ST.FRANCIS SECONDARY SCHOOL

HALF YEARLY SPECIMEN PAPER

FORM 4	**PHYSICS**	TIME: 2 hrs

Name:_____ **Class:** _____

Answer all questions on the exam paper. In calculations show all steps in your working. The use of scientific calculators is allowed.

Wherever necessary take 'g' = 10 N/kg

Waves	$v = f\lambda$	$f = \frac{1}{T}$
	$m = \frac{\text{image distance}}{\text{object distance}}$	$m = \frac{\text{height of image}}{\text{height of object}}$
	$\eta = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$
Forces & Motion	$W = mg$	Average Speed $= \frac{\text{Total Distance}}{\text{Total Time}}$
Density	$m = \rho V$	
Energy and Work	$PE = m g h$ $KE = \frac{1}{2} m v^2$	$W = F s$ Work done = Energy converted
Heat	$Q = mc\Delta\theta$	$E = P t$

Question	1	2	3	4	5	6	7	8	9	10	Total
Mark	10	9	10	10	10	10	8	10	10	13	100

Score											

1. This question is about renewable sources of energy

a) Mention two sources of energy that are suitable for a mountaneous region only. (2)

_____

b) What are two advantages of installing these types of energy sources? (2)

_____

_____

c) A wind turbine has generated a 72 000 J in 1 hour. What power did it use? (3)

_____

_____

_____

d) If in the next hour, the wind speed doubled, what happens to each of the following? Fill in the blanks using any of these increases/ remains the same/ decreases (3)

i) the amount of energy generated _____

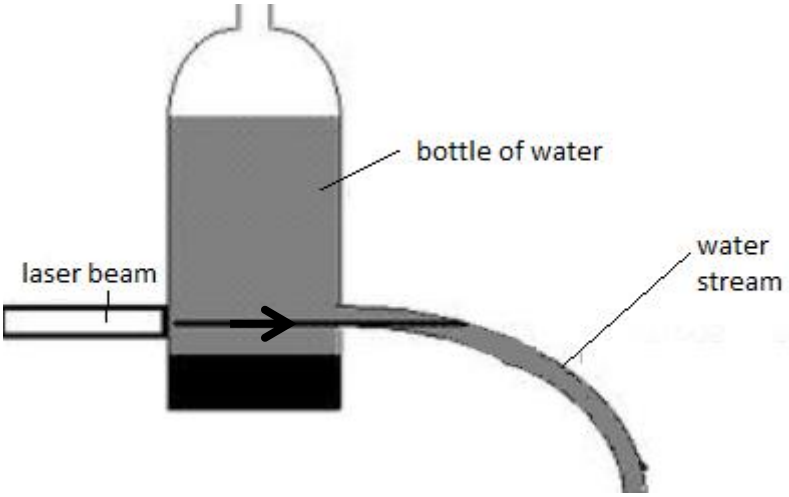
ii) the power of the turbine _____

iii) the time required to get 72 kJ _____

2. This question is about optics.

Paolo and Veronica were playing at the park and they observed how the water coming out from the hole in the ground was all lit up even though it followed a curved path.

They tried to replicate the same situation at home as shown below using a laser beam through a bottle of water with a hole such that a curved stream of water came out of the bottle.



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(a) What light phenomenon occurred not to allow the light beam to leave the water stream but to continue to pass through it? (2)

_____

_____

(b) What condition did Paolo and Veronica had to pay attention to ensure that this light phenomenon takes place? (1)

_____

_____

(c) Complete the path followed by the laser beam through the water stream. Draw and label your normals. (3)

(d) What other condition is necessary for this phenomenon to occur. (1)

_____

(e) Mention **two other** applications where the phenomenon you mentioned in (a) is used in everyday life. (2)

_____

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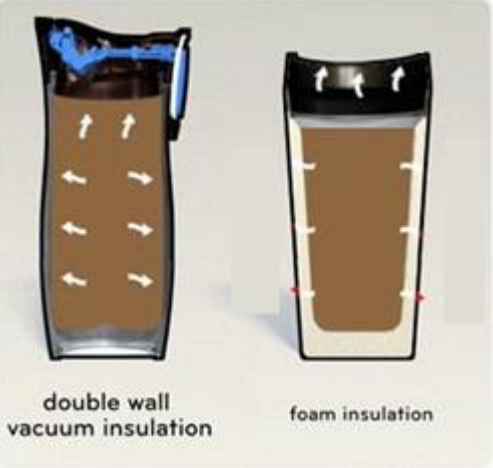
3. <u>This question is about heat transfer</u>.

A manufacturer wanted to determine which mug would be best to manufacture from the two he had designed. One has a double wall vacuum insulation while the other has foam insulation.



