Class	Register Number	Name

南洋女子中学校
NANYANG GIRLS' HIGH SCHOOL
End-of-Year Examination 2019
Secondary Three

PHYSICS **1 hour 45 minutes**
Paper 2 Theory Paper **10:00 – 11:45**
Tuesday **15 October 2019**
No additional materials are required.

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your name, register number and class in the spaces at the top of this page and on any separate answer paper used.

Write in dark blue or black ink. You may use a pencil for any diagrams or graphs.
Do not use correction fluid or tape.

Section A (40 marks)
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B (30 marks)
Answer **all** questions.
Question **11** has a choice of parts to answer: **11** ***Either*** or **11** ***Or*****.**
Write your answers in the spaces provided on the question paper.

At the end of the examination, **circle 11 Either** or **11 Or** in the grid on the right to indicate which question you have answered.

INFORMATION FOR CANDIDATES

The intended number of marks is given in the brackets [ ] at the end of each question or part question. You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

Candidates are reminded that **all** quantitative answers should include appropriate units. Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.
The use of an approved scientific calculator is expected, where appropriate.

The acceleration due to gravity (or gravitational field strength) g is taken to be 10 m s^{-2} (or 10 N kg^{-1}) near the Earth's surface.

Examiner's Use	
Section A (40 marks)	
1	
2	
3	
4	
5	
6	
7	
8	
Section B (30 marks)	
9	
10	
11 Either	
11 Or	
Paper 2 (70 marks)	

Paper 1 (30 marks)	

Overall
%

This document consists of **17** printed pages and **1** blank page.

Section A (40 marks)

Answer **all** questions.

1 A student wants to measure the cross-sectional area of a cylindrical steel rod as shown in Fig. 1.1.

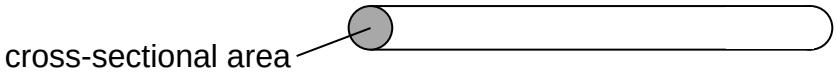

Fig. 1.1

She uses a vernier caliper and obtains the following readings as shown in Fig. 1.2 and Fig. 1.3. Fig. 1.2 shows the reading when the jaws of the vernier caliper are closed and Fig. 1.3 shows the reading when the jaws of the vernier caliper are around the steel rod.

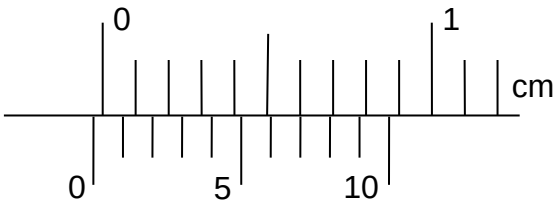

Fig. 1.2

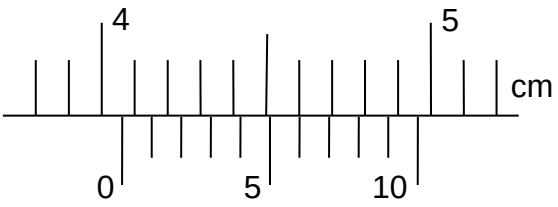

Fig. 1.3

(a) **(i)** State the zero error of the vernier caliper.

zero error = ……..[1]

(ii) Determine the cross-sectional area of the steel rod.

cross-sectional area = ……..[2]

(b) State **two** ways in which she can improve the accuracy of her results.

……

……

……[2]

2 A student stands on the top of a house and throws a ball straight down with an initial velocity of 2.0 m s^{-1}. The ball is thrown from a height of 4.5 m. Assume that air resistance is negligible.

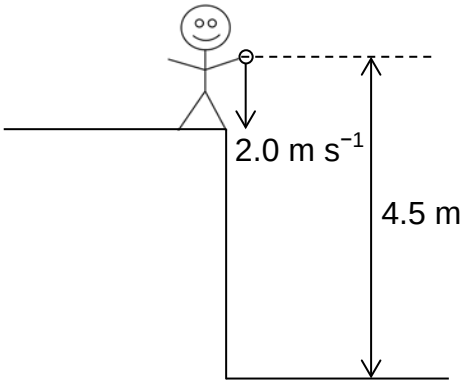

Fig. 2.1

(a) Calculate the velocity of the ball when it reaches the ground.

velocity of the ball = ……..[2]

(b) Calculate the time taken for the ball to reach the ground.

time taken to reach the ground = ……..[2]

(c) State and explain the change (if any) to **(b)** if a heavier ball had been used.

