JUNIOR LYCEUM ANNUAL EXAMINATIONS 2007

Educational Assessment Unit - Education Division

FORM 5 **PHYSICS** **TIME: 1 hr 45 min**

NAME: ____________________ **CLASS:** _____

Answer ALL questions in the spaces provided on the Exam 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.

Equations for Annual Exam Physics

Density	$m = \rho V$	
Pressure	$P = h \rho g$	$P = F/A$
Energy and Work	$PE = m g h$	$KE = \frac{1}{2} m v^2$
	$E \text{ (or } W) = P t$	$W \text{ (or WD)} = F s$
Force	$F = m a$	$W = m g$
Motion	$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$	$v = u + a t^2$
	$s = \frac{(u + v) t}{2}$	$s = \frac{1}{2} a t^2$
	$\text{momentum} = m v$	
Electricity	$Q = I t$	$W = Q V$
	$V = I R$	$R = R_1 + R_2 + R_3$
	$P = I V = I^2 R = \frac{V^2}{R}$	$R \alpha \frac{\text{length}}{\text{area}}$
Electromagnetism	$\frac{N_1}{N_2} = \frac{V_1}{V_2}$	
Heat	$H = m c \Delta\theta$	
Waves	$c = f \lambda$	

Marks Grid: For the Examiners' use ONLY

Question	1	2	3	4	5	6	7	8	Theory	Practical	Total
Max. Mark	8	8	8	8	8	15	15	15	85	15	100
Score											

Section A. **This Section carries 40 marks**

1. An empty measuring cylinder has a mass of 75 g. Its mass increases to 100 g when some olive oil is poured into it. The volume occupied by the olive oil in the measuring cylinder is 30 cm^3 (0.00003 m^3).

a. Calculate:

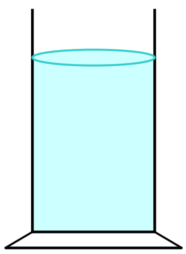
i. the **mass** of the olive oil in the measuring cylinder in **g,** **1**

ii. the **density** of this sample of olive oil in **g/cm^3,** **1**

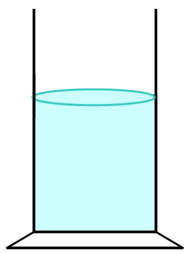
iii. the **mass** of the olive oil in the measuring cylinder in **kg,** **1**

iv. the **density** of this sample of olive oil in **kg/m^3**. **2**

b. It is noticed that when this sample of olive oil in the measuring cylinder is placed in a refrigerator and cooled to 5 ºC, the level of the olive oil in the measuring cylinder gets lower as shown in the figures below.



The level of the olive oil sample at 20 ºC



The level of the olive oil sample at 5 ºC

State the effect (if any) of this cooling on the value of the:

i. **mass** of the olive oil in the measuring cylinder, ____________________ **1**

ii. **volume** of the olive oil in the measuring cylinder, ____________________ **1**

iii. **density** of the olive oil in the measuring cylinder. ____________________ **1**

2. a. Complete the following statements:

i. A transverse wave is a wave in which the vibrations are at _____ ° to the direction of wave travel. **1**

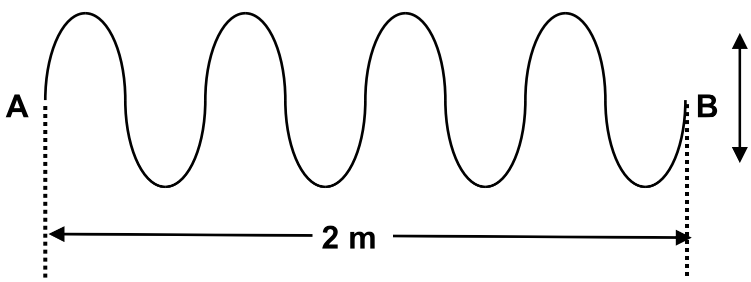
ii. A longitudinal wave is a wave in which the vibrations are at _____° to the direction of wave travel. **1**

iii. The quantity of energy transferred by both kinds of waves depends on the ____________________ of the wave. **1**

iv. The velocity of both kinds of waves depends only on the ________________ through which the wave travels. **1**

v. Sound waves cannot travel through a ________________. **1**

b. The figure below represents a transverse wave travelling through a rope held firmly at end A and moved up and down at end B.



