DEPARTMENT FOR CURRICULUM,
RESEARCH, INNOVATION AND LIFELONG LEARNING
Directorate for Learning and Assessment Programmes
Educational Assessment Unit

Track 3

Annual Examinations for Secondary Schools – SAMPLE PAPER

YEAR 11 PHYSICS TIME: 2 hours

Name: _____ Class: _____

Answer ALL questions in the spaces provided on the Examination Paper.
All working must be shown. The use of a calculator is allowed.
Where necessary take the acceleration due to gravity $g = 10\ m/s^2$.

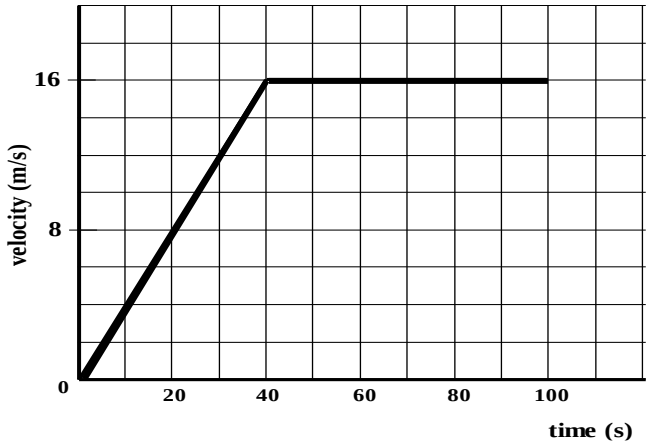
Density	$m = \rho V$		
Pressure	$P = \rho g h$	$F = P A$	
Moments	Moment $=$ F $\times$ perpendicular distance		
Energy	$PE = m g h$	$KE = \frac{1}{2}mv^2$	Work Done $=$ F s
	Work Done $=$ Energy Converted		$E = P t$
Force	$F = m a$	$W = m g$	
Motion	$\text{Average Speed} = \frac{\text{total distance}}{\text{total time}}$	$s = \frac{(u + v)\,t}{2}$	$s = ut + \frac{1}{2}at^2$
	$v = u + at$	$v^2 = u^2 + 2as$	Momentum $= m v$
Electricity	$Q = I t$	$V = I R$	$E = Q V$
	$P = I V$	$R \propto L/A$	$E = I V t$
	$R_T = R_1 + R_2 + R_3$	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$	
Electromagnetism	$\frac{N_1}{N_2} = \frac{V_1}{V_2}$		
Heat	$\Delta Q = m c \Delta\theta$		
Waves	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$	$\eta = \frac{\text{the speed of light in air}}{\text{the speed of light in medium}}$	
	$v = f \lambda$ $f = \frac{1}{T}$	$m = \frac{h_i}{h_o} = \frac{\text{image distance}}{\text{object distance}}$	
Radioactivity	A = Z + N		

Marks Grid: For the Examiners' use ONLY

Question	1	2	3	4	5	6	7	8	9	10	11	Theory	Multiply by 0.68	Prac	Final Mark
Mark	10	10	10	10	10	10	10	10	15	15	15	125	85	15	100
Score															

Section A: This section has 8 questions. Each question carries 10 marks (Total: 80 marks).

1. The velocity-time graph below describes the motion of a horse racing along a straight track.



Use the velocity-time graph to answer the following questions:

a. What is the maximum velocity reached by the horse?

_____

(1)

b. How long does it take the horse to reach this maximum velocity?

_____

(1)

c. Calculate the acceleration of the horse.

_____

(2)

d. The horse crosses the finishing line after 100 seconds. Calculate the length of the track.

_____

_____

(2)

e. Given that the mass of the jockey is 60 kg while that of the horse is 400 kg, calculate their combined momentum while the horse is running at constant velocity.

_____

_____

(2)

f. When the horse stops unexpectedly, the jockey continues to move forward. Name and state the law of motion which explains this forward movement.

_____

_____

(2)

2. a. Energy sources can be either renewable or non-renewable.

i. Give an example of a fossil fuel. _____ (1)

ii. Explain briefly the origin of fossil fuels.

_____

_____

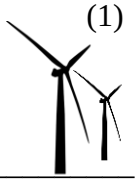
(2)

iii. Why are fossil fuels considered to be non-renewable?

_____

(1)

b. Wind energy is more environmentally friendly than fossil fuels.



i. State TWO disadvantage of using wind energy,

_____

_____

(2)

ii. Name TWO other forms of energy that are considered to be renewable.

