PART A — Structured Essay

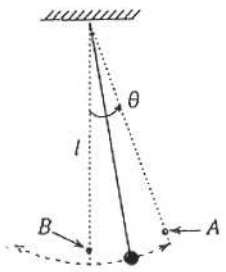
Answer all four questions on this paper itself.

(g = 10 N kg^{-1})

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1. A student plans to find the acceleration due to gravity in the laboratory using a simple pendulum.

(*a*) (i) Write down an expression for the period of oscillations T of the simple pendulum in terms of the length l of the pendulum and the acceleration due to gravity g.



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(ii) Rearrange the above expression in the most suitable manner in order to obtain a value for g by plotting a graph.

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(iii) When taking readings for T, the student keeps a reference pin directed at the point B as shown in the above diagram. State why the directing of this pin at B gives a better accuracy for the time measurement than directing it at A.

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(*b*) (i) When the student measured the time for only one oscillation, his reading was 2.0 s. If the instrumental error in the time measurement is 0.1 s, determine the percentage error of the value of the period of oscillations.

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(ii) Instead of measuring the time for one oscillation he measured the time for 25 oscillations, and the value obtained was 50.2 s. Determine the percentage error of the value of the time measurement. (Give your answer to the nearest first decimal place.)

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(*c*) The student used a uniform metal sphere of radius r as the pendulum bob. The length L he used as the length of the pendulum is shown in the diagram. After plotting the T^2 *versus* L graph he found that the gradient was 4.0 s^2 m^{-1} and the intercept was 0.04 s^2.



(i) Rewrite the expression in part (*a*) (ii) in terms of L, r and g.

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(ii) Determine g. (Take π as 3.1)

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(iii) Determine the radius r of the sphere.

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(*d*) The student observed that the amplitude of oscillations gradually decreases with time and the bob finally comes to rest due to air drag. He repeated the above experiment with a wooden sphere of the same radius. Which bob would take less time to come to rest? Give reasons for your answer.

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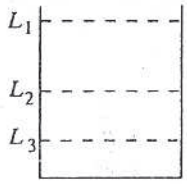
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2. A student wants to determine the specific heat capacity of a liquid using the method of cooling. For this he plans to obtain cooling curves for water and the liquid separately. All necessary equipment for the experiment have been provided.

(*a*) In this experiment it is important to use **equal volumes of water and liquid**. Give the reason for this.

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(*b*) Figure shows three different levels marked on the calorimeter.



(i) Of these three levels, up to which level the student should fill water/liquid to obtain a more accurate result in this experiment.

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(ii) Give the reason for your answer in (*b*) (i) above.

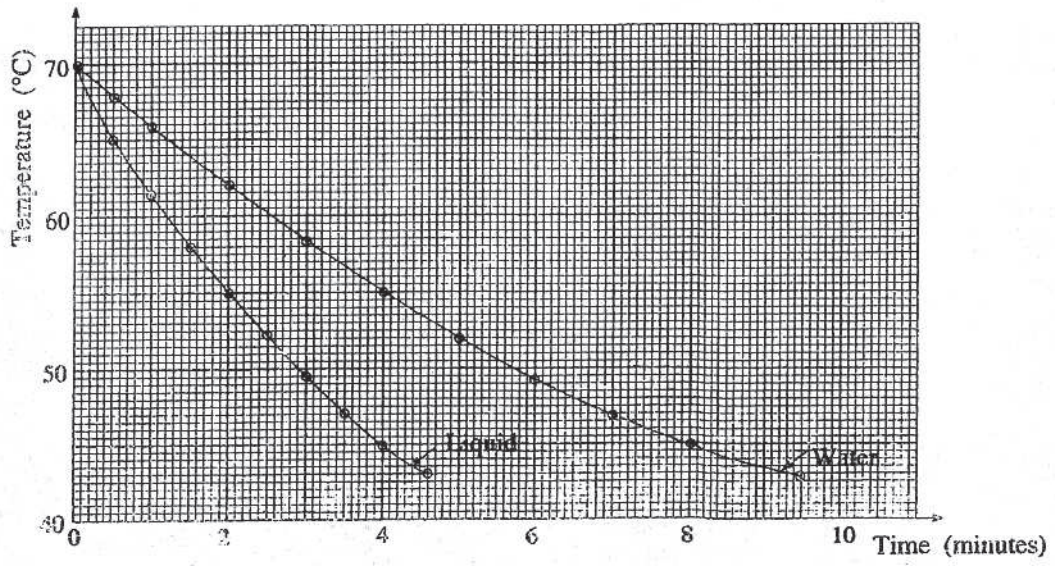
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(*c*) What experimental step should the student follow in order to make sure that the thermometer immersed in water or liquid reads the temperature of the calorimeter surface?