(a) Write the method he can follow to test which mug would keep the hot chocolate warm longer. State clearly which measurements he would need to take and what he would need to do to ensure it is a fair test. (3)

_____

_____

_____

_____

(b) Draw a table showing how the results would be presented. (2)

(c) Sketch a graph with labelled axes and cooling curves of what results you think he would obtain. (3)

(d) State **why** you think one is better than the other making special reference to the ***way how heat is transferred***. (2)

_____

_____

_____

4. **<u>This question is about specific heat capacity</u>**.

Elise was feeling cold so she filled an electric kettle that has a power rating of 3kW with 1.5 kg of water at 15˚C. She switched on the kettle for 3 minutes to fill up her hot water bottle. The specific heat capacity of water is 4200 J/kg ˚C

(a) Assuming no heat energy is lost, calculate how much heat energy has the electric kettle supplied. (2)

_____

_____

_____

(b) Calculate the final temperature reached by the water. (3)

_____

_____

_____

_____

(c) Why is it important that the kettle has a lid? (1)

_____

(d) Which property makes water good for hot water bottles? (1)

_____

_____

(e) Elise had read an article that one of the ways she can keep cool in summer is by filling a hot water bottle with icy cold water and keeping it close to her in bed. Explain. (3)

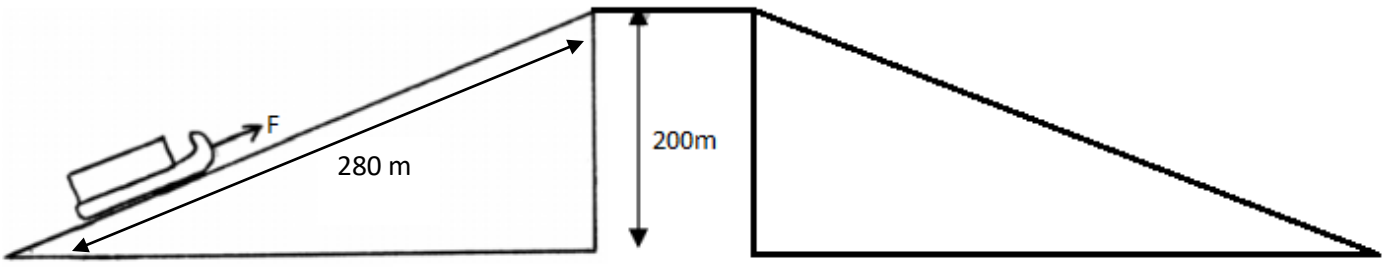
_____

_____

_____

5. <u>This question is about work, energy and power.</u>

Ella and Greta go to a skiing resort. The sledge they are going to use is pulled up a height of 200m by an electric motor. The electric motor pulls up the sledge with a force of F of 20N.



(a) Calculate the work done by the electric motor in pulling up the sledge. (2)

(b) Calculate the power of the electric motor if the pulls up the sledge to the top in 50s. (2)

(c) If the sledge together with Ella and Greta has a mass of 170kg. Calculate the gravitational potential energy at the top of the slope. (2)

(d) State the 2 energy changes that happen to the sledge at the top until it reaches the bottom. (2)

(e) Calculate the velocity of the sledge at the bottom of the slope. (2)

6. <u>This question is about heat</u>

a) Alan is in the kitchen and has decided to pack up a meal for a friend in hospital in a food vacuum flask. **Draw and label** a diagram to explain the different parts of the vacuum flask. (4)

b) Which part(s)of the vacuum flask (4)

(i) avoid(s) heat flow by conduction? _____

(ii) reflects back Infra-red waves? _____

(iii) avoid(s) heat flow by evaporation? _____

c) Describe one feature in a house that ensures it keeps the house cool in summer.

(2)

_____

_____

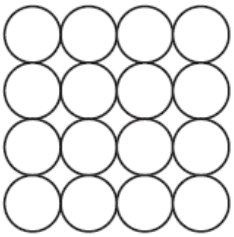
_____

_____

7. This question is about matter

According to the kinetic theory, all matter is made up of small particles. The particles are constantly moving. Diagram 1 shows how the particles may be arranged in a solid.

Diagram 1



(a) One kilogram of a gas has a much larger volume than one kilogram of a solid. Use kinetic theory to explain why. (3)

_____

_____

_____

_____

b) Diagram 2 shows the particles in a liquid. The liquid is evaporating.