……

……

……

……[2]

3 A climber is supported by a rope on a vertical wall as shown in Fig. 3.1.

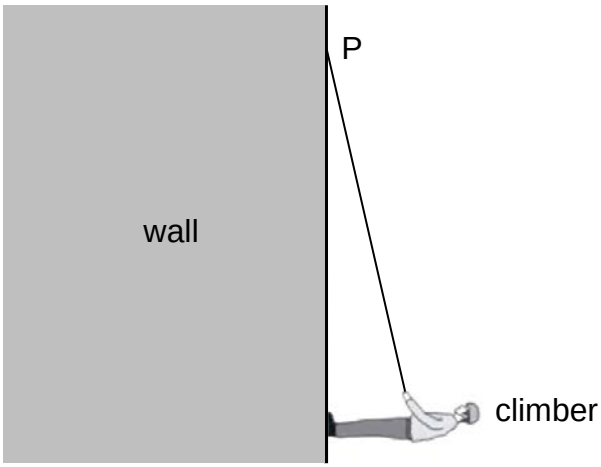

Fig. 3.1

The weight of the climber is 600 N. A light rope is attached to the climber and to a fixed point P. The normal contact exerted on the climber from the wall is 280 N.

The climber is in equilibrium.

(a) State the conditions necessary for the climber to be in equilibrium.

……

……

……[2]

(b) Draw a scaled vector diagram to determine the tension of the rope.

magnitude of tension = ……..

direction of tension = ……..[4]

4 Fig. 4.1 shows a lamp with its centre of gravity marked with a cross (X) and labelled. A man accidentally bumps into the lamp, causing it to tip as shown in Fig. 4.2.

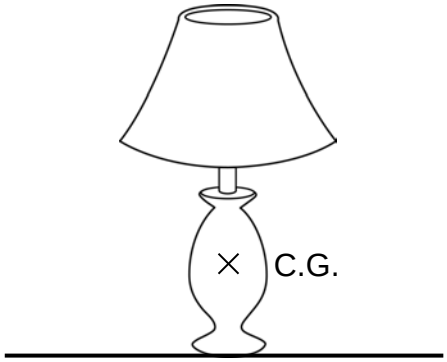

Fig. 4.1

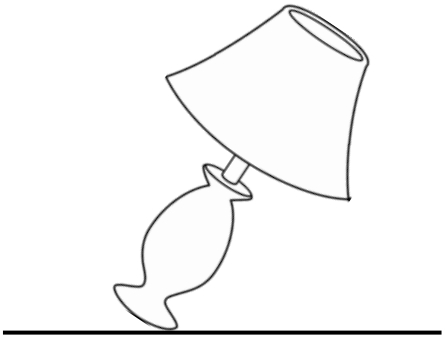

Fig. 4.2

(a) Describe and explain what happens to the lamp in Fig. 4.2.

……

……

……[2]

(b) Suggest **two** ways to make the lamp more stable.

……

……[2]

5 Fig. 5.1 shows a non-uniform beam of weight 20 N resting on a frictionless wall at D and on the floor at E. The centre of gravity of the beam is at C.

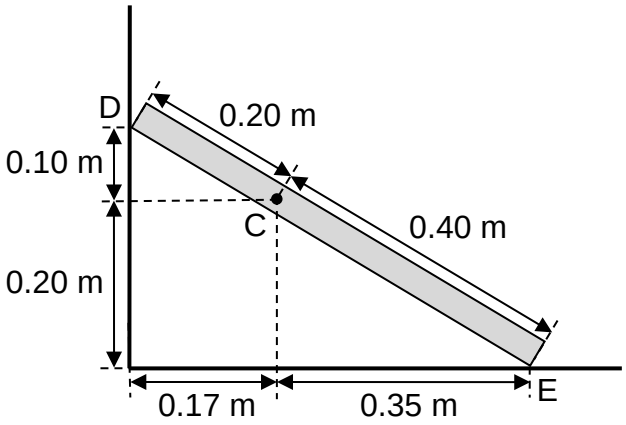

Fig. 5.1

(a) Calculate the normal contact force exerted by the wall on the beam at D.

normal contact force at D = ……..[2]

(b) State the normal contact force exerted by the floor on the beam at E.

normal contact force at E = ……..[1]

(c) If the wall has friction, state and explain if the magnitude of the normal contact force at E would be higher, lower or the same as **(b)**.