_____

(2)

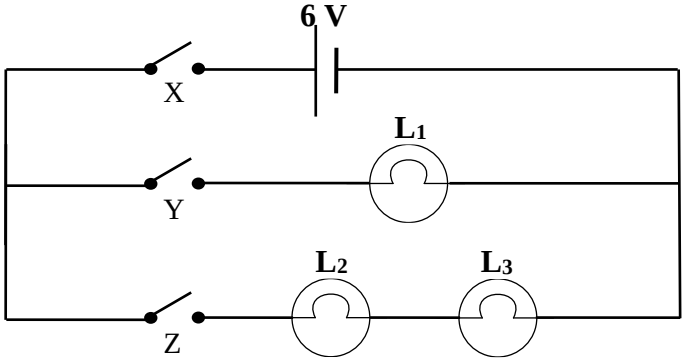
c. Calculate the percentage efficiency of a wind turbine which converts 150 000 J of wind energy into 45 000 J of electrical energy.

_____

_____

(2)

3. Three **identical** filament lamps L_1, L_2 and L_3 are connected as shown below.



a. i. L_1 and L_2 are connected in _____. (1)

ii. L_2 and L_3 are connected in _____. (1)

b. State which switch or switches need to be closed (switched on), so that only:

i. L_1 lights up,

_____

(1)

ii. L_2 and L_3 light up.

_____

(1)

c. With all switches closed, calculate:

i. the voltage across L_2,

_____

(1)

ii. the charge present in L_1 given that a current of 2 A flows for 30 seconds,

_____

(2)

iii. the resistance of L_1,

_____

_____

(2)

d. Explain why L_1 lights brighter than L_2.

_____

(1)

4 a. Explain what causes seasons on Earth.

_____

_____

(2)

b. Put the following in order of size, **smallest first:**

star, universe, planet, galaxy, solar system, asteroid.

_____

(3)

c. Curiosity is a robotic rover that has been active on planet Mars since 2011. The mass of Curiosity on Earth was 900 kg. Complete the table below.

	On Earth (g = 10 N/kg)	**On Mars** (g = 4 N/kg)
Mass of Curiosity (kg)	900	
Weight of Curiosity (N)		

(3)

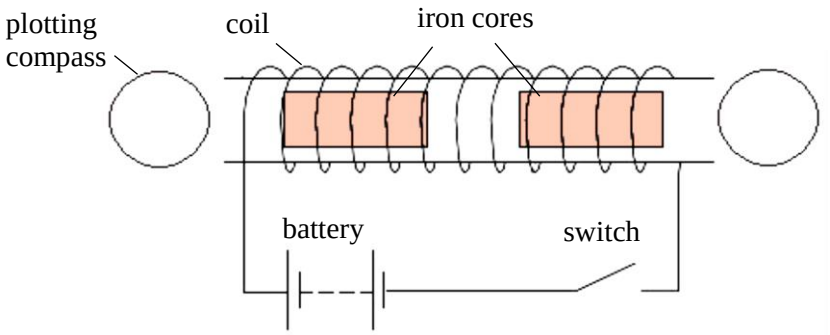
d. Name TWO advantages of space exploration.

_____

_____

(2)

5. Maria places two iron cores in a cardboard tube as shown below. When she closes the switch she observes that the iron cores move.



a. Draw arrows to represent the direction of the current through the coil. (1)

b. Label the pole formed at the ends of iron cores where they are facing each other. (1)

c. In which direction do the iron cores move? Explain.

_____

(2)

d. Draw an arrow on each plotting compass to indicate the direction of the magnetic field. (2)

e. State TWO ways by which the magnetic field can be made stronger.

_____

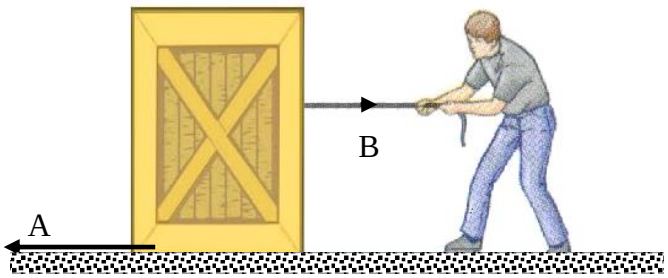
(2)

f. The battery is reversed. Explain why the movement of the iron cores is unchanged.

_____

(2)

6 a. Malcolm uses a rope to pull a large wooden box as shown below.

