SECTION A [50 MARKS]

ANSWER **ALL** QUESTIONS

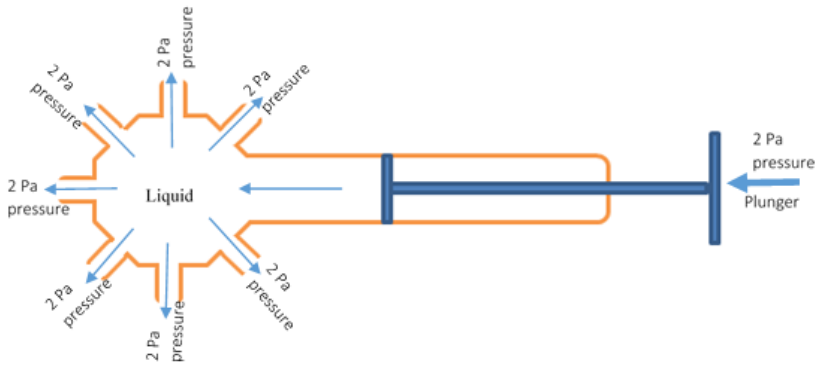
Question 1

a) **Directions: For each question, there are four alternatives A, B, C and D. Choose the correct alternative and circle it. Do not circle more than ONE alternative. If there are more than one circled, NO score will be awarded.** **[25]**

i. Force that balances the resultant force is called

A resultant force.
B frictional force.
C equilibrant force.
D gravitational force.

ii. The figure shows a cylinder with a piston connected to a container containing a liquid. When a pressure is exerted on the liquid by a plunger, the pressure is passed on equally throughout the liquid. This statement best describes



A Newton's laws.
B Archimedes' principle.
C Pascal's law.
D Ohm's law.

iii. When Wangdue Phodrang Dzong caught on fire, a fire brigade pumped water to a certain height to put off the fire. Which of the following relations describes the efficiency of the fire brigade?

A $\eta = 1$
B $\eta < 1$
C $\eta \geq 1$
D $\eta > 1$

iv. Specific resistance of the conductor is measured in

A ohm-metre.
B ampere.
C volt.
D ohm.

v. The regions of spectrum beyond red and violet are called

A electromagnetic spectrum.
B VIBGYOR.
C visible spectrums.
D invisible spectrums.

vi. The force of gravitation between the two bodies in the Universe does not depend on the

A distance between them.
B product of their masses.
C gravitational constant.
D sum of the masses.

vii. Which state of equilibrium is reached by a body when its centre of gravity is at its lowest position?

A stable equilibrium
B unstable equilibrium
C neutral equilibrium
D neither gains nor loses stability

viii. There are two pistons 'X' and 'Y' fitted to vessels in a hydraulic system. Piston 'X' is at the application of effort and piston 'Y' at the force gained. The area of

A pistons 'X' and piston 'Y' are equal.
B piston 'X' is greater than piston 'Y'.
C piston 'X' is smaller than piston 'Y'.
D pistons 'X' and piston 'Y' do not affect the system.

ix. Which of the following is an example of renewable source of energy?

A coal
B wind
C petrol
D nuclear energy

x. According to Fleming's right hand rule, if the thumb, fore finger and the middle finger of right hand are stretched perpendicular to each other, the thumb indicates the direction of

A motion of a conductor.
B induced current.
C magnetic field.
D current.

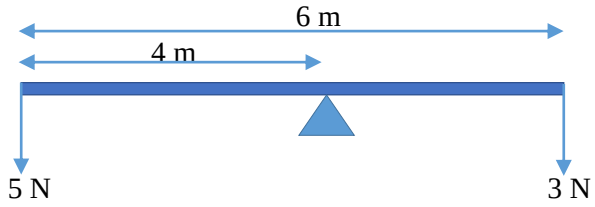
xi. Which of the following is **'TRUE'** about electromagnetic spectrum?

A Gamma rays have lower frequencies than microwaves.
B Infrared rays have lower frequencies than radio waves.
C X-rays have higher frequencies than microwaves.
D UV rays have higher frequencies than gamma rays.

xii. The sun has a huge mass, thus it exerts a very powerful gravitational pull on the earth and the other planets in the solar system. This pulling force keeps the planets in

A an elliptical orbit around the sun.
B a tangential orbit around the sun.
C a circular orbit around the sun.
D a spiral orbit around the sun.

xiii. The clockwise moment of the figure given below is



A 6 Nm.
B 18 Nm.
C 20 Nm.
D 30 Nm.

xiv. What will happen to the kinetic energy, if the mass of an object is doubled?