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(*d*) The two cooling curves obtained by the student are shown in the figure.



Other data of the experiment are also given below.

Heat capacity of the calorimeter and the stirrer	= 112 JK^{-1}
Mass of water	= 0.2 kg
Specific heat capacity of water	= 4×10^3 Jkg^{-1} K^{-1}
Mass of the liquid	= 0.172 kg

(i) What is the average rate of heat loss of the calorimeter with water during the cooling from 55 °C to 45 °C?

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(ii) Calculate the specific heat capacity of the liquid.

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(*e*) Why is it **not** suitable to use a glass container in place of the calorimeter in this experiment?

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3. A spectrometer, sodium lamp/flame and a glass prism are provided to determine the refractive index (n) of glass for light emitted from sodium. Certain adjustments in the spectrometer have to be made before taking measurements.

(*a*) **Two parts** of the spectrometer can be rotated about the vertical axis through the centre of the spectrometer independently of the other parts. List the **two** parts.

(1) .....

(2) .....

(*b*) Telescope of the spectrometer has been adjusted for parallel light by focusing to a distant object. As observed by a student through the telescope, is the image of the object erect or inverted?

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(*c*) In this experiment, the eyepiece, the telescope and the collimator have been adjusted for parallel light by one student. A second student whose near point is different from that of the first student is to continue the experiment. What is the only adjustment the second student has to repeat?

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(*d*) The prism PQR shown in figure (a) is given to level the prism table. Draw on figure (b) how you would place the prism on the prism table. Label P, Q and R. (D, E and F are the three screws available to level the prism table.)

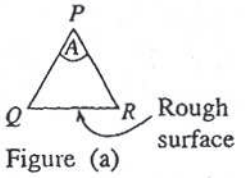


Figure (a)

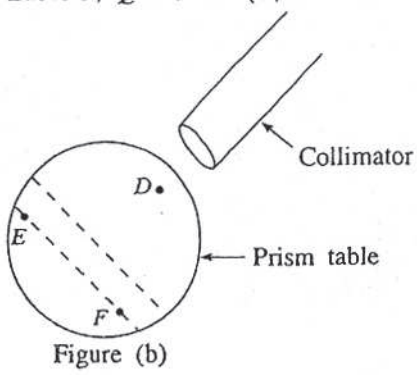


Figure (b)

(*e*) Fig. (c) shows the cross-wires (broken lines) and the image of the slit (solid line) formed by the reflected light from one surface of the prism as seen through the telescope. It indicates two errors associated with the set-up. Identify them.

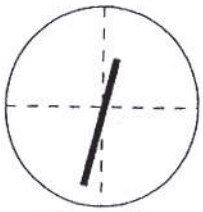


Figure (c)

(1) .....

(2) .....

(*f*) In this experiment, two measurements have to be taken to determine the angle of prism *A*.

(i) Draw on figure (d) the correct location of the prism, and the two positions of the telescope in order to obtain the two measurements.

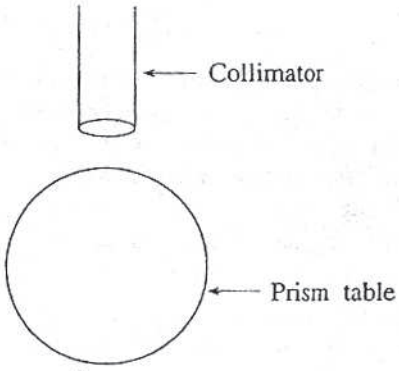


Figure (d)

(ii) Scale readings for the two measurements are 197° 6′ and 72° 52′. The scale did not pass through 360° mark when taking the measurements. Calculate the angle of prism.

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(*g*) One student argues that a source of white light can be used instead of a sodium lamp in taking measurements for the determination of the angle of minimum deviation for the wavelength of sodium light. Is this correct? Give reasons.