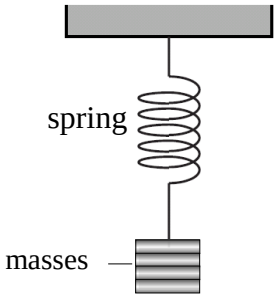


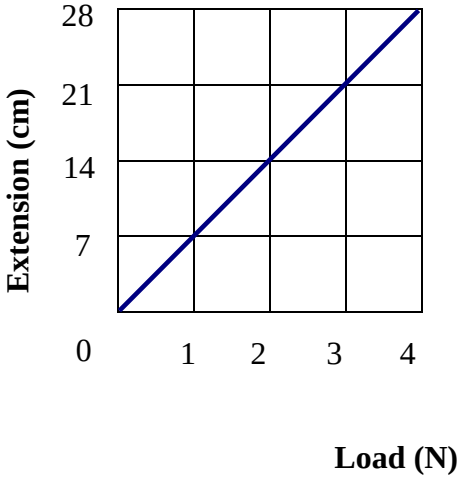
i. Name the force:

- 'A' acting between the block and the ground. _____ (1)
- 'B' acting in the stretched rope. _____ (1)

ii. Draw the reaction of the ground on the wooden block. (1)

b. Jasmine loads the spring shown using a number of masses. She plots a graph of extension (cm) against load (N).





i. She measures the extensions of the spring by using a _____. (1)

ii. How does she know that the spring obeys Hooke's law?

_____

_____

(2)

iii. The original length of the spring is 50 cm. Calculate the new length of the spring when the total load is 6 N. (Assume that the spring continues to obey Hooke's law).

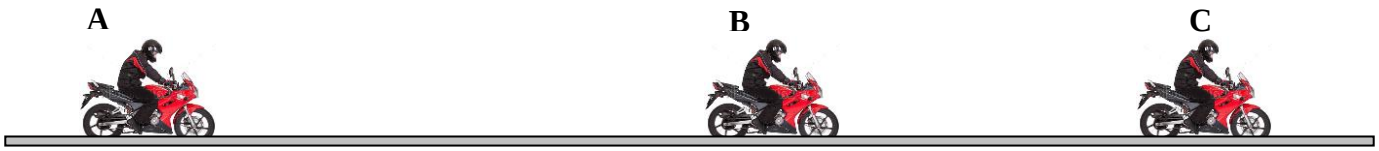
_____

_____

(2)

iv. Jasmine performs the same experiment with a similar spring which is stiffer. Draw on the same axes the graph that would result. (1)

7. Stephen of mass 80 kg is taking part in a 400 m motorcycle race. His motorcycle has a mass of 200 kg. He starts from rest at A and accelerates uniformly for 12 seconds reaching a maximum speed of 48 m/s at B. He continues to ride at constant speed until he crosses the finishing line at C.



Calculate the:

a. acceleration from A to B,

_____

_____

(2)

b. distance travelled from A to B,

_____

_____

(2)

c. time taken to travel from B to C,

_____

_____

(2)

d. average speed for the whole race,

_____

_____

(2)

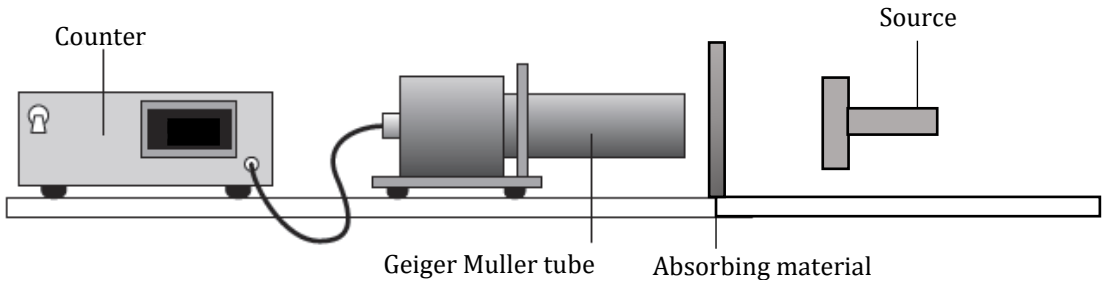
e. the kinetic energy of Stephen and his motorcycle while he travels at constant speed.

_____

_____

(2)

8. The apparatus shown below is used to study the absorption of radioactive radiation.



Different absorbing materials are placed between the source and the G-M tube. The table below shows the count rate obtained with each of the four absorbers.

Absorbing material	Air	Sheet of paper	Thin sheet of aluminium	Sheet of lead
Count rate /s	500	501	315	100

a. The source is not emitting alpha particles. How can you tell from the above table?

