

# JUNIOR LYCEUM ANNUAL EXAMINATIONS 2009

Directorate for Quality and Standards in Education  
Educational Assessment Unit

**FORM 3**

**PHYSICS**

**TIME: 1h 30min**

Name: \_\_\_\_\_

Class: \_\_\_\_\_

**Answer all questions.**

**All working must be shown. The use of a calculator is allowed.**

**Where necessary take acceleration due to gravity  $g = 10\text{m/s}^2$ .**

**You may find some of these formulae useful.**

<b>Measurement &amp; Density</b>	$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$	$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$
<b>Force</b>	$W = mg$	Moment of a force = force X perpendicular distance
<b>Energy &amp; Work</b>	Work done = F s	$\text{Power} = \frac{\text{Work done}}{\text{Time taken}}$
	$\text{PE} = m g h$	$\text{KE} = \frac{mv^2}{2}$
<b>Pressure</b>	$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$	$\text{Pressure} = \rho h g$
<b>Waves</b>	$v = f \lambda$	$\text{Frequency} = \frac{\text{number of waves}}{\text{time}}$
	$\text{Refractive Index of glass} = \frac{\text{speed of light in air}}{\text{speed of light in glass}}$	
	$\text{Magnification} = \frac{\text{height of image}}{\text{height of object}} = \frac{\text{image distance}}{\text{object distance}}$	

*For office use only:*

<b>Number</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>Total</b>
<b>Max Mark</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>85</b>
<b>Actual Mark</b>									

	<b>Total Theory</b>	<b>Total Practical</b>	<b>Final Mark</b>
<b>Actual Mark</b>			
<b>Max Mark</b>	85	15	100

## SECTION A

Answer all questions in the space provided. This section carries 40 marks.

- 1.(a) In the below diagram, draw lines to join each physical quantity with a unit. An example has been done for you.

Force	s
Energy	Kg
Pressure	N
Frequency	J
Mass	Pa
Time	Hz

(5)

- (b) Complete the following:

- (i) A ruler is used to measure the \_\_\_\_\_ of an object.
- (ii) \_\_\_\_\_ is used to measure the weight of an object.
- (iii) 3.5kJ is equal to \_\_\_\_\_ J. (3)

2. Claire has a metal ring. She uses a measuring cylinder to find the volume of the ring as shown.

- (i) The initial volume of water is \_\_\_\_\_ (1)
- (ii) The final volume of water is \_\_\_\_\_ (1)
- (iii) The volume of the ring is \_\_\_\_\_ (1)
- (iv) The mass of the metal ring is 214g. Calculate the density of the metal.

\_\_\_\_\_

\_\_\_\_\_

(2)

- (v) The densities of three different metals are:

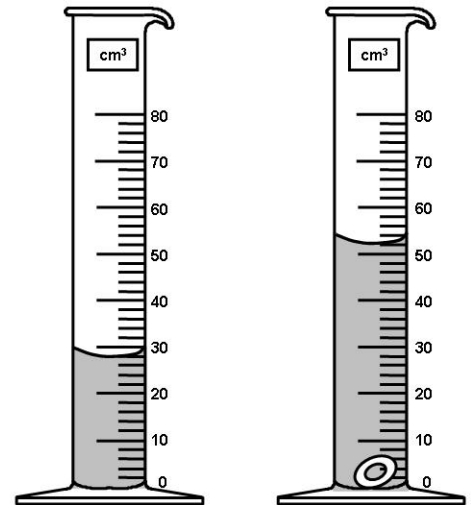
<i>Metal</i>	<i>Density (g/cm<sup>3</sup>)</i>
Gold	19.3
Copper	8.9
Bronze	9.9

Which metal is the ring made of?

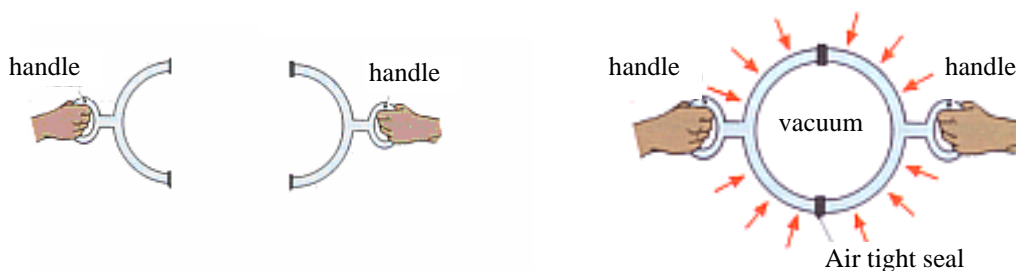
(1)

- (vi) Underline the correct answer: A bigger ring of the same metal will have the same / more / less density than the original ring. Give one reason for your answer.