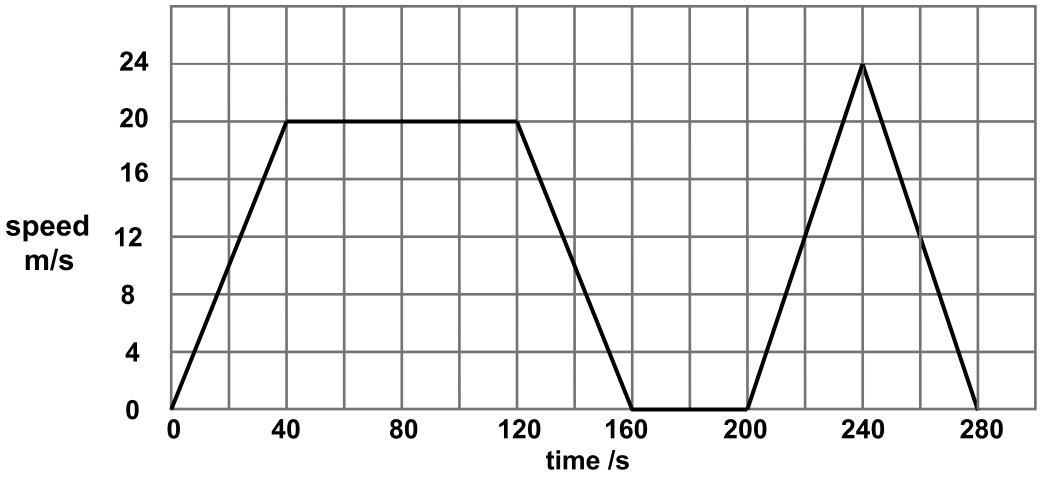
Use the above figure to calculate:

i. the **number of complete waves**, __________. **1**

ii. the **wavelength** λ in m, **1**

iii. the **velocity of the wave** through the rope in m/s, given that the frequency of the vibration is 2 Hz **1**

3. Maria drives from her home to the supermarket. The graph below shows how her speed changes throughout the **whole** journey.



a. From the graph find:

i. her **highest speed** in m/s, ______ m/s **1**

ii. the **speed** in m/s while she travels at constant velocity, ______ m/s **1**

iii. the **acceleration** in m/s^2 during the first 40 s of her journey. ______ m/s^2 **1**

b. Maria stops at the traffic lights. How long does she wait at the traffic lights? ______ s **1**

c. Use the graph to find the **distance** in meters Maria covers during the **last 80 s** of her journey. **2**

d. Calculate:

i. the **momentum** in kgm/s when Maria is travelling at **24 m/s** given that the total mass of the car and Maria is 5000 kg. **1**

ii. the average **braking force F** in N of Maria's car during the **last 40 s** of her journey given that the braking force F = change in momentum/time. **1**

4. The list below consists of some electrical components that might be found in an electric circuit:

switch, filament lamp, diode, rheostat, light dependent resistor (LDR), short connecting wire, thermistor.

a. Which of the above electrical components:

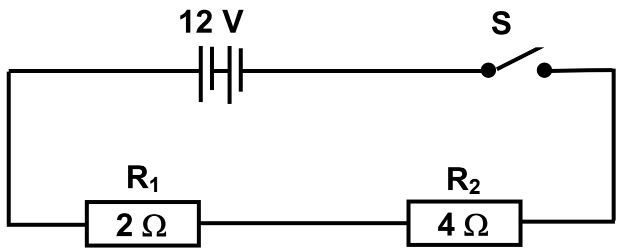
i. has negligible resistance, ____________________ **1**

ii. causes a break in the circuit cutting current flow, ____________________ **1**

iii. has a resistance dropping rapidly when its temperature rises, ____________________ **1**

iv. has a high resistance in the dark. ____________________ **1**

b. The following circuit diagram shows two resistors R_1 and R_2 connected in series to a 12-Volt car battery.



