JUNIOR LYCEUMS ANNUAL EXAMINATIONS 2000
Educational Assessment Unit - Education Division

FORM 3 **PHYSICS** **TIME: 1 hr 30 min**

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.

You may find some of these formulae useful.

acceleration due to gravity $g = 10\ m/s^2$

area of triangle $= \frac{\text{base x height}}{2}$ area of trapezium $= \frac{h}{2}$ (sum of parallel sides)

$v = \frac{s}{t}$ $v = u + at$ $s = \frac{at^2}{2}$ $W = mg$ density $= \frac{\text{mass}}{\text{volume}}$

work done $= F s$ $PE = mgh$ $P = \frac{\text{work done}}{\text{time}}$ $KE = \frac{mv^2}{2}$

moment of a force = Force x perpendicular distance

$$\text{magnification} = \frac{\text{height of image}}{\text{height of object}} = \frac{\text{image distance}}{\text{object distance}}$$

$$\text{refractive index} = \frac{\text{sine (angle in air)}}{\text{sine (angle in medium)}}$$

$$\text{sine (critical angle)} = \frac{1}{\text{refractive index}}$$

$$\text{frequency} = \frac{\text{number of waves}}{\text{time}}$$

$v = f\lambda$

Section A. Answer All Questions. This Section carries 55 marks.

1. Complete the following Table:

No:	Physical Quantity	S.I. symbol	Value	Value in S.I. Units	
a.	distance		3.5 km	3500 m	[1]
b.	time	t	2.5 minutes		[1]
c.	energy	E	4 kJ		[1]
d.	mass		1500 g		[2]

2. a. i. State **ONE** difference between **vectors** and **scalars**. [1]

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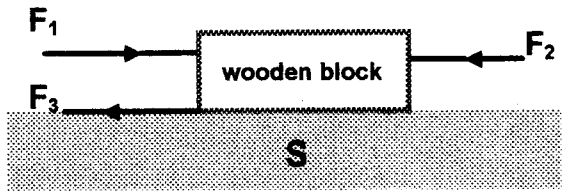
ii. An example of a vector is _____. [1]

iii. An example of a scalar is _____. [1]

b. The diagram below shows the **three** forces acting on a wooden block while being pushed along a **rough** surface S.
Force F_1 is the force pushing the wooden block forwards.



i. F_2 is the _____. [1]

ii. F_3 is the force of _____ between the wooden block and the rough surface S. [1]

iii. Calculate the size of the resultant force **F** acting on the wooden block given that F_3 is 5 N, F_2 is 3 N and the pushing force F_1 is 12 N. [3]

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iv. Which force will not exist if the surface S is a **smooth** surface?. [2]

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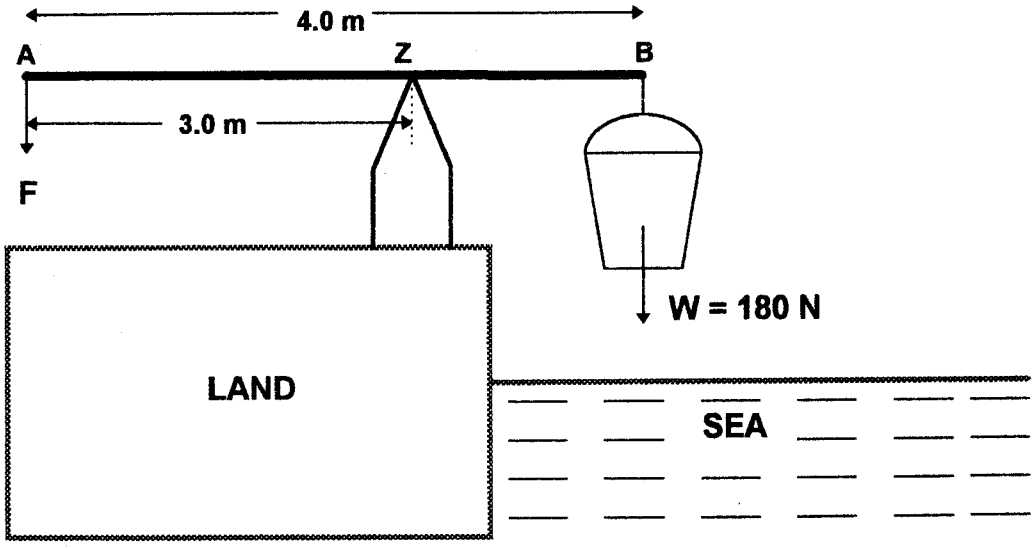
3. The diagram shows a device for lifting water from the sea.
The weight of the rod AB can be ignored.



