I have marked out a few of the questions, based on what we covered last year. We will start with Chapter 5 in the textbook (Electricity)

IB Physics HL – Year 2
Summer Assignment

1. The order of magnitude of the weight of an apple is

A. 10^{-4} N. B. 10^{-2} N. C. 1 N. D. 10^{2} N.

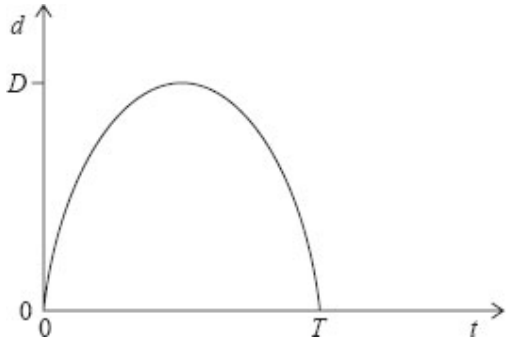
2. The density of a metal cube is given by the expression $\rho = \frac{M}{V}$ where M is the mass and V is the volume of the cube. The percentage uncertainties in M and V are as shown below.

M	12 %
V	4.0 %

The percentage uncertainty in the calculated value of the density is

A. 3.0 %. B. 8.0 %. C. 16 %. D. 48 %.

3. A ball is thrown vertically upwards from the ground. The graph shows the variation with time t of the vertical displacement d of the ball. Which of the following gives the final displacement after time T and the average speed between time $t = 0$ and time $t = T$?



	Displacement	Average speed
A.	0	0
B.	0	$\frac{2D}{T}$
C.	$2D$	$\frac{2D}{T}$
D.	$2D$	0

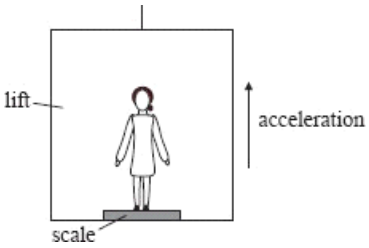
4. A general expression for Newton's second law of motion is

$$F = \frac{\Delta p}{\Delta t}.$$

What condition is applied so that the law may be expressed in the form $F = ma$?

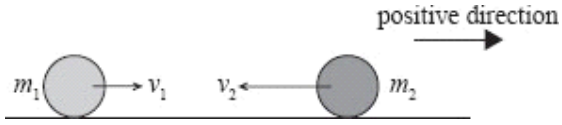
A. The mass m is constant. B. The acceleration a is constant.
C. The force F is constant. D. The direction of the force F is constant.

5. Mandy stands on a weighing scale inside a lift (elevator) that accelerates vertically upwards as shown in the diagram below. The forces on Mandy are her weight W and the reaction force from the scale R. The reading of the scale is



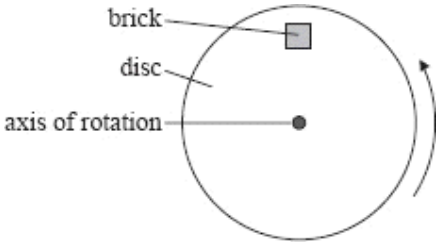
A. $R + W$. B. W. C. R. D. $R - W$.

6. Two spheres of masses m_1 and m_2 are moving towards each other along the same straight-line with speeds v_1 and v_2 as shown. The spheres collide. Which of the following gives the total change in linear momentum of the spheres as a result of the collision?

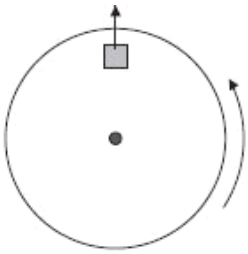


A. 0 B. $m_1v_1 + m_2v_2$
C. $m_1v_1 - m_2v_2$ D. $m_2v_2 - m_1v_1$

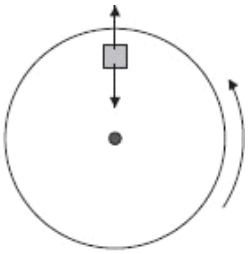
7. A brick is placed on the surface of a flat horizontal disc as shown in the diagram below. The disc is rotating at constant speed about a vertical axis through its centre. The brick does not move relative to the disc. Which of the diagrams below correctly represents the **horizontal** force or forces acting on the brick?



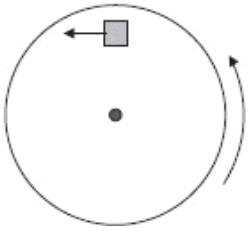
A.



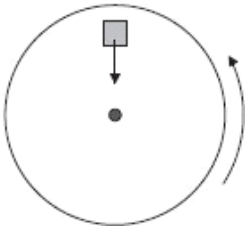
B.



C.