The switch S is closed. Calculate the:

i. **total resistance R** in ohms of the circuit. **1**

ii. **current I** in amperes flowing through the circuit, **1**

iii. **power P** of the circuit in Watts. **1**

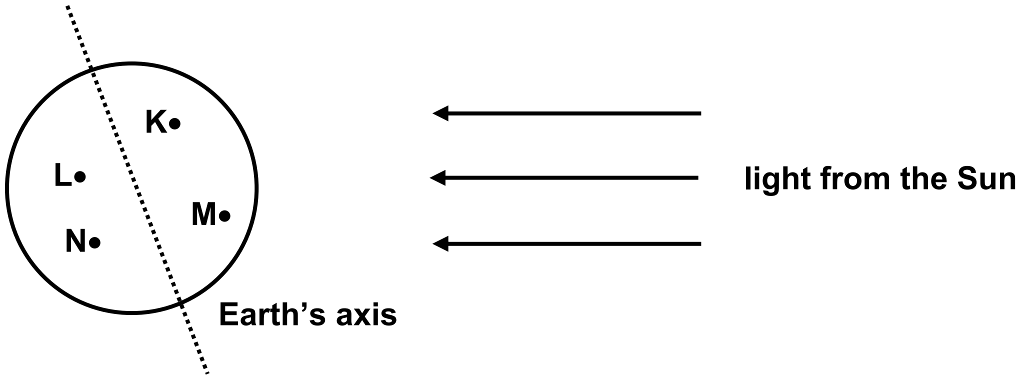
c. Five different fuses of values: 2 A, 3 A, 5 A, 7 A, and 13 A are available. Which is the best fuse which may be added to the circuit? ______________ **1**

5. The following terms are associated with the study of the universe:

solar system, planet, galaxy.

a. Place the terms in the list above, starting from the **smallest:** **1**

b. The diagram shows Earth and four cities **K, L, M, N** on the Earth's surface.



State:

i. which cities are in daylight , ____________ **1**

ii. which cities are in night-time, ____________ **1**

iii. how long does it take **city M** to return to the same place again as Earth spins on its axis, ____________ **1**

iv. how long does it take Earth to complete one orbit around the Sun. ____________ **1**

c. A communications satellite orbits around the earth in high orbit.

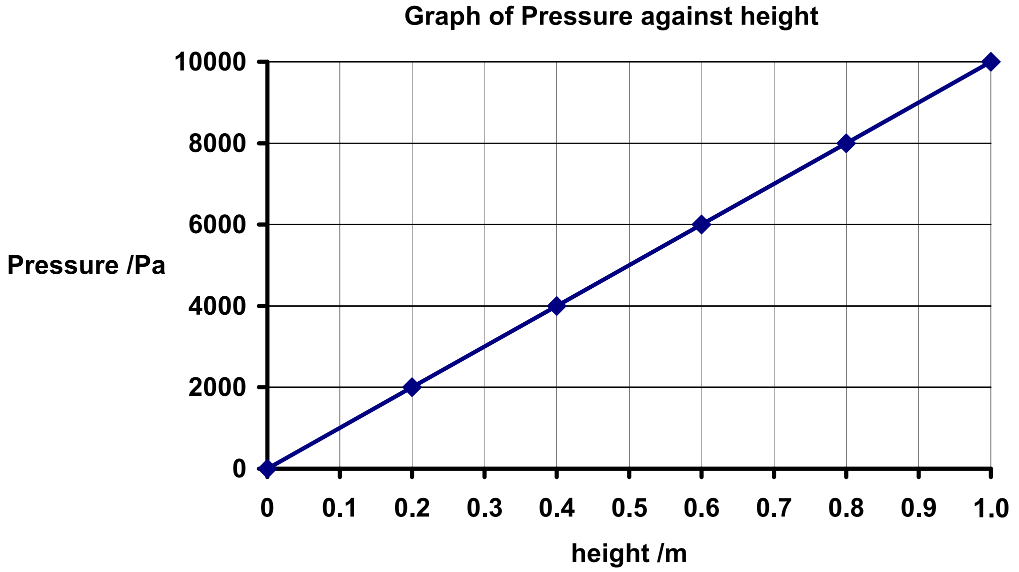
i. The ________________________ force keeps the satellite from escaping its orbit. **1**

ii. Explain why the geostationary satellite appears stationary from the Earth. **2**

Section B. **This section carries 45 marks**

6. This question is about pressure

A storage tank contains a **liquid.** The graph below shows how the pressure in Pa **due to the liquid only** changes with its height in the tank.



