and the average speed of the particles in gases X and Y?



**20.** Two identical containers X and Y each contain an ideal gas. X has *N* molecules of gas at an absolute temperature of *T* and Y has 3*N* molecules of gas at an absolute temperature of . What is the ratio of the pressures ?



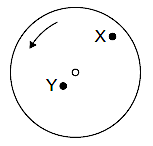
A.

B.

C.

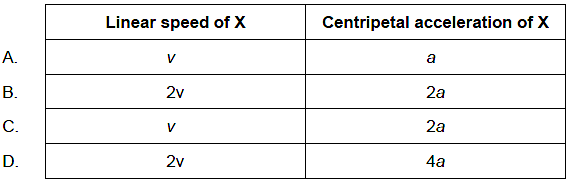
D.

**21.** A horizontal disc rotates uniformly at a constant angular velocity about a central axis normal to the plane of the disc.

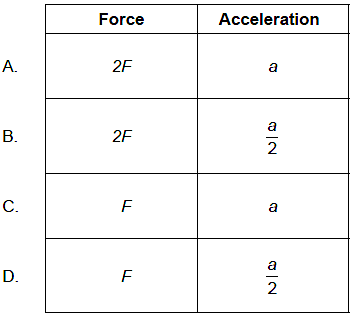


Point X is a distance 2*L* from the centre of the disc. Point Y is a distance *L* from the centre of the disc. Point Y has a linear speed *v* and a centripetal acceleration *a*.

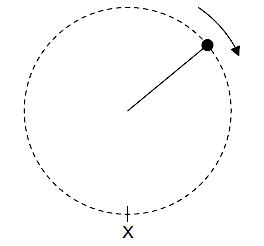
What is the linear speed and centripetal acceleration of point X?



**22.** Two satellites of mass *m* and 2*m* orbit a planet at the same orbit radius. If *F* is the force exerted on the satellite of mass *m* by the planet and a is the centripetal acceleration of this satellite, what is the force and acceleration of the satellite with mass 2*m*?



**23.** A small ball of weight W is attached to a string and moves in a vertical circle of radius R.



What is the smallest kinetic energy of the ball at position X for the ball to maintain the circular motion with radius *R*?

A. *W R*

B. *2 W R*

C.

D.

**24.** The gravitational field strength at the surface of Earth is *g*. Another planet has double the radius of Earth and the same density as Earth. What is the gravitational field strength at the surface of this planet?

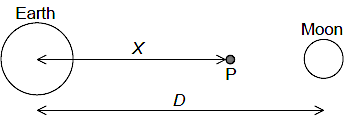
A. 4*g*

B. 2*g*

C.

D.

**25.** The centre of the Earth is separated from the centre of the Moon by a distance *D*. Point P lies on a line joining the centre of the Earth and the centre of the Moon, a distance *X* from the centre of the Earth. The gravitational field strength at P is zero.



What is the ratio ?

A.

B.

C.

D.