A Kinetic energy will be zero.
B Kinetic energy will be doubled.
C Kinetic energy will be minimized.
D Kinetic energy will remain unchanged.

xv. A 240 V room heater draws a current of 0.12 A. How much resistance does it offer?

A 5000 Ω
B 4000 Ω
C 3000 Ω
D 2000 Ω

xvi. What rays are used to scan the luggage in an airport?

A X-rays
B Infrared rays
C Gamma rays
D Ultraviolet rays

xvii. What position and force should be applied to open a heavy door easily?

A from the top
B at the Centre
C near the doors hinge
D at the edge of the door

xviii. Study the figure given below and choose the correct statements from the following.

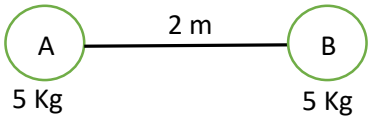


figure A

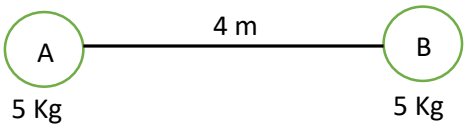


figure B

A The gravitational force of attraction is greater in figure A.
B The gravitational force of attraction is greater in figure B.
C The gravitational force of attraction is minimum in figure A.
D The gravitational force of attraction is same in both the figures.

xix. The five star energy rating labelled refrigerators are considered more energy efficient than three star energy rating labelled refrigerator because they

A functions through 24hrs.
B are available in abundance.
C consumes less energy.
D are more durable.

xx. The factors on which the resistance of a conductor depends are

I. temperature of the conductor
II. pressure of the conductor
III. length of the conductor
IV. mass of the conductor.

A I and III.
B I and II.
C II and IV.
D II and III

xxi. When massive stars collapse under their own gravity, they cause explosions. All are true to the above statement **EXCEPT**

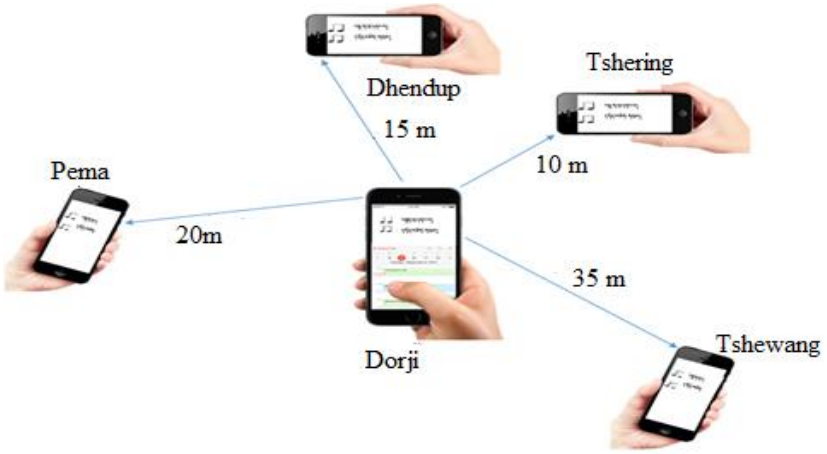
A the explosions lead to protoplanets.
B the explosion caused are called supernovae.
C a whole galaxy outshine for several weeks or months.
D the light produced from the explosions can outshine a whole galaxy.

xxii. The work done to stop a car of mass 50 kg moving with velocity 20 ms^{-1} is

A 20,000 J.
B 10,000 J.
C 1,000 J.
D 100 J.