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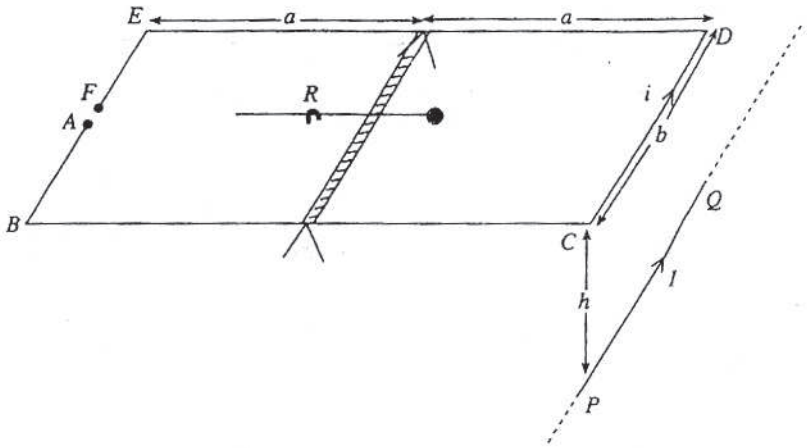
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(*h*) If the angle of prism is *A* and the angle of minimum deviation for sodium light is *D*, write down an expression for the refractive index *n*.

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4.



The figure shows a set-up of a current balance made of a rigid rectangular wire frame *ABCDEF* made in such a way that the ends of the wire *A* and *F* are not in contact with each other. A light strip of insulating material which carries a rider arrangement is fixed to the wire frame at the middle as shown in the figure. The set-up is **first balanced horizontally** on two knife-edges by adjusting the position of the rider *R*. The knife-edges are in contact with the wire frame so that a current can be passed through the frame by connecting an external current source to the knife-edges.

As shown in the figure a long straight wire *PQ* carrying a current *I* is now placed parallel to the wire segment *CD* at a distance *h* vertically below it.

Neglect the earth's magnetic field in answering the following questions.

(*a*) Write down an expression for the magnetic flux density *B* at a point on *CD*, due to the current *I* through *PQ*.

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(*b*) A current *i* is now made to flow through the wire frame in the direction shown in the diagram. Obtain an expression for the magnitude of the force *F* acting on *CD* due to *B* above, once the wire frame is **rebalanced horizontally** by adjusting rider *R*.

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(*c*) On the diagram, indicate with an arrow, the direction along which the rider *R* has to be moved from its initial position, in order to rebalance the wire frame in part (*b*) above.

Briefly explain why you need to move the rider in the direction indicated in order to rebalance the wire frame.

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(*d*) In part (*b*) above, if the rider had to be moved by a distance Δx from its initial position to rebalance the wire frame, obtain an expression for *I* in terms of *m*, *i*, *h*, *a*, *b*, Δx, μ_0 and *g*, where *m* is the mass of the rider.

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(*e*) This set-up can be used for measuring an unknown current I passing through PQ, by connecting PQ and the wire frame in series. Rewrite your expression in part (*d*) above for this situation.

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(*f*) The set-up in part (*e*) above can be used to check the calibration of an ammeter.

(i) How would you connect the ammeter to the set-up?

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(ii) Briefly state the calibration procedure.

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(*g*) The sensitivity of the current measurement carried out with the set-up mentioned in part (*e*) above can be increased by changing the magnitudes of h, m, a and b. By placing a ✓ in the appropriate column, indicate how you would increase the sensitivity of the current measurement.

Parameter	**By increasing the magnitude**	**By decreasing the magnitude**
h		
m		
a		
b		

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கல்விப் பொதுத் தராதரப் பத்திர(உயர் தர)ப் பரீட்சை, 2006 ஏப்பிரல்
General Certificate of Education (Adv. Level) Examination, April 2006

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பௌதிகவியல் II
Physics II

PART B — Essay

Answer four questions only.

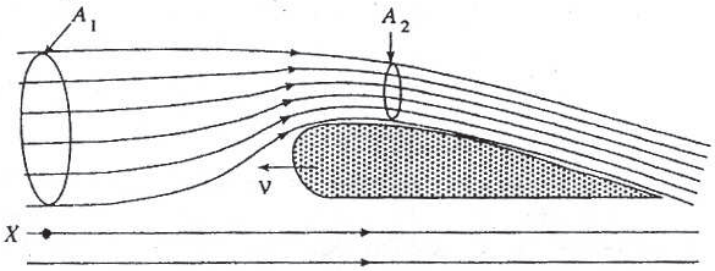
($g = 10\,\text{N kg}^{-1}$)

1. (i) Bernoulli's equation for a fluid flow can be written as

$$P + \frac{1}{2}\rho v^2 + h\rho g = \text{constant}$$, where all symbols have their usual meaning.

Applying dimensional analysis only to the term $\frac{1}{2}\rho v^2$ show that it has the dimensions of pressure.

(ii) Figure shows a cross section of a wing of an aeroplane which is moving through air horizontally to the left at a constant velocity v relative to the ground.