……

……

……[2]

6 Fig. 6.1 shows a manometer. The atmospheric pressure is 75 cm Hg; the gas within the gas vessel has a volume of 0.012 m^3. The densities of mercury and water are 13 600 kg m^{-3} and 1000 kg m^{-3} respectively.

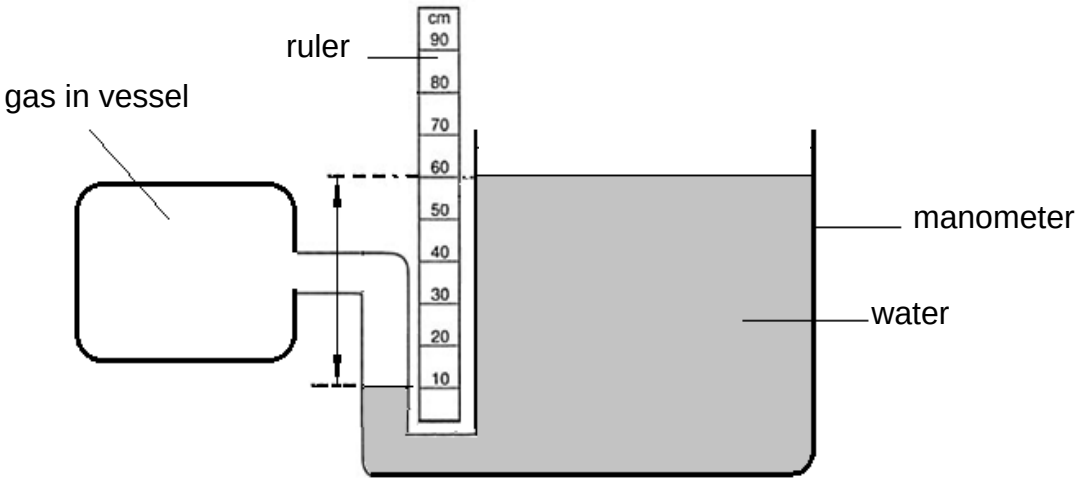

Fig. 6.1

(a) Label in Fig. 6.1 a point 'S' that is the location with the highest pressure. [1]

(b) Determine the gas pressure exerted by the gas in the vessel.

gas pressure = …… [2]

(c) The gas is allowed to expand to a new volume of 0.013 m^3. Determine the new gas pressure exerted by the gas. State any assumptions you made.

assumption : ……

new gas pressure = …… [2]