a. The perpendicular distance between the bucket and the pivot **Z** is _____ m. **[2]**

b. Calculate the **size** of the moment of the bucket about the pivot **Z.** **[2]**

c. The direction of rotation caused by the bucket about the turning point **Z** is _____. **[2]**

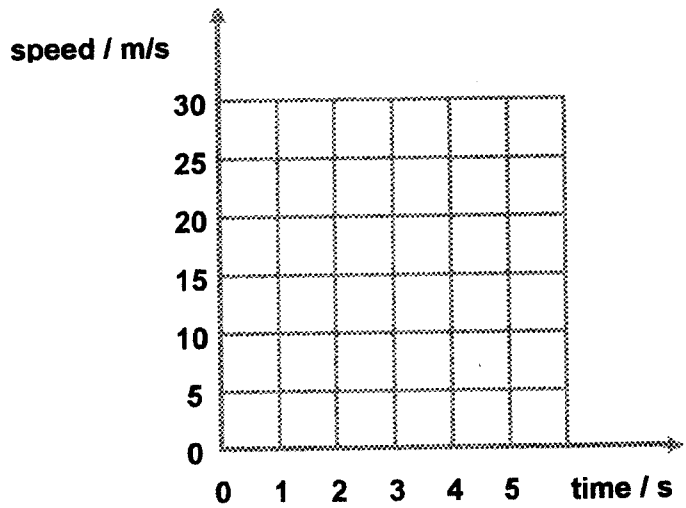
d. Calculate the downward force **F** to balance the bucket. **[4]**

4. a. A driver of a car has a thinking time of 0.7 s, that is, there is a delay of 0.7 s between the driver deciding to stop the car and pressing the brake pedal.

If the car is travelling at 20 m/s, calculate the distance covered by the car during the thinking time. **[2]**

b. Once the brake pedal has been pressed, the car decelerates uniformly and stops in 3.0 s.

i. Draw on the figure below, a graph, to show how the speed of the car changes during the last 3.0 s. **[3]**



ii. From your graph, find the distance covered by the car during braking. **[3]**

iii. Calculate the **total distance** covered by the car, between the driver deciding to stop the car and the car finally coming to rest. **[2]**

5. The energy supplied to a crane to raise a load of 1000 N through a height of 5 m is 6250 J.

a. What is the work input? _____ J. [1]

b. Calculate the work done [or work output] by the crane. [2]

c. Calculate the efficiency of the crane. [3]

d. How much energy is wasted? [2]

e. What happens to the wasted energy? [2]

6. a . The following represent ray diagrams

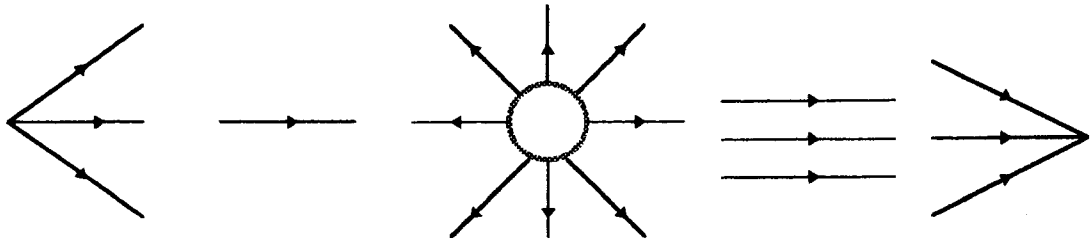


Figure A **Figure B** **Figure C** **Figure D** **Figure E**

i. Figure _____ represents a parallel beam of light. [1]
ii. Figure B represents a _____ of light. [1]
iii. Figure _____ represents a convergent beam of light. [1]
iv. Figure _____ represents a divergent beam of light. [1]
v. Figure _____ represents a source of light. [1]

b. i. A magnified image is an image _____ than the object. [1]
ii. A converging lens is _____ at the _____ than at the edges. [2]
iii. A real image produced by a converging lens is always _____. [1]
iv. The image of an object placed on the focus of a converging lens is formed at _____. [1]

Section B. Answer All Questions. This Section carries 45 marks.