\_\_\_\_\_ (2)



- 3.(a) Otto von Guericke, (1602-1686), a German physicist, born in Magdeburg, performed a famous experiment: the 'Magdeburg Hemispheres'. He placed two halves of a large, hollow metal ball together and sucked out all the air from inside the ball. Two teams of eight horses could not pull the rings apart.



- (i) Give one reason why air was sucked out from the inside of the ball.

(1)

- (ii) Explain why the two halves of the metal ball could not be pulled apart.

(1)

- (b) Jacob dives in a swimming pool.

- (i) Using the formula  $P = \rho hg$ , calculate the pressure due to the water, when the Jacob is at a depth of 1.3m. (The density of water is  $1000\text{kg/m}^3$ ).

(2)

- (ii) What is the pressure at the surface of the water called?

(1)

- (iii) If this pressure at the surface of the water is  $101,000\text{ N/m}^2$ , calculate the total pressure on the diver.

(1)

- (iv) Complete the following sentence by choosing one word from the following:

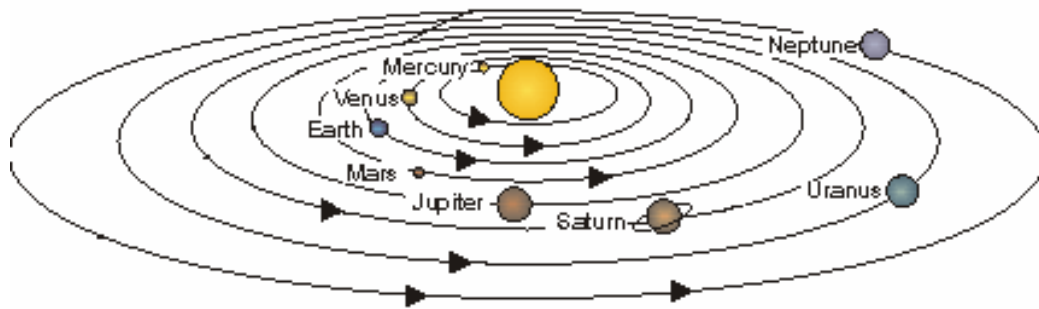
*increases, decreases, remains the same*

Pressure \_\_\_\_\_ as the diver goes deeper under the water.

Give one reason for your answer.

(2)

4. The diagram represents our solar system.



- (i) Rearrange the following in order of size, the **largest** first.

galaxy, universe, solar system

\_\_\_\_\_ (1)

- (ii) How long does it take the earth to orbit the sun?

\_\_\_\_\_ (1)

- (iii) Why would you expect Jupiter to take longer than Earth to orbit the sun?

\_\_\_\_\_ (1)

- (iv) Give **one** reason why planets in our solar system orbit around the sun and not around Jupiter.

\_\_\_\_\_ (1)

- (v) Name **one** natural satellite that orbits around Earth.

\_\_\_\_\_ (1)

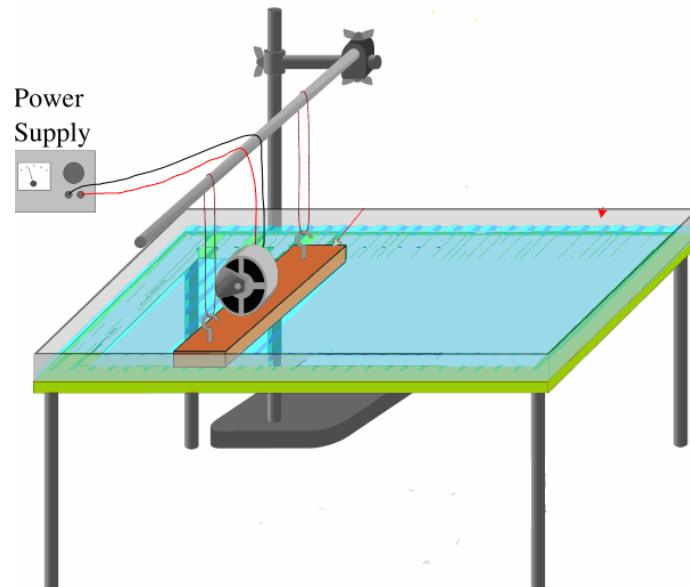
- (vi) Name **two** uses of artificial satellites.

\_\_\_\_\_ (2)

- (vii) Name the force that keeps the satellites orbiting around the Earth.