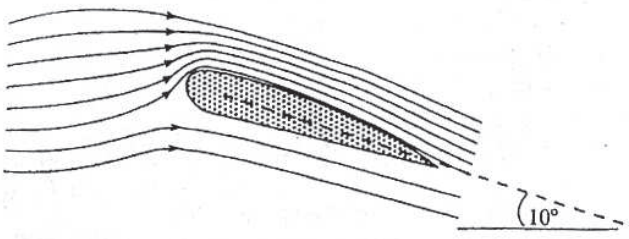
(*a*) What is the magnitude and direction of the velocity of air at point *X* **relative to the plane**? Assume that air is at rest relative to the ground.

(*b*) As shown in the figure, the cross-sectional area of a tube of flow exists away from the wing is A_1, and the corresponding area of the same tube of flow over the top surface of the wing is A_2. If $\frac{A_1}{A_2} = 1.2$, write down an expression for the speed (v') of air passing over the top surface of the wing relative to the aeroplane in terms of v.

(*c*) If the plane has a mass of 2.64×10^5 kg and total **effective** surface area of **both wings** is 250 m^2, calculate the minimum value of v necessary for the aeroplane to just lift-off the ground. (The density of air is 1.20 kg m^{-3}.)

(*d*) The aeroplane starts at rest on the runway and applies a constant horizontal driving force of 6.00×10^6 N from its engines. If the average drag force due to air is 7.20×10^5 N, how far does the aeroplane have to travel along the runway in order to achieve the speed v, calculated in (ii) (*c*) above?

(iii) The cross section of a wing of the aeroplane which is moving 10° to the horizontal just after take-off, is shown in the figure.

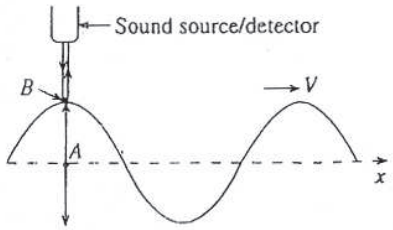


(*a*) Copy the cross section of the wing on to your answer paper and draw the direction of the net force acting on the wing due to the pressure difference between the bottom and top of the wing.

(*b*) Now the speed of air over the top surface of wings relative to the aeroplane has increased to 250 m s^{-1}. Assuming the speed of air below the bottom surface of the wings relative to the aeroplane remains the same as in (ii) (*a*), calculate the net vertical lifting force acting on the **wings** now.

(iv) Consider a situation where the plane is moving horizontally at an altitude of 10 km with a speed v_1. If the air is at rest relative to the ground at this altitude also, then the value v_1 should be greater than the value v, calculated in (ii) (*c*) above. Give a reason why this is so. Assume that the mass of the aeroplane has the same value given in (ii) (*c*) above.

2. The figure shows ripples moving in x-direction on the surface of a liquid. The liquid at the surface performs simple harmonic motion in a vertical direction. A stationary sound source/detector is placed above the liquid surface to study the vertical motion at a given location of the liquid surface due to the propagation of the wave. The sound source sends sound signals vertically downwards as shown in the figure, and the reflected signal from the oscillating liquid surface is detected by the detector. The detector is also capable of determining the frequency of the beats produced by the waves emitted by the source and the waves received after being reflected from the liquid surface. The frequency of the sound waves produced by the source is 680 kHz and the speed of sound in air is 340 m s^{-1}.



(i) (*a*) At what position shown in the figure (*A* or *B*) is the speed of the liquid surface minimum? What is the value of the speed?

(*b*) What is the frequency of the reflected sound waves at the instant when the speed of the liquid surface is minimum?

(ii) (*a*) If the speed of sound in air and the frequency of the sound waves emitted by the source are u and f_0 respectively, write down an expression for the frequency f' as observed at liquid surface when the liquid surface is moving away from the sound source at speed v, in terms of v, f_0 and u.

(*b*) For the situation described in (ii) (*a*) obtain an expression for the frequency f'' measured by the detector in terms of v, f_0 and u.

(*c*) Using your expressions in (ii) (*a*) and (ii) (*b*) show that when $v << u$ the beat frequency measured by the detector is $\frac{2f_0 v}{u}$.

(*d*) At what position (*A* or *B*) of the liquid surface can the maximum beat frequency be detected? If this frequency is 600 Hz, find the magnitude of the velocity of the liquid surface at this position.

(*e*) Sketch the value of the beat frequency measured by the detector as a function of time for a complete period of oscillation of the liquid surface for the situation $v << u$.