7 Fig. 7.1 shows a device that is used to compress objects placed above the large piston.

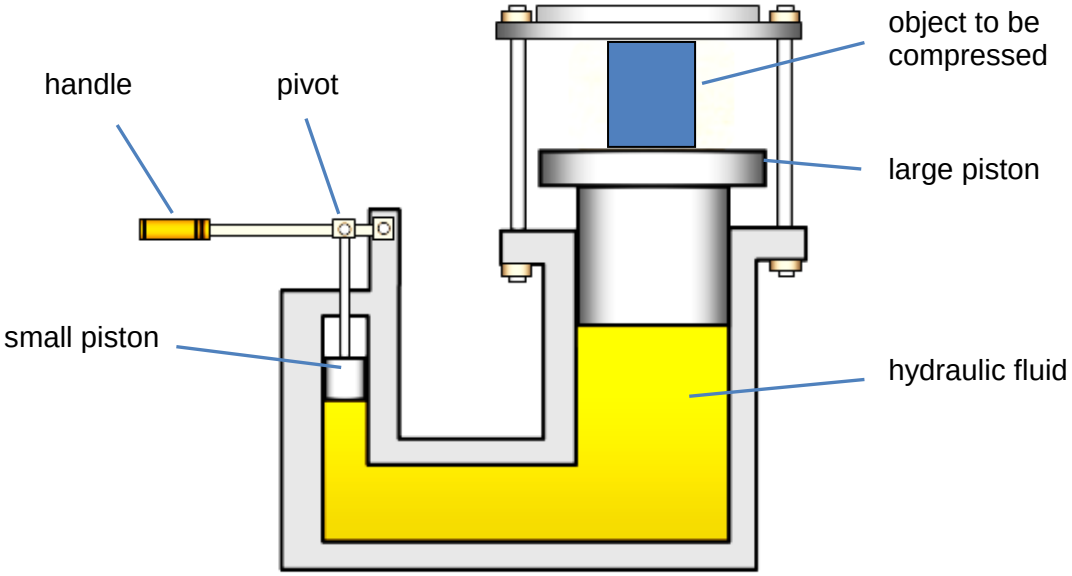

Fig. 7.1

(a) Explain how a small force on the left handle can produce a large force on the object.

……..

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……..

……

……..[2]

(b) Explain why the small piston moves a greater distance than the large piston.

……..

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……..[2]

8 A reflecting surface is placed on a building at an angle as shown in Fig. 8.1. An observer at the bottom of the building sees the image of object P in the reflecting surface.

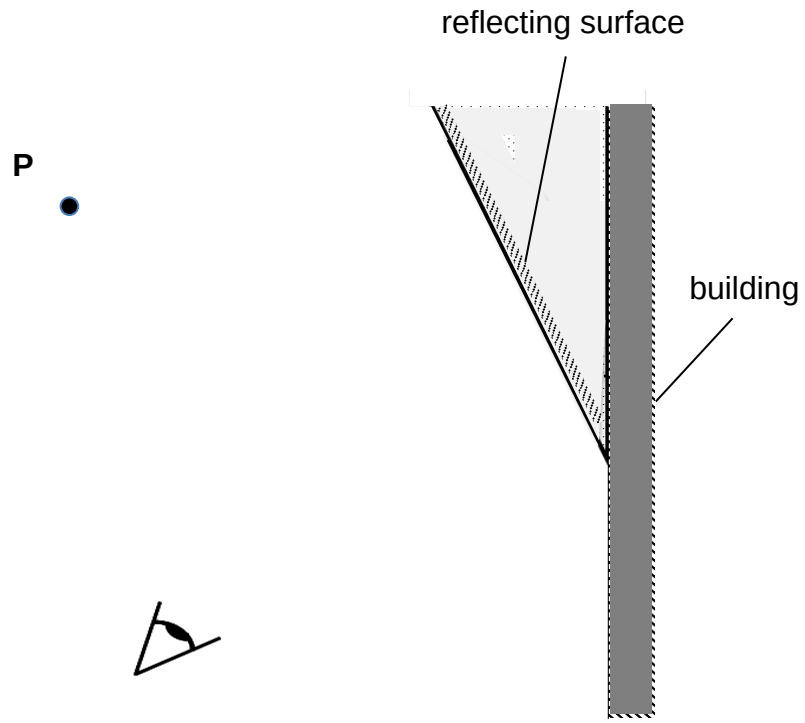

Fig. 8.1

(a) Draw a cone of rays on Fig. 8.1 to show how the observer can see the object P. [3]

(b) The observer predicts that the image of object P would look bigger and inverted. State and explain if the observer's prediction is correct.

……..

……..

……..[2]

Section B (30 marks)

Answer questions **9, 10** and **only one of the alternative questions** in Question **11**.

9 Blocks J and K are connected by a string as shown in Fig. 9.1. They are pulled upwards with a force of 70 N. The mass of block J is 2.0 kg and the mass of block K is 3.0 kg.

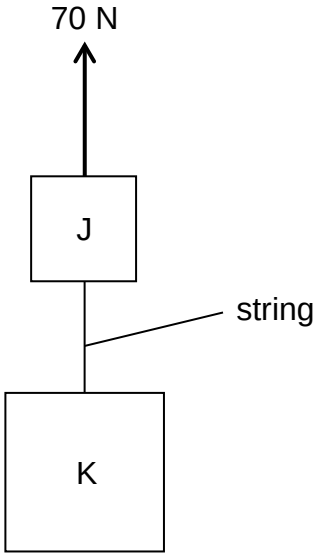

Fig. 9.1

(a) State Newton's Second Law.