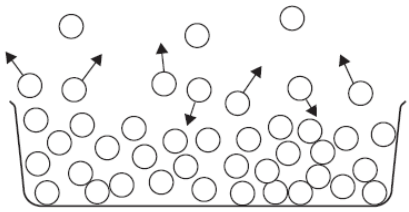
i) How can you tell that the liquid is evaporating? (2)

_____

_____

_____

Diagram 2



ii) The temperature of the liquid in the container (decreases/ increases/ remaina the same) as the liquid evaporates. (1)

c) A gas is contained in an empty plastic bottle at room temperature. The bottle is later put in ice as shown in the picture. (2)

What happens then to: (*use increases/ decreases/ stays the same)*

i) the density of the gas? _____

ii) the temperature of the gas? _____

iii) the mass of the gas? _____

iv) the pressure inside the bottle? _____

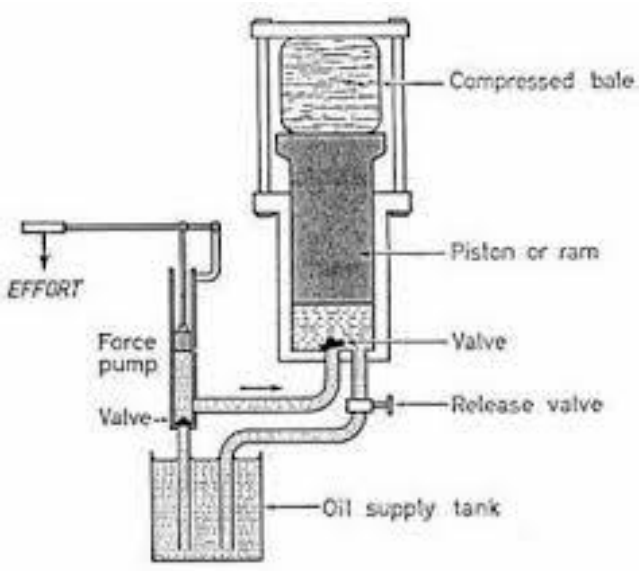
8. **This question is about Pressure**

a) Is pressure a scalar or a vector? _____ (1)

b i) A panel beater uses a hydraulic machine to fix a car. The liquid in the system is oil because it is _____. If _____ leaks into a hydraulic machine, it will work (more/ less) efficient as some of the pressure is lost to compress it. A hydraulic machine is a force _____. (2)

b ii) Hydraulic machines include a hydraulic press, _____ and the _____. (2)

c) At the Sant'Antnin recyling plant the following hydraulic press is used to stack plastic and paper in bales as shown. When the effort on the force pump is 5N a pressure of 2 kPa is exerted in the system.



i) From the above information determine the area of the force pump shown. (2)

_____

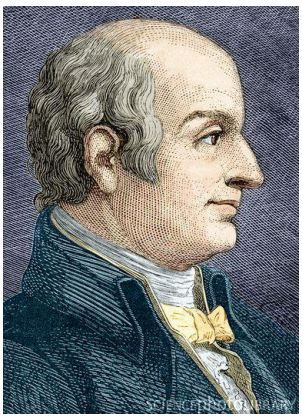
_____

ii) If the piston has an area of 2.5 m^2, will the system be able to withstand a bale of mass 45 kg? (3)

_____

_____

9. This question is about waves



Lazzaro Spallanzani is an Italian scientist pioneer in ultrasound studies. He wondered how bats can fly in completedarkness. He blindfolded them and noticed that they still could fly well. He then plugged their ears and found that they bumped into obstacles.

He concluded that bats must emit sound waves which we cannot hear and then listen to the echoes to determine the distance and direction of objects.

(a) What is the normal range of hearing for human beings?

_____(1)

(b) Explain how sound travels through air.

_____(1)

(c) Is ultrasound made up of transverse or longitudinal waves?

_____(1)

(d) A bat emits a sound with a frequency of 34 kHz.

(i) What does the term frequency mean?

_____(1)

(ii) The speed of sound in air is 340 m/s. Calculate the wavelength in metres of the sound waves produced by the bat.

_____(2)

(e) A bat is flying close to a wall and receives the reflected sound after 0.16s.

(i) What is the reflected sound called?

_____(1)

(ii) Calculate the distance between the bat and the wall. (Speed of sound in air is 340m/s).

_____(2)

(f) Mention the basic difference between Sound waves and Light waves

_____(1)

10. This question is about the relationship between mass and weight.

Isaac and Albert set up an experiment to find the relationship between mass and weight.

a. Describe briefly how Isaac finds the mass of an amount of water in a beaker. (3)

_____

_____

_____

_____

b. Isaac and Albert present the data in the table below.

m/kg	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5
W/N	0	4.9	9.8	14.7	19.6	24.5	29.4	34.3

i. Use the table to determine the value of the relationship between mass and weight. (2)

_____

ii. Plot a graph of weight W in N (y axis) against the mass m in kg (x axis). (4)

iii. With reference to the graph it is seen that the weight is (directly/inversely) proportional to the mass. (1)

iv. If the mass is 4.5kg, and using the value from (i) to determine the value of the weight.(2)

_____

_____

End of Exam