(iii) (*a*) If the time interval between two successive zero values of the beat frequency is 0.05 s, what is the frequency of the ripples?

(*b*) For small wavelengths the speed V of the ripples on a liquid is given by $V = \sqrt{\frac{2\pi T}{\lambda \rho}}$

where T, λ and ρ are the surface tension of the liquid, wavelength of the ripples and the density of the liquid respectively. If λ = 12 mm and ρ = 13 600 kg m^{-3}, obtain a value for T. (Take π = 3.)

3. Read the following passage carefully and answer the questions given below.

The exchange of oxygen and carbon dioxide in the lungs takes place across the surface membranes of small balloon-like structures (see the figure 1) called alveoli. There are about 150 million alveoli in each lung. The presence of a large number of alveoli increases the effective surface area and thereby the exchange of air takes place more efficiently.

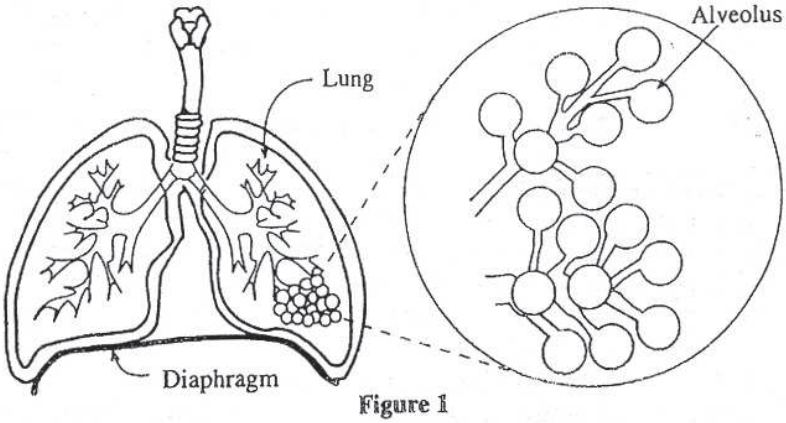


Figure 1

Inflating these alveoli in the process of inhalation requires an excess pressure inside the alveoli relative to their surroundings. This pressure difference is achieved by making the pressure outside the alveoli less with respect to the atmospheric pressure by moving the diaphragm (see the figure 1) down. The maximum pressure difference that could be provided by this action is only 1.0 mm Hg.

During inhalation the radius of an alveolus normally increases from 0.05 mm to 0.10 mm. The fluid lining the inner surface of alveoli has a surface tension of 5.0×10^{-2} N m^{-1}. The 1.0 mm Hg pressure change occurring due to the movement of the diaphragm is not sufficient to inflate an alveolus from 0.05 mm to 0.10 mm. Therefore these alveoli are fully inflated by secreting a surface tension reducing liquid (surfactant) and thereby lowering the surface tension of the above mentioned fluid to about $\frac{1}{15}$. Once the surface tension of the fluid is reduced, a pressure change of 1.0 mm Hg is sufficient to inflate the alveoli fully.

Another very important function of the surface tension reducing liquid is to avoid all small alveoli, being collapsed into one large alveolus.

All alveoli do not have the same size. If the surface tension of the fluid takes the same value everywhere, air from smaller alveoli would flow into larger alveoli. This process would continue till the entire lung is converted into one giant alveolus. But this does not happen because of the surface tension reducing liquid.

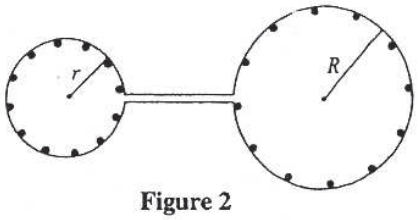


Figure 2

Consider two alveoli, one with radius r and another with radius R ($r < R$) connected together like two bubbles as shown in figure 2.

The number of molecules of the surface tension reducing liquid, shown as black dots, is the same in both alveoli, but its distribution is more dense (more liquid molecules on a unit surface area) in the small alveolus. Therefore the reduction of the surface tension is more in the small alveolus than that in the large one. Due to this, the internal pressures could be maintained at the same value in both alveoli and the smaller alveolus would not collapse into the larger one.

(i) What is the advantage of having a large number of small alveoli in a lung instead of one big alveolus?