xxiii. One joule of work is said to be done when a force of

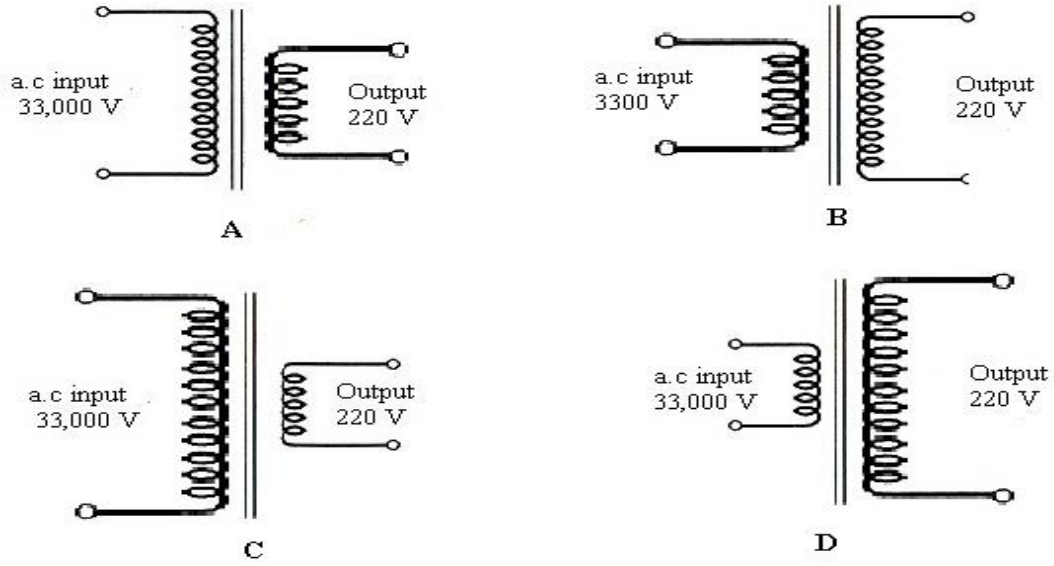
A 1 dyne displaces a body by 1 cm.
B 1 N displaces a body by 1 m.
C 1 N displaces a body by 1 cm.
D 1 dyne displaces a body by 1 m.



xxiv. In the figure above Dorji is trying to transfer some Dzongkha songs using 'Bluetooth' to his four friends. Who will receive the songs?

A Dhendup
B Tshewang
C Tshering
D Pema

xxv. Bhutan Power Corporation (BPC) is in the process of transmitting power supply to one of the residential areas from a sub-station of 33,000 V a.c. Which of the following transformers would you advise BPC to use so that the supplied voltage becomes 220 V a.c?



b) Match each item under Column A with the item in Column B. Rewrite the correct pairs by writing the alphabet against the number in the space provide. **[5]**

	Column A		**Column B**
i.	force in equilibrium	a.	magnitude of force
ii.	Amount of work done	b.	buoyant force
iii.	Hot air balloons	c.	big crunch
iv.	Air traffic controller	d.	visible light
v.	Origin of solar system	e.	microwaves
		f.	statics
		g.	nebula theory

i.	
ii.	
iii.	
iv.	
v.	

c) Fill in the blanks by writing suitable words. [5]

i.	Opening a lock with a key constitutes _____ action.	
ii.	An iron ball and aluminum ball experience same buoyant force when dipped in water if both have equal _____.	
iii.	The pressure exerted by a lady of weight 45 kg, wearing a circular heel of area $0.025m^2$ is _____.	
iv.	Voltage can be either increased or decreased by using transformers in the case of _____ current.	
v.	The signals through _____ cables do not weaken the signals as compared to copper cables.	

d) Correct the following statement by changing the underlined word(s) ONLY. Re-write the correct word(s) only. DO NOT copy the whole sentence. [5]

i. Both <u>kinetic energy and potential energy</u> are possessed by a simple pendulum, when it is at the mean position.

ii. Voltage drop due to resistance in a circuit is also called as <u>terminal</u> voltage.

iii. Unwanted signals can be easily removed from an <u>analogue</u> signal.

iv. The light from the galaxies throughout the universe are almost all <u>blue shifted.</u>

v. The most important factor in determining the air drag force is the <u>density of the air.</u>

i.	
ii.	
iii.	
iv.	
v.	

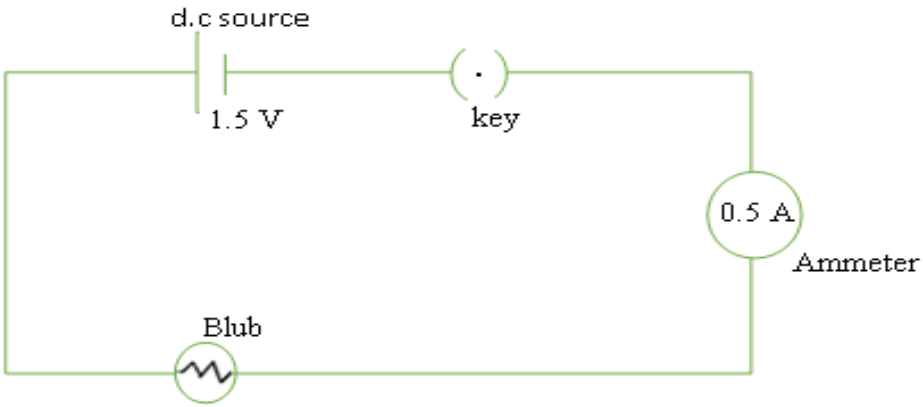
e) Answer the following questions. **[2]**

i. An object under a free fall hits the ground after 5 seconds. Circle **"Yes"** or **"No"** for each question.