a. What do you notice about the graph which shows that the pressure due to the liquid is directly proportional to its height? **2**

b. Using the graph find:

i. the **depth** of the liquid when the pressure due to the liquid is 9000 Pa. _______ **1**

ii. the pressure **due to the liquid** at a depth of 0.5 m, _______ **1**

iii. the **density** of the liquid. **3**

c. Given that atmospheric pressure is **100 000 Pa**:

i. what is the **total pressure** in Pa at the **surface** of the liquid? **1**

ii. calculate the **total pressure** in Pa at a liquid depth of 0.5 m. **2**

d. The storage tank containing the liquid rests on a concrete roof. The base area of the storage tank is 4 m^2. Calculate the pressure exerted on the roof when the tank is completely filled with the liquid given that the total weight of the tank and the liquid is 8000 N. **3**

e. The liquid is transferred to similar tank of the same weight but with a larger base area. State what changes, if any, take place to:

i. the **total weight** of the liquid and the tank, _______________ **1**

ii. the **pressure** exerted by the tank and the liquid on the roof. _______________ **1**

7. This question is about the transformation of energy

The table below shows the **rise in temperature Δθ** which takes place when a lump of lead on mass 0.1 kg hits the ground after it has been dropped from **different heights h.**

rise in temperature / ºC	0.0	0.7	1.1	1.9	2.4	2.9	3.7	4.1
height / m	0.0	10	20	30	40	50	60	70

a. Using the above table:

i On the graph paper provided, plot a graph, of rise in temperature (y-axis) against the height (x-axis). Draw the best straight line. **5**

ii. Explain why some of the points you have plotted do not lie on the line you have drawn. **1**

b. From **your** graph find the:

i. **rise** in temperature when the lead lump is dropped from a height of 35 m, _____ **1**

ii. **temperature** of the lead lump after being dropped from a height of 35 m given that the temperature of the surroundings is 20 ºC, **1**

c. The rise in temperature **Δθ** which takes place when a similar lump of lead of mass 2 kg hits the ground after it has been dropped from a height of 39 m is 3 ºC. Calculate:

i. the **potential energy** of the lead lump just before it is dropped from a height of 39 m, **2**

ii. the **velocity** with which it strikes the ground after it is dropped from a height of 39 m assuming no air resistance, **2**

iii. the value of the **specific heat capacity** of lead obtained when the lead lump is dropped from a height of 39 m assuming no energy losses. **3**

8. This question is about electromagnetic induction.

a. Describe an experiment to show that a current is induced in a coil when it cuts lines of magnetic flux. You are provided with the following apparatus:

a bar magnet; a long coil; a zero-centre galvanometer; connecting wire.

Your description should include:

i. a **labelled** diagram of the experimental set up, **3**

ii. a **very** brief description of the method, **2**

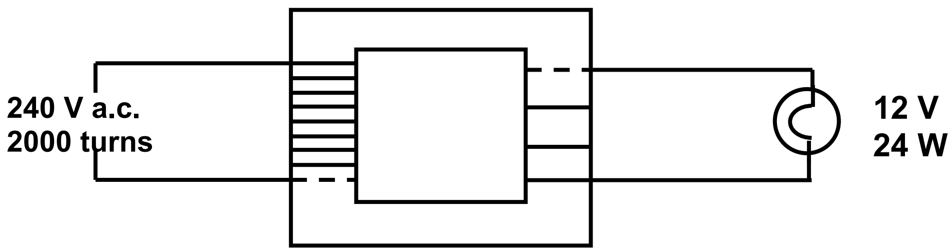
PLEASE TURN OVER

iii. **one** observation, **1**

iv. **one** conclusion, **1**

v. **two ways** of increasing the size of the induced current in the coil. **2**

b. One use of electromagnetic induction is in the transformer. A 240 V a.c. supply is connected to the primary coil of a transformer and a 12 V, 24 W lamp is connected to its secondary coil as shown in the figure below.



Calculate the:

i. **current in the secondary coil** given that the lamp is at its normal brightness. **2**

ii. **number of turns in the secondary coil** given that the number of turns in the primary coil is 2000 turns. **2**

iii. **current in the primary coil** of the transformer, assuming it to be 100% efficient. **2**