(ii) (*a*) Taking the radius of a single inflated alveolus to be 0.1 mm, calculate the total surface area of 1.5×10^8 number of such alveoli. (Take $\pi = 3$)

(*b*) If a lung is made of one large spherical alveolus, estimate the radius that the lung should have in order to achieve the surface area calculated in (ii) (*a*) above. (Take $\pi = 3$ and $\sqrt{1.5} = 1.22$)

(iii) (*a*) Take the excess pressure inside an alveolus to be $\frac{2T}{r}$. Here T is the surface tension of the fluid (5.0×10^{-2} N m^{-1}) **without surfactant**, and r is the radius of the alveolus. Calculate the excess pressure, (ΔP_1) that should be inside the alveolus to make r = 0.05 mm. Similarly calculate the excess pressure (ΔP_2) that should be inside the alveolus to make r = 0.10 mm.

(*b*) Calculate the difference of these excess pressures $(\Delta P_1 - \Delta P_2)$ in mm of Hg.

(1 Pa = 7.5×10^{-3} mm Hg)

Hence show that this pressure difference cannot be achieved only by moving the diaphragm.

(*c*) Show that with low surface tension $\left(\frac{5.0}{15} \times 10^{-2} \text{N m}^{-1}\right)$ in the fluid due to secretion of the surface tension reducing liquid, 1.0 mm Hg pressure difference is sufficient to fully inflate the alveolus.

(iv) Now draw your attention to the figure 2 of the paragraph.

(*a*) Why is the reduction of surface tension is more in the small alveolus than that of the large alveolus due to the secreted liquid?

(*b*) If the effective surface tensions with the secreted liquid in the small alveolus and the large alveolus are T_r and T_R respectively, obtain an expression which should have for the ratio $\frac{T_r}{T_R}$, in terms of r and R, in order to prevent air flowing from the small alveolus to the large alveolus. Assume that the pressure outside both alveoli is the same.

(*c*) (i) An expression for the effective surface tension, T_r, can be written as

$$T_r = 5.0 \times 10^{-2} - \frac{k}{r^2}, \text{ where } k \text{ is a constant.}$$

Write down the dimensions of k.

(ii) Write down a similar expression for T_R.

(*d*) Using these two expressions and the relationship obtained in (iv) (*b*) above determine values for T_r and T_R. (Take r = 0.5 mm and R = 1.0 mm)

4. Consider a hypothetical situation in which a point object of mass m carrying a charge $+q$ is fixed at a point in space where there are no other objects and charges present except at infinity.

(i) Show that if $m = \frac{q}{2\sqrt{\pi G \varepsilon_0}}$, a second object having identical mass and charge can be brought from infinity towards the first object without doing any work. (Neglect the energy required to initiate the motion of the second object at infinity.) G is the universal gravitational constant and ε_0 is the permittivity of free space.

Show also that when bringing the second object from infinity,

(a) if $m > \frac{q}{2\sqrt{\pi G \varepsilon_0}}$, work is done by the object and

(b) if $m < \frac{q}{2\sqrt{\pi G \varepsilon_0}}$, work has to be done on the object.

(ii) What is the total work that has to be done when bringing the second object from infinity to a point at a distance r from the first object under the condition stated in (i) (b) above?

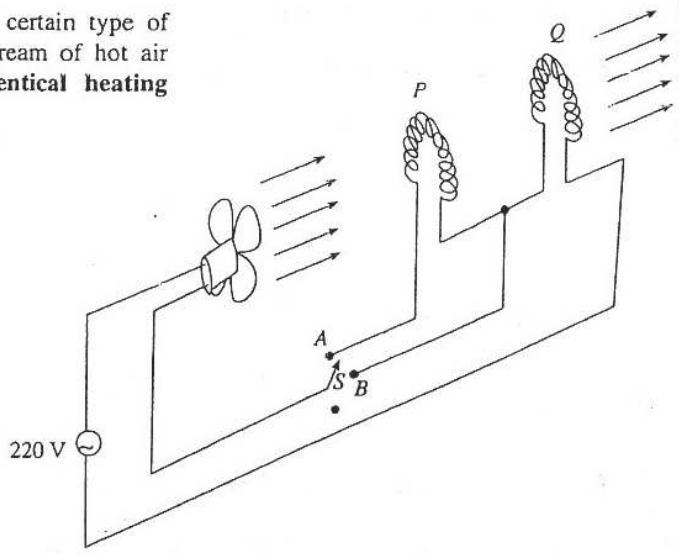
(iii) State under which condition given in (i) above, the second object has a capability of existing in a circular orbit around the first object.

(iv) If the second object moves in a circular orbit of radius r as stated in (iii) above with a speed v_0, write down an expression relating r and other quantities mentioned above.

