UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF APPLIED PHYSICS AND ENGINEERING MATHEMATICS

NATIONAL DIPLOMA IN: BIOMEDICAL TECHNOLOGY

MODULE: PHY1AET
PHYSICS 1B

CAMPUS **DFC**

JULY EXAMINATION

DATE: JULY 2016

ASSESSOR(S)	**DR P L MASITENG**
INTERNAL MODERATOR	**DR S RAMAILA**
DURATION 3 HOURS	**MARKS 109**

NUMBER OF PAGES: 11 PAGES, INCLUDING 2 INFORMATION SHEETS

INSTRUCTIONS: CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT)

REQUIREMENTS: 1 MULTIPLE CHOICE ANSWER SHEET.

INSTRUCTIONS TO CANDIDATES

1. **THIS QUESTION PAPER CONSISTS OF 2 SECTIONS.**
   ANSWER SECTION A ON THE OPTICAL ANSWER SHEET PROVIDED.
   FOLLOW THE INTRUCTIONS ON THE ANSWER SHEET CAREFULLY.
   IF YOU MAKE A MISTAKE PLEASE REQUEST A NEW ANSWER SHEET.
   DO NOT MARK MORE THAN ONE ANSWER. PLACE THE ANSWER SHEET IN THE ANSWER BOOK. DO NOT FOLD OR CREASE THE ANSWER SHEET IN ANY WAY!
2. **ANSWER SECTION B IN THE ANSWER BOOK PROVIDED.**
3. **AN INFORMATION SHEET IS ATTACHED**
4. **ANSWER ALL THE QUESTIONS.**

SECTION A –MULTIPLE CHOICE

QUESTION 1

1. The ratio $\frac{\text{sin (angle of incidence)}}{\text{sin (angle of refraction)}}$ is known as:

   A. the definition of relative refractive index
   B. the constant in Snell's law
   C. the definition of absolute refractive index
   D. refraction.

2. Magnification is defined as:

   A. $\frac{\text{Image distance}}{\text{Object distance}}$

   B. $\frac{\text{Object size}}{\text{Image size}}$

   C. $\frac{\text{Image size}}{\text{Object size}}$

   D. the number of times that the object is magnified

3. An object is placed 16 cm from a concave mirror of focal length 12 cm. The distance between the object and the image is:

   A. 8 cm
   B. 10 cm
   C. 12 cm
   D. 16 cm

4. For diffuse reflection:

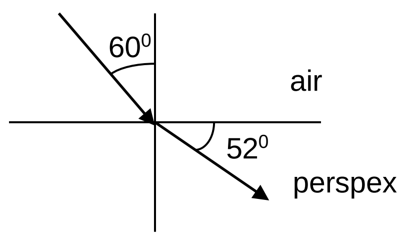
A. the angle of incidence equals the angle of reflection
B. the rays of the reflected beam are not parallel
C. the incident ray, the normal at the point of incidence and the reflected ray all lie in the same plane
D. all of the above.

5. An object, 7 mm high, is held 10 cm from a magnifying glass. The image appears to be 14 mm high. The focal length of the lens is:

A. 20 cm
B. 6.7 cm
C. -10 cm
D. 3.3 cm

6. The diagram shows a light ray travelling from air into Perspex. The refractive index of Perspex is:

A. 0.7
B. 0.6
C. 1.4
D. 1.1



7. Whenever the angle of incidence exceeds the critical angle

A. no refraction occurs
B. no reflection occurs
C. the angle of refraction equals 90^0
D. the angle of refraction exceeds 90^0

8. An object is placed 30 cm in front of a concave lens. The image is formed 6 cm from the lens. The focal length of the lens is:

A. 5 cm
B. 4.3 cm
C. – 24 cm
D. – 7.5 cm

9. The newton is defined as a force that will:

A. accelerate a 1 kg mass by 1 m s^{-2} in the direction of that force
B. change the velocity of a body by 1 m s^{-1}
C. change the magnitude of the velocity of the body
D. cause an acceleration of 1 m s^{-2} to a body.

10. Potential energy is defined as a body's:

    A. ability to do work because of its virtue of motion
    B. ability to do work by virtue of its motion
    C. ability to do work by virtue of its position
    D. mass times gravity times height.