1. This question is about the Kinetic Theory and Brownian Motion.

a. According to the kinetic theory of matter:

i. Matter exists in three states:_____, _____, and _____. **[3]**

ii. All matter is made up of _____. **[1]**

iii. The particles of a gas at room temperature possess _____energy. **[1]**

iv. The motion of the particles in a gas is described as _____. **[1]**

b. An experiment was set up to show Brownian Motion in air using a smoke cell.

i. Draw a labelled diagram of the experimental set-up . **[4]**

[2]

ii. Explain why it is possible to see individual smoke particles but not air particles.

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[1]

iii. The particles showing Brownian Motion are the _____ particles. **[1]**

iv. The particles causing Brownian Motion are the _____ particles. **[1]**

v. What causes this random motion?

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2. This question is about the refractive index and critical angle of a **semicircular transparent plastic block.**

The following table of results is obtained from an experiment to find the refractive index and critical angle of a semicircular plastic block.

angle in plastic /°	0	10	20	30	40	45	50
angle in air /°	0	13	27	41	57	68	90

a. Plot a graph, on the graph paper provided, of angle in plastic [x-axis] against angle in air [y-axis]. Draw the **BEST SMOOTH CURVE.** **[5]**

b. From your graph, find the angle in air when the angle in plastic is 35°. **[1]**

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c. From your graph, find the angle in plastic when the angle in air is 25°. **[1]**

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d. What is the critical angle of this kind of plastic? **[3]**

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e. Calculate the refractive index of this kind of plastic. **[2]**

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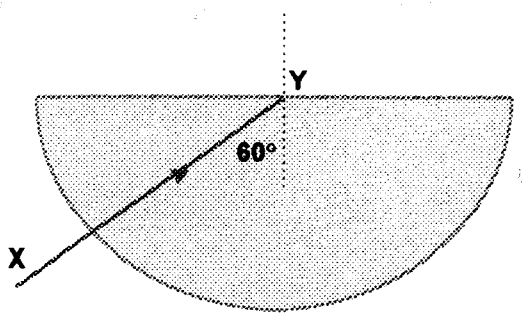
f. Complete the figure below to show the path of the ray of light XY incident on the semicircular plastic block used in the experiment. **[3]**
Explain your answer.



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3. This question is about water waves.

Two students set up a ripple tank in the laboratory to study the properties of waves.

a. Explain how you would obtain circular water waves of constant frequency. **[3]**

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b. Waves are set up in the ripple tank. A small floating object goes up and down 5 times per second. The wave crests produced are 10 cm apart.

i. The frequency of the wave = _____ Hz **[1]**

ii. The wavelength of the wave = _____ m **[1]**

iii. Calculate the velocity of the wave. **[2]**

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c. The students now produced straight waves to study the behaviour of waves when passing through gaps.

i. Explain how you would produce a straight water wave. **[3]**

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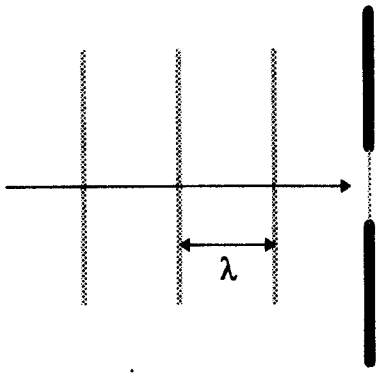
ii. The students place a barrier with a gap as shown below. **[3]**
Draw the shape of the wavefronts after passing through the gap.



iii. This spreading of water waves when these pass through a gap is referred to as _____. **[2]**