(v) An asteroid of mass m located far away from a certain planet of mass M starts to move towards the planet due to the gravitational influence between them. Assume that the planet is stationary and there is no gravitational influence on the planet and the asteroid from other celestial objects. If the speed of the asteroid when it is at a distance R away from the planet is v, derive an expression for the magnitude of the charge that has to be placed on each of the objects at that instant (i.e. at the instant when the separation is R) in order to stop the asteroid at a distance $\frac{R}{2}$ from the planet and reverse its motion.

5. **Answer either part (a) or part (b) only.**

(a) The figure represents the essential parts of a certain type of a hot air blower. It shows a way in which stream of hot air is produced by flowing air through two **identical heating elements P and Q**, using a fan.



(i) If each heating element is made of nichrome wires with area of cross section 10^{-8} m^2 and length 0.45 m, calculate the resistance of **one** heating element at room temperature of 25 °C. (Resistivity of nichrome at 25 °C is $10^{-6}\ \Omega$ m.)

(ii) Assuming that the effective resistance of the fan motor is 10 Ω and that the heating elements are still at room temperature, calculate the following:

(a) The **total** power consumption of the heating elements when the switch S is at position A.

(b) The power consumption of the fan motor when the switch S is at position A.

(c) The **total** power consumption of heating elements when the switch S is at position B.

(d) The power consumption of the fan motor when the switch S is at position B.

(iii) (a) What are the **forms** to which the electrical energy consumed by the fan motor is converted?

(b) Considering your calculations in part (ii) above, make a qualitative comparison on the speeds and the temperatures of the air flow at switch positions A and B.
(Assume that the fan speed is proportional to the current through it.)

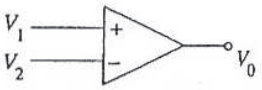
(iv) When the hot air blower is operating at switch position B, the temperature of the heating element Q rises to a steady value of 200 °C.

(a) Calculate the resistance of Q at the new temperature. (Temperature coefficient of resistance of nichrome is 0.002 $\Omega\ K^{-1}$).

(b) Will this change in temperature cause an increase or decrease of the rate of heat generated by Q? If so, by how much? (Neglect any temperature changes of other parts of the circuit.)

(v) While the hot air blower is operating at switch position B, if the heating element Q is moved away from the air flow without disconnecting it from the circuit, will the fan speed increase or decrease? Give reasons for your answer.

(b) (i) If A is the open loop gain of the operational amplifier shown, write down an expression for V_0 in terms of V_1, V_2 and A.



(ii) If the saturation voltage of the output of the above operational amplifier is ±5 V, and $A = 10^5$, find the **minimum value** of the input voltage difference, $(V_1 - V_2)$, that is necessary to saturate the output.

(iii) Output saturation voltage of the operational amplifier shown in the circuit (see figure 1) is ±5 V.

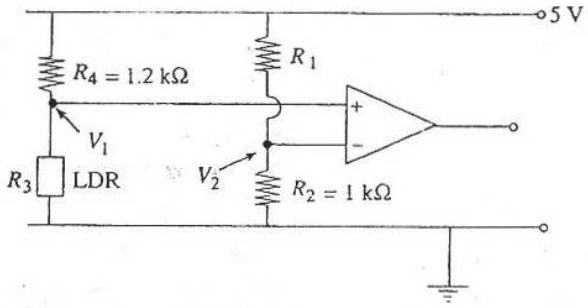


Figure 1

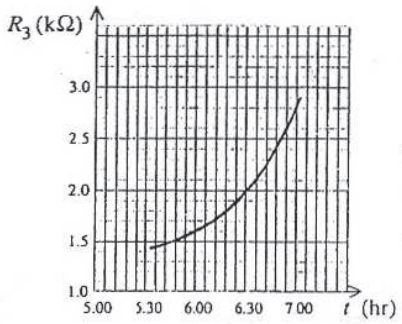
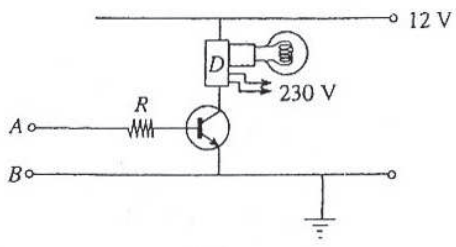


Figure 2

(a) If $R_2 = 1\ k\Omega$, calculate the value of R_1 which makes $V_2 = +3$ V.
Assume that no current flows into the input terminals of the operational amplifier.

