LIMPOPO

PROVINCIAL GOVERNMENT

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF

EDUCATION

NATIONAL

SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES: PHYSICS (P1)

HALF YEARLY EXAMINATION

3RD JUNE 2014

MARKS	:	150
TIME	:	3 Hours

This question paper consists of (13) pages including this cover page, a graph sheet and a data sheet.

INSTRUCTIONS AND INFORMATION

1. Answer all questions.
2. Non-programmable calculators may be used.
3. Appropriate mathematical instruments may be used.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Be brief whenever motivations, discussions, et cetera, are required
6. Where needed, data sheets and graph papers will be provided by the school.
7. Leave ONE line between two sub-questions, for example between QUESTION 3.1 and QUESTION 3.2.
8. Show the formulae and substitutions in ALL calculations.
9. Round off your final answer to two (2) decimal places, unless otherwise stated.

QUESTION 1

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question number (1.1 – 1.10) in the ANSWER BOOK.

1.1 Which of the following pairs can be classified as vectors?

A. Friction and mass
B. Mass and inertia
C. Inertia and weight
D. Weight and friction (2)

1.2 Which one of the following represents a closed vector diagram?

A B C D

(2)

1.3 A brick slides on a rough horizontal surface. Which ONE of the following actions will increase the frictional force acting on the brick?

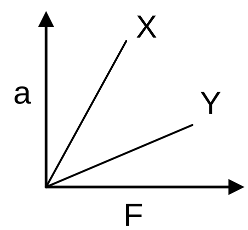
A. Decreasing the surface area of contact

B. Increasing the surface area of contact

C. Putting a second brick on it

D. Decreasing the mass of the brick (2)

1.4 The graphs below show the relationship between the net force and the acceleration for two masses X and Y.



Which one of the following statements is true?

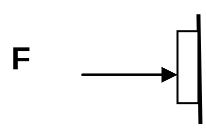
A. The bodies have equal masses.

B. Body X has a smaller mass.

C. Body Y has a smaller mass.

D. The mass does not affect the gradient of the graphs. (2)

1.5 Consider a man pressing a book against a wall with a force **F** as shown in the sketch below.



The reaction force to force **F** will be:

A. The force with which the wall presses on the book

B. The force with which the book presses on the wall

C. The force with which the book presses on the man

D. The frictional force between the book and the wall (2)

1.6 A wave passes from a medium of high optical density to one of low optical density.

Which ONE of the following is correct?

A The frequency of the wave remains constant.
B The speed of the wave remains constant.
C The frequency of the wave increases.
D The frequency of the wave decreases. (2)

1.7 An artificial satellite circles around the earth at a height where the gravitational force is a ¼ of that at the surface of the earth. If the earth's radius is R, the height of the satellite **above the surface** of the earth is

A. 2R
B. R
C. ½ R
D. ¼ R (2)

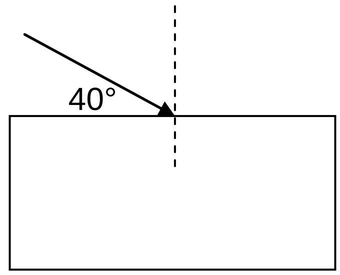
1.8 Which ONE of the following properties demonstrates the wave nature of light?

A. Light can be refracted.
B. Light travels at a speed of 3×10^8 m.s^{-1}
C. White light can be separated into a number of different colours
D. Light is diffracted after passing through a narrow slit. (2)

1.9 The ability of a wave to spread out in wave fronts as they pass through a small opening is known as

A. Refraction
B. Interference
C. Reflection
D. Diffraction (2)

1.10 A ray of light strikes a rectangular Perspex block so that the angle between the ray and the side of the block is 40° as shown in the diagram



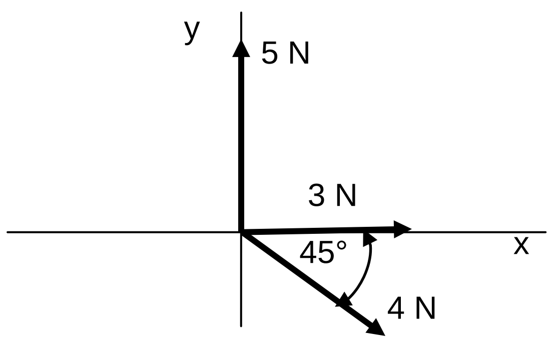
Which ONE of the statements below is correct?