Does an object have kinetic energy and potential energy at the same time?	YES / NO	
Will air resistance affect the object's motion?	YES / NO	
Object accelerates in the downward direction with 9.8 m/s	YES / NO	
Is the energy of a free falling object conserved?	YES / NO	

ii. Write down **TWO** features of modern cars which improve the energy efficiency. [1]

iii. Study the diagram and answer the following question. [2]

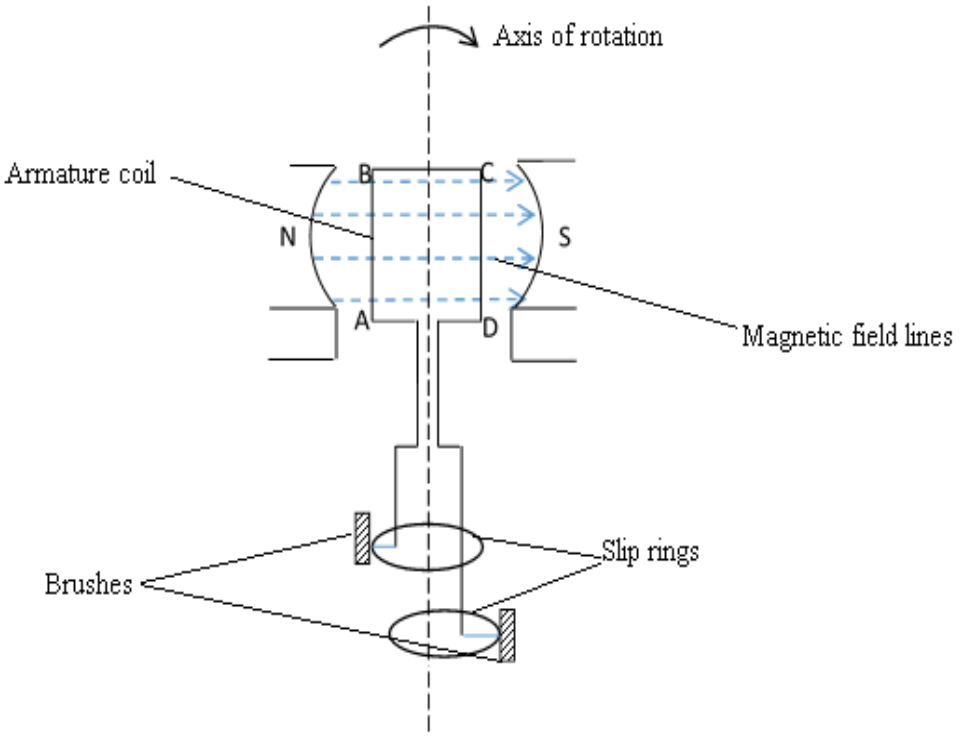


Calculate the resistance offered by the bulb.

iv. How do scientists confirm the existence of life on the alien worlds? [2]

v. Why do the astronomers look into the past when they observe the distant objects in the sky? [1]

vi. Name the device and state the conversion of energy illustrated by the device shown below. [2]



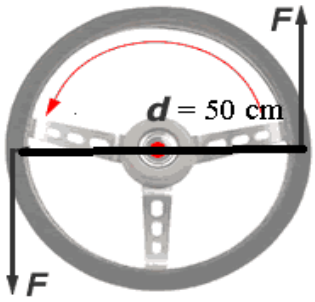
SECTION B [50 Marks]

*ATTEMPT ANY **FIVE** QUESTIONS*

Question 2

a) List **TWO** ways to increase the stability of a body. [2]

b) The figure below shows a driver rotating a steering wheel producing a torque of 300 Nm. What magnitude of force is required to produce this torque? [2]



c) Study the given table below to answer the following questions:

Object	Surface area	Thrust
1	$4\,m^2$	$60\,N$
2	$10\,m^2$	$50\,N$
3	$30\,m^2$	$70\,N$

i. Identify the object that would experience the maximum pressure. [1]

ii. Which of the three objects would double its pressure if the surface area is decreased by 2 m²? Show your work clearly. [2]

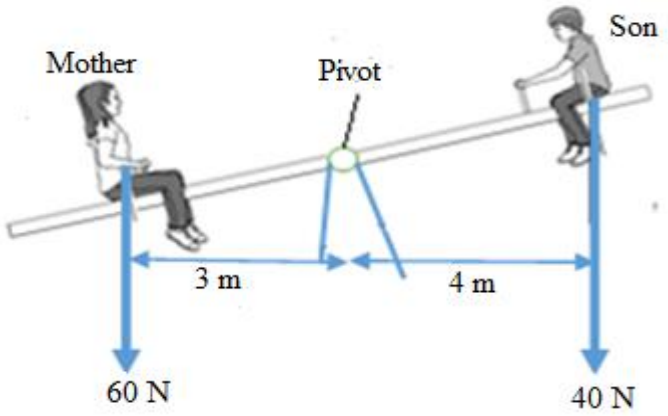
d)

i. What is the work done, if force and displacement are in the same direction? [1]

ii. Write down **any TWO** conditions in which work done is said to be zero. Give an example each. [2]

Question 3

a) In the figure below, a mother with a weight of 60 N is seated on the left side of a see-saw which is 3 m away from the pivot and her son with a weight of 40 N is seated at a distance of 4m on the right. Where should the sister of 10 N be seated to balance the see-saw? [2]



b) Draw a sketch of how a voltage current graph changes for a filament lamp. Explain whether it obeys Ohm's law. [2]

c) Name **TWO** effects of a force applied to a non-rigid body. Give **ONE** example each. [2]

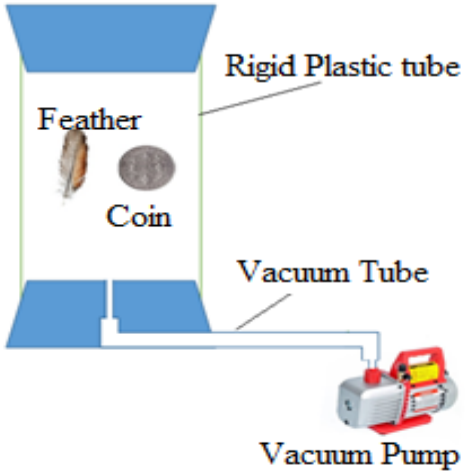
d) *Bhutan is a mountainous country with many high current rivers with potentials of generating electricity. It has taken the advantage of harnessing water resources by constructing many hydro power plants.*

In the light of the above statement, are we mindful of the sustainable use of our water resources? Justify with **TWO** major reasons. [2]

e) Is it easier to swim in a sea water than in a river water? Give reasons. [2]

Question 4

a) In an experimental setup below, a coin and a feather of roughly same surface area are made to fall in a plastic tube. It was observed that the feather falls much more slowly than the coin. Next, air is pumped out of the tube using a vacuum pump. Now it is observed that the feather falls much more rapidly almost as fast as the coin.



[2]

Why do you think the a feather does not fall in the same manner in the two experiments?

b) A ball with a mass of 3.0 kg is lifted to a height of 5m above the ground. The ball is then allowed to fall to the ground. Disregard any friction force while answering these questions. [2]

i. Calculate the ***potential energy*** of the ball when raised to 5m above the ground.

ii. How much ***kinetic energy*** does the ball have when held 5m above the ground?

i.	
ii.	

c) Electrical appliances are marked with a rating in watts (W) and volts (V). For example an electric bulb is marked 100W- 220V. [1]

i. What information does it represent?

ii. What amount of current is required for the electric bulb to work? [2]

d)

i. Compare the radio waves and the micro waves in terms of their wavelengths. [1]

ii. A student carried out an experiment on sound waves and concluded that within a certain range, we can hear or talk to each other even if we don't see each other. Why? Give **TWO** reasons. [2]

Question 5

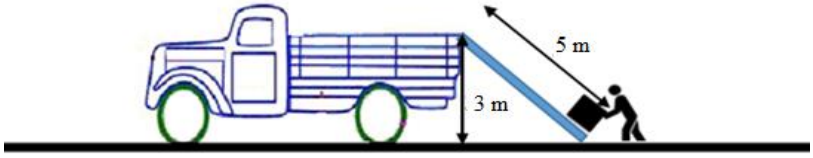
a) *Energy efficiency and renewable energy are said to be the twin pillars of sustainable energy policy.* Mention any **TWO** consequences of not using energy efficiently and economically. [2]

b) The figure below represents conducting wires of the same material but of different lengths with equal diameter. Assume the thickness of the wires are the same.