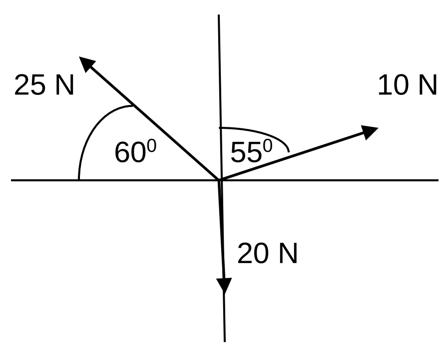
11. Average velocity is defined as:

    A. the total displacement per total time taken
    B. the rate at which displacement takes place
    C. the rate of distance travelled
    D. the average displacement per average time taken

12. When the velocity of a car is doubled, its:

    A. kinetic energy is doubled
    B. inertia is doubled
    C. acceleration is doubled
    D. momentum is doubled.

Questions 13 to 16 refer to the sketch which shows 3 forces acting on a body:



13. The resultant X component, R_x,is:

    A. – 6.8 N
    B. 13.2 N
    C. – 4.3 N
    D. 15.7 N.

14. The resultant y-component, R_y, is:

    A. 7.4 N
    B. 29.8 N
    C. 9.8 N
    D. 27.4 N.

15. The magnitude of the resultant is:

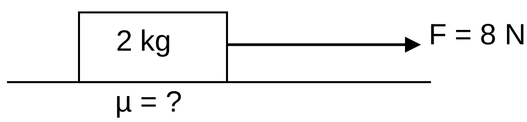
A. 8.6 N
B. 11.9 N
C. 3.1 N
D. 16.4 N.

16. The direction of the resultant is:

A. 59.8^0 N of W
B. 77.1^0 N of W
C. 36.6^0 N of E
D. 61.5 N of E.

17. A 2 kg mass accelerates by 2 m s^{-2} in the direction of the force as shown. The coefficient of friction between the body and the surface is:

A. 0.1
B. 0.2
C. 0.3
D. 0.4.



18. An object of mass 2 kg having a velocity of 0.5 m s^{-1} collides with a stationary object of mass 6 kg and sticks to it. The velocity of both objects immediately after impact is:

A. 0.5 m s^{-1}
B. 0.334 m s^{-1}
C. 0.125 m s^{-1}
D. 0.667 m s^{-1}

19. A boat travelling at 12 km h^{-1} in a direction due north is driven off course by an ocean current of 5 km h^{-1} in an easterly direction. How many kilometres will the boat cover in 2 hours?

A. 26 km
B. 13 km
C. 24 km
D. 10 km

20. A body of mass 2 kg is projected vertically upwards from the top of a tower 50 m high with a velocity of 20 m s^{-1}. The total energy of the body at maximum height is:

A. 400 J
B. 580 J
C. 980 J
D. 1 380 J

6\...

21. A pressure exerted by a column of liquid of relative density 1.6 is 4. 704 kPa. The height of this column of liquid is:

A. 300 m
B. 0.3 m
C. 3×10^{-4} m
D. 3 m

22. The total pressure under 50 cm of mercury (RD = 13.6) at standard air pressure measures:

A. 66.64 kPa
B. 6 765.8 kPa
C. 167.94 kPa
D. 6 664 kPa

23. 20 m^3 of helium gas at 100 kPa pressure is available to fill balloons of 5 m^3 capacity each. How many balloons can be filled at 80 kPa pressure if the temperature remains constant?

A. 25
B. 5
C. 4
D. 16

24. A body of weight 12 N floats in oil of relative density 0.8. The mass of oil displaced is:

A. 15 kg
B. 9.6 kg
C. 122 kg
D. 1.22 kg

25. A stone having a volume of 3×10^{-4} m^3 weighs 8 N in air. Its weight in water is:

A. 2.94 N
B. 7.99 N
C. 5.06 N
D. 0 N

26. The SI unit of heat capacity is:

A. J kg^{-1} $^0C^{-1}$
B. J kg^{-1}
C. J
D. J $^0C^{-1}$

27. Approximately 0.2 kg of a substance having a heat capacity of 500 J K^{-1} is heated by 100 ^{0}C. The amount of heat absorbed by the substance is:

A. 1 kJ
B. 50 kJ
C. 1 MJ
D. 10 kJ

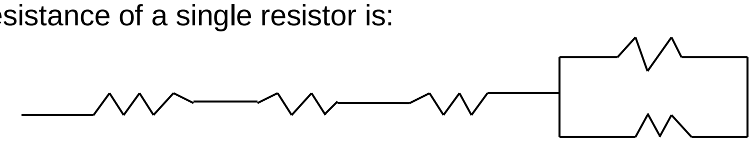
28. The volt can be expressed as:

A. J s^{-1}
B. C s^{-1}
C. J C^{-1}
D. W C^{-1}

29. A current of 2 A flows for 1 minute under the influence of a 20 V potential difference. The work done in moving the charge is:

A. 2 400 J
B. 40 J
C. 24 J
D. 3500 J

30. Five identical resistors are connected as shown, resulting in a total effective resistance of 14 Ω. The resistance of a single resistor is:



A. 2.8 Ω
B. 2 Ω
C. 4 Ω
D. 3 Ω

31. A fridge has to absorb 20 k J of heat in the process of cooling a certain mass of water from 65 ^{0}C to 10 ^{0}C. The mass of the water is:

A. 86.6 g
B. 8.8 g
C. 59.7 g
D. 4.76 g

32. A voltmeter:

A. measures the internal resistance of a cell
B. measures electric potential difference between two points
C. compares resistances
D. measures electrostatic charge

33. Which one of the following does not influence the resistance of a conductor?.

A. its thickness
B. its length
C. the potential difference across it
D. the type of material it is made of

Total Section A: 2 x 33 = 66

SECTION B

QUESTION 1

1.1. Define the focus of:

1.1.1 a convex lens
1.1.2 a convex mirror

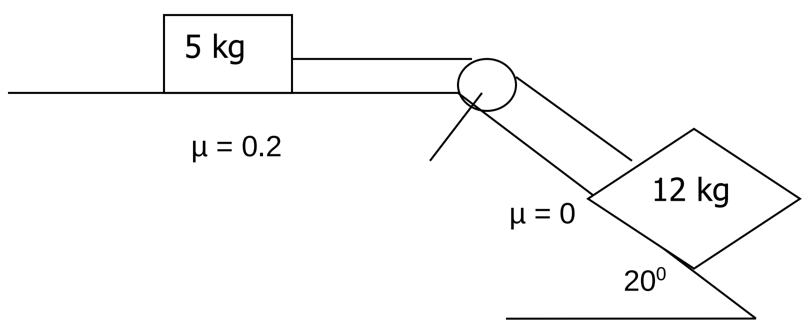
(5)

1.2.
1.2.1. Draw a ray diagram to show image formation by a concave lens.
1.2.2. Describe the image. (5)

[10]

QUESTION 2

2.1. For the system shown below, calculate:



2.1.1 the acceleration
2.1.2 the tension in the string connecting the bodies. (7)

[11]

QUESTION 3

3.1 A lead block has dimensions of 2 cm x 3 cm x 4 cm. The density of lead is 11.3×10^3 kg m^{-3}.

Calculate:

3.1.1. the weight of the lead block (2)
3.1.2. the pressure exerted by the weight if the block lies on its 2 cm x 3 cm side. (2)

3.2. A metal ball weighs 3.9 N in air. It is suspended from a rope and then lowered into a liquid of relative density 0.84. If the relative density of the metal is 7.8 ,what is the tension in the rope when the ball is immersed in the liquid. (6)

[10]

QUESTION 4

4.1. Define the coefficient of linear expansion. (2)

4.2. A copper rod is 2.5 m long at 15 ^{0}C. Calculate its length when heated to 35 ^{0}C. The linear expansivity of copper is 1.7×10^{-5} ^{0}C^{-1}. (3)

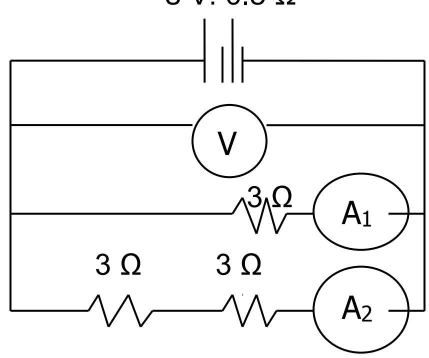
4.3. Calculate how much energy is required to heat 5 g of pyrex glass from 15 ^{0}C to 65 ^{0}C. The specific heat capacity of pyrex is 837 J kg^{-1} ^{0}C^{-1}.

(3)

[7]

QUESTION 5

5.1. For the circuit shown below, calculate:



5.1.1. The reading on the voltmeter. (7)
5.2.2. The ammeter readings A_1 and A_2. (2)

[9]

Total Section B: 47

Grand total: 109