(b) R_3 is the value of a light dependent resistor (LDR) whose resistance varies with the time (t) of day according to the curve shown in figure 2.
Show that the output voltage of the operational amplifier is −5 V at 6.00 p.m. and +5 V at 6.30 p.m.

(iv) In the circuit shown the device D has the capability of lighting a 230 V lamp when the transistor is set to operate in the saturation mode. The input terminals AB of this circuit are to be connected to the output of the operational amplifier circuit shown in figure 1 above to light the 230 V bulb when dark (i.e. at 6.30 p.m.).

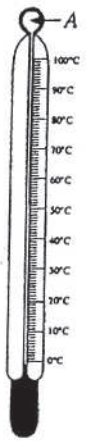


(a) If the base current needed to operate the transistor in the saturation mode is 100 μA, calculate a suitable value for R. $(V_{BE} = 0.7\ V)$

(b) If the effective collector resistance due to device D is 600 Ω, find the collector current through the transistor when the lamp is lit.

6. Answer either part (*a*) or part (*b*) only.

(*a*) The **internal** volume of the bulb of a mercury-in-glass thermometer is 1 cm^3 at 0 °C. The linear expansivity of glass is $3 \times 10^{-6}\ °C^{-1}$ and the volume expansivity of mercury is $2 \times 10^{-4}\ °C^{-1}$. The volume of the capillary is negligible when compared to the volume of the glass bulb.



(i) The temperature of the bulb is increased from 0 °C to 100 °C.

(*a*) Find the final internal volume of the glass bulb.

(*b*) Find the increase in volume of mercury.

(*c*) Find the rise of mercury volume in the capillary tube.

(*d*) If this thermometer is made using a suitable capillary to have a sensitivity of 0.25 cm rise per 1 °C, find the cross-sectional area of the capillary. Assume that the cross section of the capillary is uniform.

(ii) Thermometers are designed with a small cavity *A*, as shown in the figure, as a protection for accidental overheating of the thermometer. What would be the minimum volume of the cavity *A* in order to protect the above mentioned thermometer up to 300 °C?

(iii) The 0 °C and 100 °C marks on the scale of an incorrectly calibrated thermometer correspond to temperatures of −0.3 °C and 99.8 °C respectively. Find the correct temperature when this thermometer reads 40 °C.

(iv) Give **three** reasons as to why mercury is a suitable thermometric liquid for liquid-in-glass thermometers?

(*b*) (i) Consider the decay of a radioactive ^{210}Po (polonium) atom which is at rest into a daughter atom ^{206}Pb (lead) and an $^{4}\alpha$-particle.

$$^{210}Po \longrightarrow {}^{206}Pb + {}^{4}\alpha + \text{Energy}(E)$$

where *E* is the energy released in the decay. The atomic masses of ^{210}Po and ^{206}Pb are $348.571554 \times 10^{-27}$ kg, $341.917595 \times 10^{-27}$ kg respectively, and mass of the α-particle is 6.644625×10^{-27} kg and the speed of light is (*c*) $3.0 \times 10^{8}\ m\,s^{-1}$.

(*a*) Calculate the sum of the masses of the ^{206}Pb atom and the α-particle.

(*b*) Find the loss of mass (Δm) due to decay.

(*c*) *E* is the energy created by the mass (Δm) lost in the decay. Calculate *E* (Take $E = \Delta mc^2$).

(*d*) If the α-particle is emitted in the direction *x* with momentum *p*, what would be the magnitude and the direction of the momentum of the daughter atom.

Log tables may be used for the calculations of the following parts.

(*e*) The kinetic energy *K* of the emitted α-particle is given by $K = \dfrac{A_d}{A_d + A_\alpha} E$, where A_d and A_α are the mass numbers of the daughter atom and the α-particle respectively. Find *K*.

(ii) A radioactive sample contains 1 g of polonium (^{210}Po). Decay constant (λ) of polonium for the decay in (i) above is $5.6 \times 10^{-8}\ s^{-1}$.
Find the following:

(*a*) the initial number (*N*) of ^{210}Po atoms in the sample. (Take Avogadro constant = $6 \times 10^{23}\ mole^{-1}$)

(*b*) the initial activity (*A*) of the sample ($A = \lambda N$).

(*c*) the initial rate of emission of α-particles.

(*d*) the initial rate of release of energy from the sample.

(*e*) (i) The half-life *T* of ^{210}Po in days. (Take $T = \dfrac{0.7}{\lambda}$ and 1 s = 1.16×10^{-5} days.)

(ii) Approximately by what fraction, does the activity of a given ^{210}Po sample decrease in 2 years?

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