_____

_____

(2)

b. Is the source emitting beta particles? Explain.

_____

_____

(2)

c. What is the evidence that γ-rays are being emitted?

_____

_____

(2)

d. In a different experiment, a science student placed a radioactive source in front of the G-M tube and measured the count rate every 15 minutes.

Time/min	0	15	30	45	60
Count rate /min	860	662	530	440	342
Corrected count rate /min	830	632	500	410	312

i. From the table, the background radiation = _____counts/min (1)

ii. Define the term half-life. _____

_____

(1)

iii. Estimate the half-life of this radioactive source.

_____

_____

(2)

Section B: This section has 3 questions. Each question carries 15 marks (Total: 45 marks).

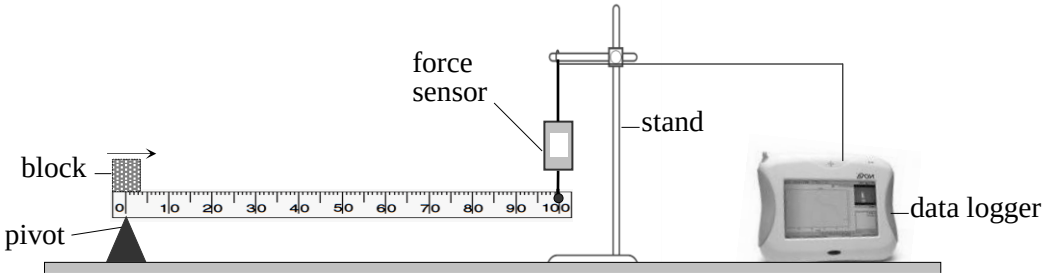
9. This question is about turning forces.

a. What is meant by the moment of a force?

_____

_____

(1)



b. Amy sets up the apparatus shown above. It consists of a balanced metre rule of negligible weight pivoted at one end and suspended horizontally by means of a force sensor at the other end. She moves a block several times towards the force sensor which is connected to a data logger. She obtains the following results.

Distance of mass from pivot (cm)	10	20	30	40	50	60
Force measured by force sensor (N)	2.5	5.0	6.8	10.0	12.5	15.0

i. Plot a graph of Force (N) on the y-axis against Distance (cm) on the x-axis. (5)

ii. One of her readings was incorrect. Circle on your graph the reading that was incorrect. (1)

iii. The correct value should have been _____ N. (1)

iv. Calculate the anti-clockwise moment when the block is placed on the 40 cm mark.

_____

(1)

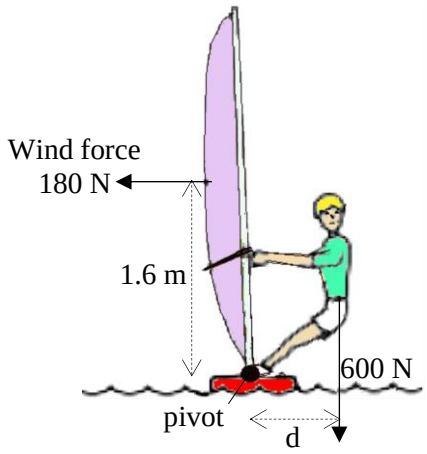
v. Use the principle of moments to calculate the weight of the block.

_____

_____

(2)

c. Alex is practising windsurfing as shown below. Suddenly the wind force increases and he leans backwards to balance his windsurf.



i. Calculate the moment produced by the wind force.

_____

_____

(2)

ii. What is the moment caused by Alex if he balances his windsurf?

_____

(1)

iii. Find the value of distance ‘d’.

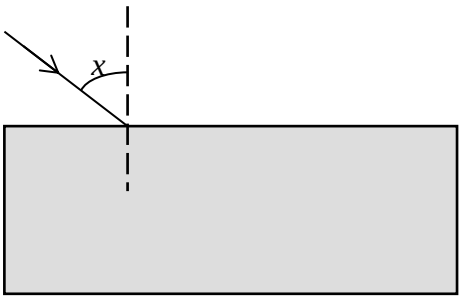
_____

_____

(1)

10. This questions is about light.

Sam and Kim were in the physics lab investigating some properties of light.



a. Kim aimed a ray of light towards a rectangular glass block as shown in the diagram.

i. Name the angle labelled '*x*' in the diagram.

_____ (1)

ii. Complete the path of the light ray through and out of the glass block. (2)

iii. What happens to the speed of light when the ray enters the glass block?