A. angle of incidence is 50°
B. ray is bent towards the normal
C. ray undergoes dispersion
D. angle of refraction is 50° (2)

TOTAL **[20]**

QUESTION 2

The diagram below shows three forces of 5 N, 4 N and 3 N acting on an object in the same Cartesian plane.



Calculate the:

2.1 Magnitude of the resultant force acting on the object. (10)

2.2 Direction of the resultant force. (3)

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QUESTION 3

3.1 State Newton's first law of motion. (2)

3.2 Driving down the road in your car, you slam on the brakes suddenly. Use your knowledge of Newton's laws to explain why your body will move forward. (3)

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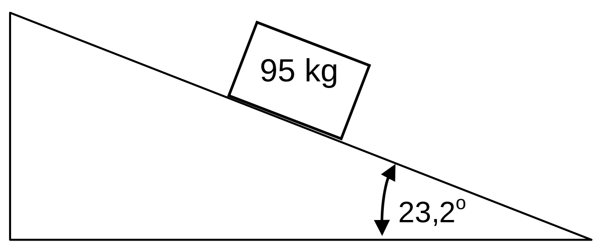
QUESTION 4

4.1 What do you understand by the term normal force? (2)

4.2 A crate of mass 95 kg crate lies on a plane inclined at $23{,}2^{o}$. At this angle the crate just begins to slip. Refer to the diagram below



4.2.1 Draw a free-body diagram of the crate. (3)

4.2.2 Define the term *static friction*. (2)

4.2.3 Calculate the magnitude of the static frictional force between the crate and the flatbed of the truck. (4)

4.2.4 Calculate the normal force (3)

4.2.5 Calculate the coefficient of static friction between the crate and the flatbed of the truck. (3)

4.2.6 The truck bed is now tilted at an angle of 20.0°. State whether the static friction force will be **LESS THAN; EQUAL TO; OR GREATER THAN** before. GIVE REASON FOR THE ANSWER. (3)

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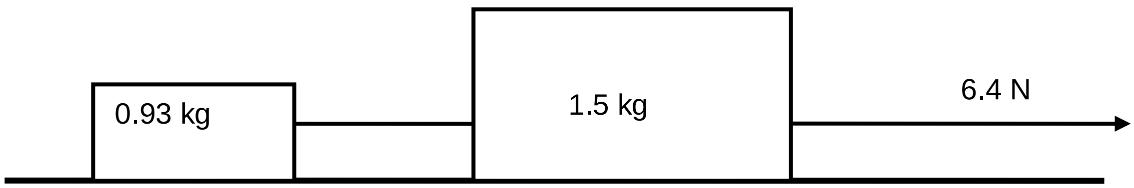
QUESTION 5

5.1 State Newton's second law of motion. (2)

5.2 A 6.4 N force pulls horizontally on a block of mass 1.5 kg. The block slides on a smooth horizontal surface. The first block is connected by a horizontal string to a second block of mass 0.93 kg on the same surface.



5.2.1 Draw a free-body diagram for each block. (7)

5.2.2 Determine the acceleration of the blocks. (7)

5.2.3 Determine the tension in the string. (3)

5.2.4 The mass of the first block is increased. State whether the tension in the string will **INCREASE, DECREASE OR STAY THE SAME.** (1)

5.3 The metal head of a hammer is loose. To tighten it, you tap the hammer down onto the floor. Should you tap the hammer **WITH THE HANDLE END DOWN** or **WITH THE HEAD END DOWN**? Explain your answer. (4)

5.4 5.4.1 What do you understand by the term "apparent weight" of an object by referring to motion in a lift. (2)

5.4.2 If you ride in an elevator moving upwards with a constant speed, is your apparent weight the **SAME AS, GREATER THAN OR LESS THAN** your weight? Explain the answer. (4)

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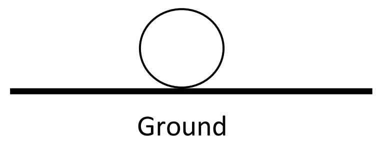
QUESTION 6

6.1 A learner bounces a soccer ball on the ground.

6.1.1 The sketch below represents the ball as it strikes the ground.



Redraw the diagram and indicate ALL the forces involved. Clearly name the forces. (4)

6.1.2 Which force causes the ball to return to the learner's hand? (1)

6.2 Differentiate between mass and weight of the object. (4)

6.2 If a mountain climber, of mass 64 kg, climbs to the top of Mount Everest, he will be about 8850 m above sea level. Assume that sea level is at the surface of the earth.