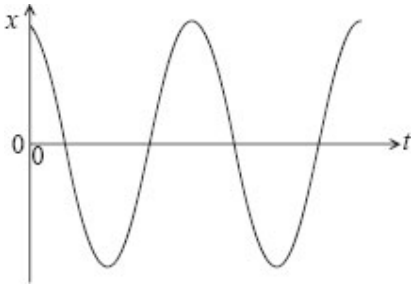
D.



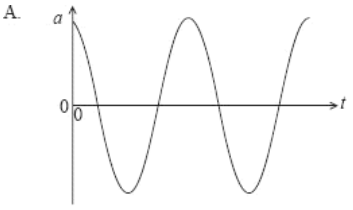
8. A frictionless trolley of mass m moves down a slope with a constant acceleration a. A second similar frictionless trolley has mass $2m$. The acceleration of the second trolley as it moves down the slope is

A. $\frac{1}{2}a$. B. a. C. $2a$. D. $4a$.

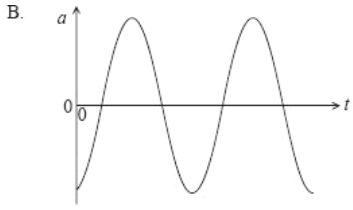
9. The graph below shows the variation with time t of the displacement x of a particle undergoing simple harmonic motion. Which graph correctly shows the variation with time t of the acceleration a of the particle?



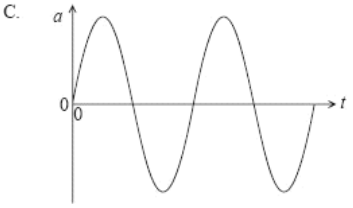
A.



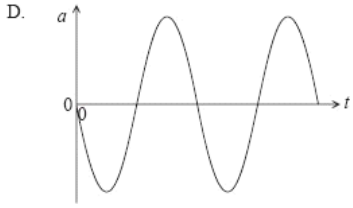
B.



C.



D.



10. A wooden block is at rest on a horizontal frictionless surface. A horizontal spring is attached between the block and a rigid support. The block is displaced to the right by an amount X and is then released. The period of oscillations is T and the total energy of the system is E.

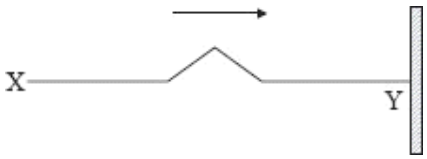
For an initial displacement of $\frac{X}{2}$ which of the following shows the best estimate for the period of oscillations and the total energy of the system?

	Period	Total energy
A.	T	$\frac{E}{2}$
B.	T	$\frac{E}{4}$
C.	$\frac{T}{2}$	$\frac{E}{2}$
D.	$\frac{T}{2}$	$\frac{E}{4}$

11. Which of the following correctly describes the change, if any, in the speed, wavelength and frequency of a light wave as it passes from air into glass?

	Speed	Wavelength	Frequency
A.	decreases	decreases	unchanged
B.	decreases	unchanged	decreases
C.	unchanged	increases	decreases
D.	increases	increases	unchanged

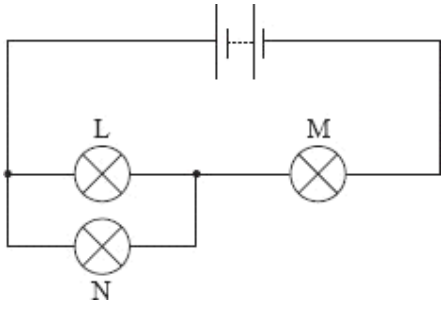
12. The diagram below shows a pulse travelling along a rope from X to Y. The end Y of the rope is tied to a fixed support.



When the pulse reaches end Y it will

A. disappear.
B. cause the end of the rope at Y to oscillate up and down.
C. be reflected and be inverted.
D. be reflected and not be inverted.

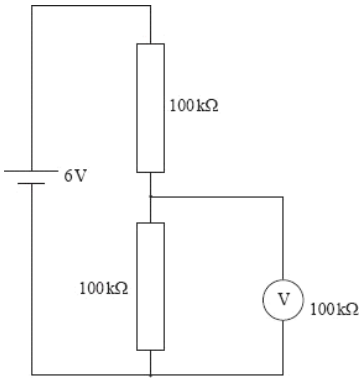
In the circuit below, the battery has negligible internal resistance. Three identical lamps L, M and N of constant resistance are connected as shown. The filament of lamp N breaks. Which of the following shows the subsequent changes to the brightness of lamp L and lamp M?



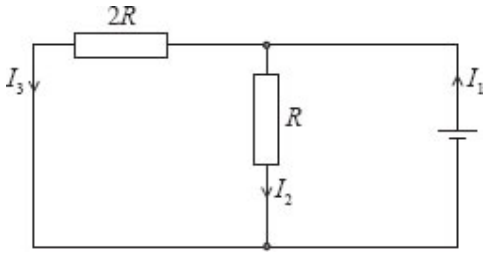
	Lamp L	Lamp M
A.	stays the same	decreases
B.	increases	stays the same
C.	increases	decreases
D.	decreases	increases

In the circuit at right, the voltmeter has a resistance 100 kΩ. The battery has negligible internal resistance and emf 6 V. The reading on the voltmeter is

A. 0 V. B. 2 V. C. 3 V. D. 4 V.



In the circuit shown below, the cell has negligible internal resistance. Which of the following equations is correct?