_____

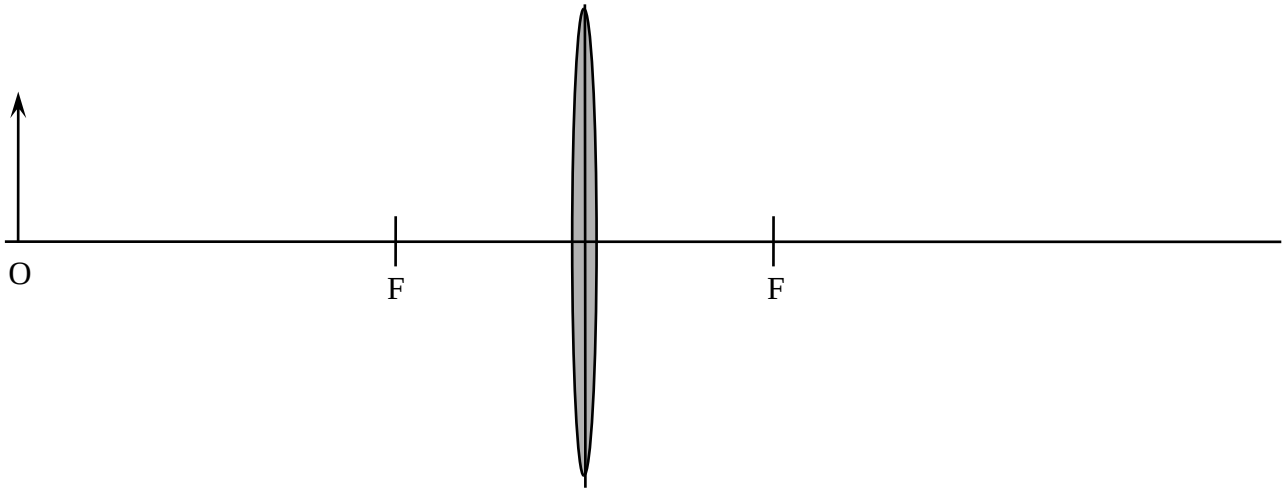
(1)

iv. At one point, a light ray inside the glass block hits the glass-air boundary at an angle of 60°. If the critical angle of this glass is 42°, state what happens to the light ray now.

_____

(2)

b. Sam places a well-lit object O in front of a converging (convex) lens as shown below.



i. Name the points labelled F. _____ (1)

ii. State a use for the lens in this setup. _____ (1)

iii. Complete the ray diagram above to find where the image I of the object O forms. (3)

iv. State TWO properties of the image formed.

_____

(2)

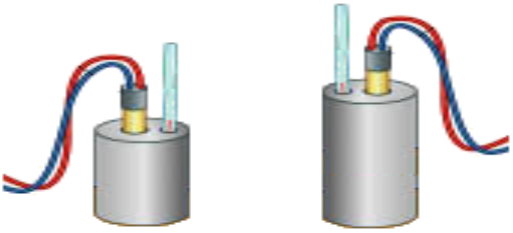
v. Calculate the magnification of the lens in this setup.

_____

(2)

11. This question is about specific heat capacity.

a. An iron block and an aluminium block have a mass of 1 kg each.



Iron block Aluminium block

i. Explain why the two metal blocks have the same mass even though the iron block is smaller in size.

_____

(1)

ii. Identical heaters are used to heat each block. Calculate the power rating of the heater if it uses 900 J of electrical energy every 30 seconds.

_____

_____

(2)

iii. The specific heat capacity of iron is 450 J/kg°C while that of aluminium is 900 J/kg°C. Given that initially the two blocks are at room temperature, which one will reach the highest temperature after being heated for five minutes. Explain.

_____

_____

(2)

iv. Name the process by which heat is transferred through each block.

_____

(1)

v. A liquid-in-glass thermometer is used to measure the temperature of each block. By which process does the liquid inside the thermometer rise when heated?

_____

(1)

b. Elisa is asked to find the specific heat capacity of water. She is given the following apparatus:

- container
- lid
- heater
- insulating material
- thermometer
- joulemeter (an instrument to measure energy)
- top pan balance
- stirrer

i. In the space below draw a labelled diagram showing how the apparatus should be set up. (3)

ii. Write down the equation she has to use.

_____

(1)

iii. Explain how she needs to measure each of the three quantities used in the equation.

_____

_____

_____

_____

_____

(3)

iv. Name ONE precaution that she can take.

_____

_____

(1)