\_\_\_\_\_ (1)

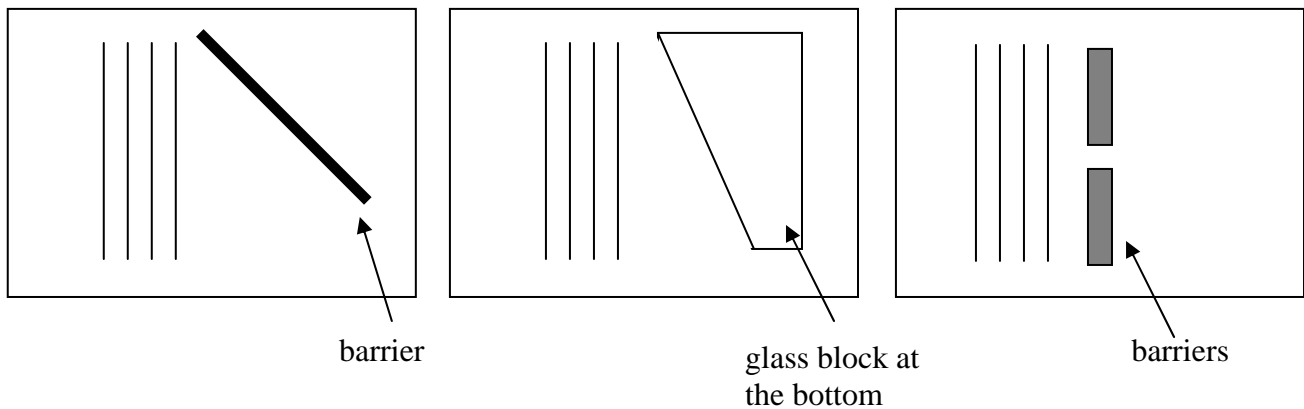
5. The following laboratory apparatus is used to demonstrate waves.



- (a) Name the above laboratory apparatus. \_\_\_\_\_ (1)
- (b) On the above diagram:
- (i) draw the position of the lamp. (1)
- (ii) label the motor. (1)
- (iii) mark with the symbol X, the position where the waves will be clearly visible. (1)
- (c) How are the waves being produced?

\_\_\_\_\_ (1)

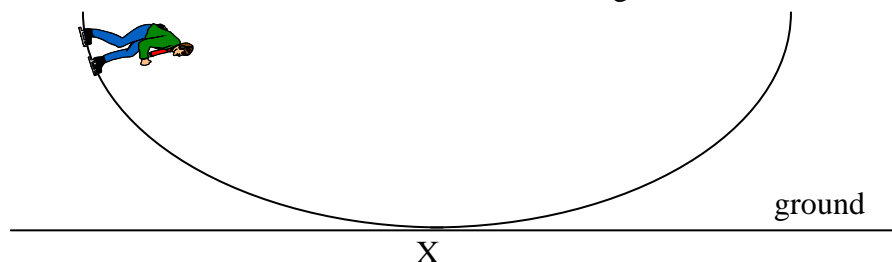
- (d) Complete the wavefronts in **each** of the following diagrams.



(3)

**SECTION B: Answer ALL questions. This section has a total of 45 marks.**

6. A skater slides from one side to another of a skating track as shown.



- (a) State the Principal of conservation of energy.

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(2)

- (b) The skater has a mass of 70kg.

- (i) Calculate the potential energy gained by the skater when he is 3.2m above the ground.

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(1)

- (ii) Assuming no loss in energy, calculate the maximum velocity of the skater at point X as shown on the diagram.

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(3)

- (iii) Eventually the skater slows down and stops. In terms of energy change explain what happens as the skater slows down.

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(2)

- (c) A table of the gravitational potential energy of the skater and the respective height is shown below.

Height (m)	0	1	2	3	4	5	6
Gravitational Potential Energy (J)	0	700	1400	2100	2800	3500	4200

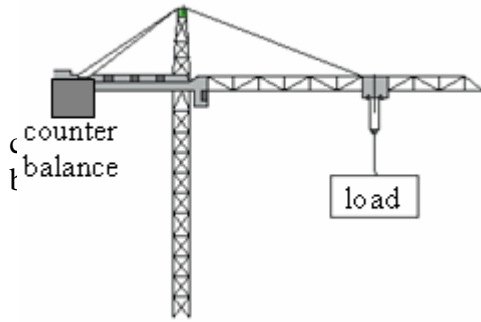
- (i) Draw a graph of gravitational potential energy (*y-axis*) against height (*x-axis*). (5)

- (ii) From your graph,

- what is the gravitational potential energy when the height of the skater is 2.5m? \_\_\_\_\_ (1)
- what is the height of the skater when his gravitational potential energy is 3000J? \_\_\_\_\_ (1)



7. (a) Simon and Claire observe a crane close to their school.