A. $I_1 = 2I_2$ B. $I_1 = 2I_3$
C. $I_2 = 2I_3$ D. $I_3 = 2I_1$

16. In Newton's universal law of gravitation the masses are assumed to be

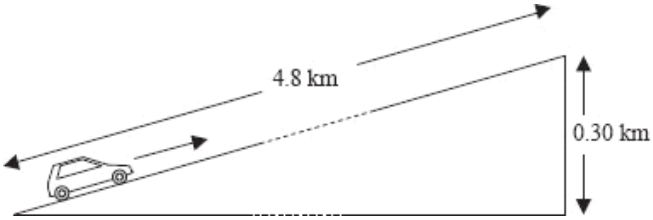
A. extended masses. B. masses of planets.
C. point masses. D. spherical masses.

17. Mechanical power

(a) Define *power*.

(b) A car is travelling with constant speed *v* along a horizontal straight road. There is a total resistive force *F* acting on the car.
Deduce that the power *P* to overcome the force *F* is $P = Fv$.

(c) A car drives up a straight incline that is 4.8 km long. The total height of the incline is 0.30 km. The car moves up the incline at a steady speed of 16 m s^{-1}. During the climb, the average friction force acting on the car is 5.0×10^2 N. The total weight of the car and the driver is 1.2×10^4 N.

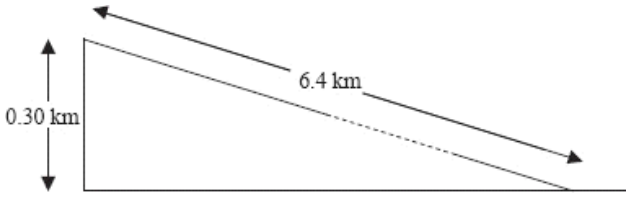


(i) Determine the time it takes the car to travel from the bottom to the top of the incline.

(ii) Determine the work done against the gravitational force in travelling from the bottom to the top of the incline.

(iii) Using your answers to (c)(i) and (c)(ii), calculate a value for the minimum power output of the car engine needed to move the car from the bottom to the top of the incline.

(d) From the top of the incline, the road continues downwards in a straight line. At the point where the road starts to go downwards, the driver of the car in (c), stops the car to look at the view. In continuing his journey, the driver decides to save fuel. He switches off the engine and allows the car to move freely down the hill. The car descends a height of 0.30 km in a distance of 6.4 km before levelling out. The average resistive force acting on the car is 5.0×10^2 N.



Estimate

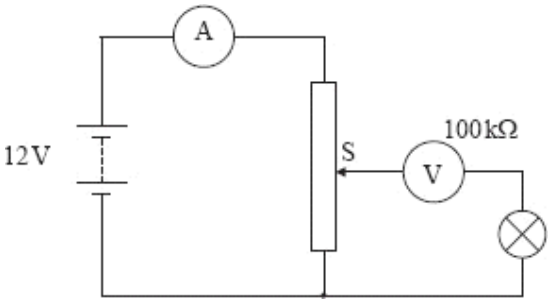
(i) the acceleration of the car down the incline.

(ii) the speed of the car at the bottom of the incline.

(e) In fact, for the last few hundred metres of its journey down the hill, the car travels at constant speed. State the value of the frictional force acting on the car whilst it is moving at constant speed.

This question is about an electric circuit. A particular filament lamp is rated at 12 V, 6.0 mA. It just lights when the potential difference across the filament is 6.0 V. A student sets up an electric circuit to measure the *I-V* characteristic of the filament lamp.

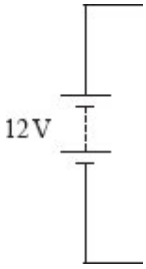
In the circuit, shown below, the student has connected the voltmeter and the ammeter into the circuit **incorrectly**. The battery has emf 12 V and negligible internal resistance. The ammeter has negligible resistance and the resistance of the voltmeter is 100 kΩ. The maximum resistance of the variable resistor is 15Ω.



(a) Explain, without doing any calculations, whether there is a position of the slide S at which the lamp will be lit.

(b) Estimate the maximum reading of the ammeter.

(c) Complete the circuit diagram below showing the correct position of the voltmeter and of the ammeter in order to determine the *I*-*V* characteristic of the filament lamp.



The electric field strength at a point may be defined as

A. the force exerted on unit positive charge placed at that point.
B. the force per unit positive charge on a small test charge placed at that point.
C. the work done on unit positive charge to move the charge to that point from infinity.
D. the work done per unit positive charge to move a small test charge to that point from infinity.