6.2.1 State Newton's law of universal gravitation. (2)

Determine the:

6.2.2 Acceleration due to gravity at this altitude (4)

6.2.3 Mountain climber's weight at this altitude (3)

6.3 It is often said that astronauts experience weightlessness because they are beyond the pull of the Earth's gravity. Is the statement true or false? Explain. (3)

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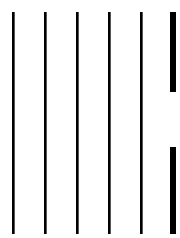
QUESTION 7

7.1 State Huygen's principle . (2)

7.2 Describe how transverse water waves with a plane wave front may be produced in a ripple tank. (2)

7.3 Explain how the wavelength of a wave could be shortened. (2)

The diagram below shows plane water waves in a ripple tank approaching a narrow gap, the size of which is approximately the same as the wavelength of the waves.



7.4 Redraw the diagram and sketch the diffraction pattern of the wave fronts emerging from the gap. (2)

7.5 Describe how the pattern of the wave fronts emerging from the gap would change if the size of the gap were significantly increased. Only state INCREASE, DECREASE OR REMAIN UNCHANGED. (2)

7.6 Explain why light seems to travel in a straight line and does not appear to be diffracted when passing through a door opening. (2)

[12]

QUESTION 8

In an experiment to verify Snell's law, a learner measured the angle of incidence *i* and the angle of refraction *r* for a ray of light entering a substance. The experiment was repeated for different values of the angle of incidence and the resulting data was recorded.

i (°)	30	40	50	55	60	65	70
Sin i	0,50	0,64	0,77	0,82	0,87	0,91	0,94
r (°)	19	26	30	33	36	38	40
Sin r	0,33	0,44	0,50	0,54	0,59	0,62	0,64

8.1 Explain why the experiment was repeated. (1)

8.2 Draw the graph of sin *i* versus sin *r* on the graph paper provided. (7)

8.3 Explain how the graph verifies Snell's law (2)

8.4 From the graph calculate the refractive index of the substance. (4)

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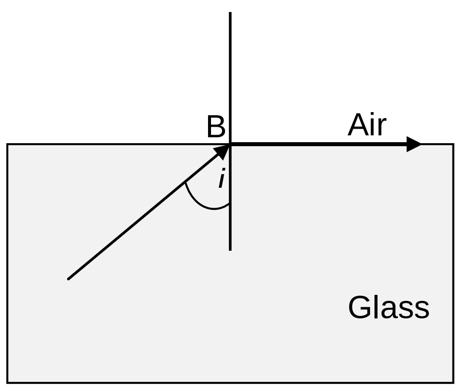
QUESTION 9

A ray of light strikes a glass-air interface and travels as shown in the diagram below.



9.1 What special name is given to the angle of incidence, *i*, when the effect shown in the diagram occurs? (1)

9.2 In the diagram the value of the angle *i* is 41.8°. Calculate a value for the refractive index of the glass. (4)

9.3 Draw a ray diagram to show what happens to the refracted ray when the angle of incidence is increased to 45° (2)

[7]

QUESTION 10

Optical fibres are generally composed of silica, with an index of refraction of 1.44. The outer layer has a low index of refraction.

10.1 Why is the outer layer optically less dense than the inner layer? (2)

10.2 Name two uses of optical fibres. (2)

10.3 Give two reasons why telecommunications industry uses optical fibres instead of copper conductors to transmit signals. (2)

10.4 Calculate how fast light travels in a silica fibre. (3)

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GRAND TOTAL **[150]**

QUESTION 8.2 GRAPH PAPER GRADE 11

Name of Learner: ______________________________

Name of School: ______________________________

DATA FOR PHYSICAL SCIENCES P1 GRADE 11

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum	c	3,0 x 10^{8} $m \cdot s^{-1}$
Gravitational constant	G	6,67 x 10^{-11} $N \cdot m^{2} \cdot kg^{-2}$
Mass of Earth	M_{Earth}	5.98 × 10^{24} kg
Radius of Earth	R_{Earth}	6.38 × 10^{6} m

TABLE 2: FORMULAE

MECHANICS

$F_{net} = ma$	$F_g = mg$
$F = \frac{GMm}{R^2}$	$g = \frac{GM}{R^2}$

WAVES, LIGHT AND SOUND

$v = f\lambda$	$\sin\theta = \frac{m\lambda}{a}$
$c = nv$	$n_i \sin\theta_i = n_r \sin\theta_r$