(i) **Draw** on the diagram and **name** the two forces acting on the load. (2)

(ii) The crane lifts a load of 30,000N through a vertical distance of 15m. Calculate the work done in lifting the load. Give the correct units for work.

\_\_\_\_\_

(iii) The load is lifted in 1 minute. Calculate the power used in lifting the load. Give the correct units for power. (2)

\_\_\_\_\_

(iv) The crane has a counter balance on the opposite side of the load. What is the purpose of the counter balance? (3)

\_\_\_\_\_

(b) Simon and Claire are curious to know how far the crane is from their school. They observe that each time the load is moved the crane makes a loud noise.

They measure the time it takes between seeing the load move and hearing the sound. The time is 0.60s.

(i) Name the apparatus used to measure this time. \_\_\_\_\_ (1)

(ii) Name **one** precaution they need to take to measure the time accurately.

\_\_\_\_\_

(iii) The speed of sound in air is 330m/s. Calculate the distance between the crane and the school. (1)

\_\_\_\_\_

\_\_\_\_\_

(iv) What type of wave is sound? How does sound travel in air? (2)

\_\_\_\_\_

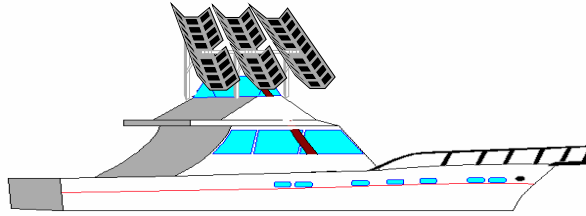
\_\_\_\_\_

(v) Discuss **one** source of error in this experiment. (2)

\_\_\_\_\_

(1)

8. (a) An engineer designed a boat that does not have sails or fuel tanks. It is powered only by batteries which are charged by solar energy. The boat has its roof top covered with solar panels as shown in diagram. The sun provides the energy to push the boat forward.



- (i) Is solar energy renewable or non-renewable?

(1)

- (ii) Name **one** major advantage and **one** major disadvantage of using solar energy instead of burning fossil fuels.

Advantage: \_\_\_\_\_

Disadvantage: \_\_\_\_\_

(2)

- (iii) How does the boat travel at night?

(1)

- (iv) Complete the following energy diagram for the movement of the boat.

Solar energy → \_\_\_\_\_ → \_\_\_\_\_

(2)

- (v) In full sunlight, the solar panels transfer 5400J per second to the batteries which drive the electric motor. Assuming the boat is 100% efficient, calculate the maximum speed of the boat if the mass of the boat is 1200kg.

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(2)

(b) Another engineer proposed that the electricity necessary for a whole village may be supplied by a number of wind turbines.

(i) Is wind energy renewable or non-renewable?



(1)

(ii) Name **one** major advantage and **one** major disadvantage of using wind energy instead of burning fossil fuels.

Advantage: \_\_\_\_\_

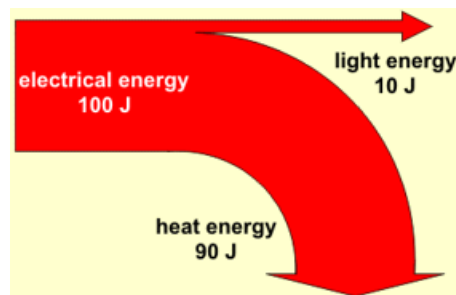
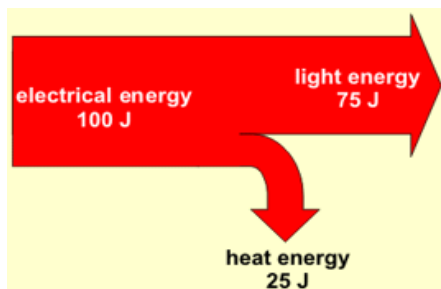
Disadvantage: \_\_\_\_\_

(2)

(iii) The engineer advised the people of the village to buy and use appliances which are energy saving. It will result in lower electricity bills for the people. Give **one** other reason why using energy saving appliances is advantageous to the country.

\_\_\_\_\_ (1)

(c) (i) The energy diagram of two types of bulbs are shown below. Write beneath each diagram (i) filament bulb, or (ii) energy saving bulb.



\_\_\_\_\_ (1)

(ii) Explain your answers.

\_\_\_\_\_

\_\_\_\_\_ (2)