Which conducting wire experiences maximum voltage drop for the same magnitude of current? Give reasons to support your answer. [2]

c) Name and state Newton's summarized ideas about gravity. [2]

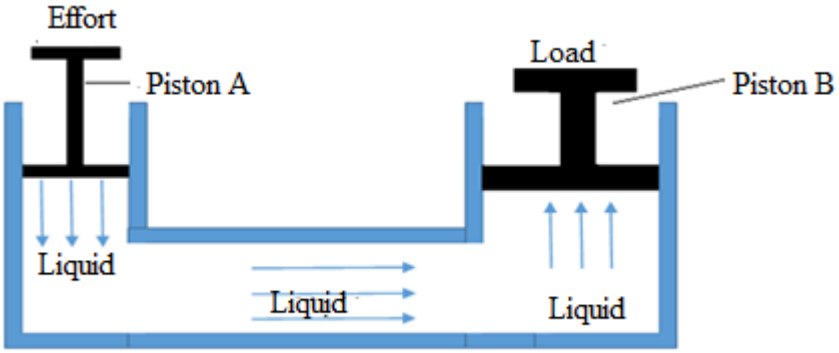
d) In the figure below, a labourer is loading a truck with a box weighing 350 kg. If there are 10 boxes of equal mass, what would be the total amount of work done by a labourer after loading all the boxes into the truck? [2]



e) Explain how the earth is different from the other planets in terms of providing sustenance to life forms. [2]

Question 6

a) The given figure below shows a simple construction of a hydraulic machine. [2]
Is it possible to develop more pressure at piston 'A' than in piston 'B'? Why?



b) Write **TWO** ways by which the magnitude of current induced in a circuit can be changed. [2]

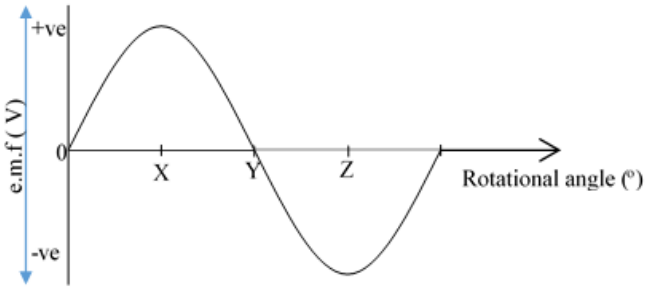
c) A transformer has 8 windings in its primary core and 5 in its secondary coil. If the primary voltage is 0.24 kV, find the secondary voltage in volts. [2]

d) Distinguish between the analogue signal and the digital signal based on the graphical representation and bandwidth. [2]

e) What are the units of the universe and galaxy? [2]

Question 7

a) The figure below shows the change in induced alternating voltage. Write the values of rotational angle at points 'X' and 'Y'. How does the speed of rotation of the armature and strength of magnetic field change the voltage of alternating current? [1]



b) Radio waves, microwaves, infra-red and visible lights are all parts of the electromagnetic waves that are used for communication. State **ONE** property that is common to all. [1]

c) Study the given table carefully and fill in the boxes **1, 2, 3** and **4.** [2]

Waves	**Wavelength**	**Uses**	**Effect**	
1.	10^{-4} m to 7.8×10^{-7} m	2.	They cause cataracts, corneal ulcers and retinal burns.	
3.	3.8×10^{-7} m to 1.0×10^{-4} m	Produce vitamin D in our body.	4.	

d) The earth has a mass of 6×10^{24} kg and that of the moon is 7×10^{22} kg are separated by a distance 2×10^{8} m. Calculate the gravitational force of attraction between them. [2]
[$G = 1.67 \times 10^{-11}$ Nm^2kg^{-2}.]

e)

i. Scientists believe that our universe is expanding continuously. How do they know this? [2]

ii. What is the cause of the change of composition of the Earth's atmosphere, oceans and the ways how rocks weather in time? [1]