……

……..[1]

(b) Draw and clearly label all the forces acting on the free body diagrams for blocks J and K shown below in Fig. 9.2 and Fig. 9.3 respectively. [3]

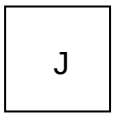

Fig. 9.2

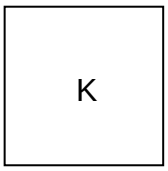

Fig. 9.3

(c) Determine the magnitude of the acceleration of the blocks.

acceleration = …… [2]

(d) Determine the tension in the string.

tension = …… [2]

(e) The 70 N force is now removed. State and explain what happens to the tension in the string.

……

……

……..[2]

10 As fossil fuels and natural gas are slowly depleting, many countries are looking to renewable energy sources. Some countries look to wind energy to generate electrical energy. Wind energy is not only a renewable energy, it is also clean and pollution free.

Fig. 10.1 shows a wind turbine with 3 blades, each 40 m long.

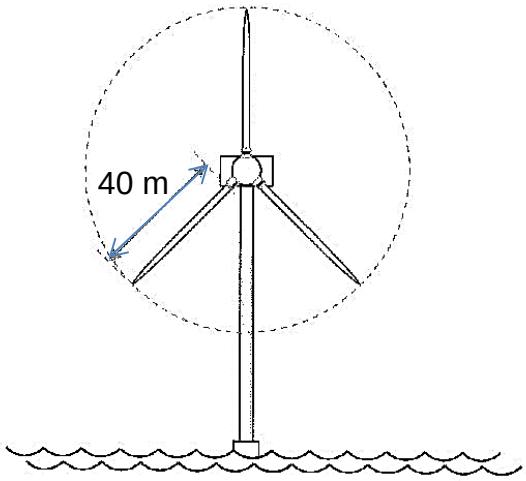

Fig. 10.1

(a) The speed of the wind on a particular day is 8.0 m s^{-1}.

(i) Calculate the volume of air passing through the blades every second.

volume = ... [1]

(ii) Given that 90 000 kg of air passes through the blade every second, calculate the density of the air passing through the blades.

density = ... [1]

(iii) Hence, calculate the maximum possible rate of kinetic energy that can be converted from the wind by the rotating blades.

kinetic energy = ... [1]

(iv) Explain the reason why the rate of kinetic energy is smaller than the value calculated in **(iii).**

……

……..[1]

(b) The wind turbine produces electrical energy used to power a lighting system in a house.

Fig. 10.2 shows a light ray P from the lighting system incident on a window pane in the house.

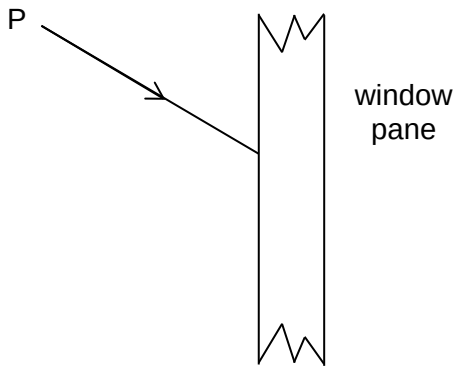

Fig. 10.2

Part of ray P is reflected off the window pane.

(i) On Fig.10.2, draw accurately the reflected path of ray P on the window pane. Indicate clearly the angle of incidence and angle of reflection. [2]

(ii) State the two laws of reflection.

……

……

……

……..[2]

(iii) Determine the angle of deviation of the reflected light ray.

angle of deviation = …… [2]

11 EITHER

Two cars, X and Y, are travelling along the outside lane of a motorway at a speed of 20.0 m s^{-1}. They are a distance *d* apart, with car X in front of car Y.

The driver of car X sees a slower vehicle move out in front of him, and brakes hard until his speed has fallen to 10.0 m s^{-1} over a time interval of 2.0 s. The driver of car Y sees car X brake and, after a reaction time of 1.0 s, brakes with the same constant deceleration as X and comes to the same final speed.

(a) Define *acceleration*.

……..

……[1]

(b) The velocity-time graph of car X is shown in Fig. 11.1 below.

Sketch the velocity-time graph of car Y in Fig. 11.1. [3]

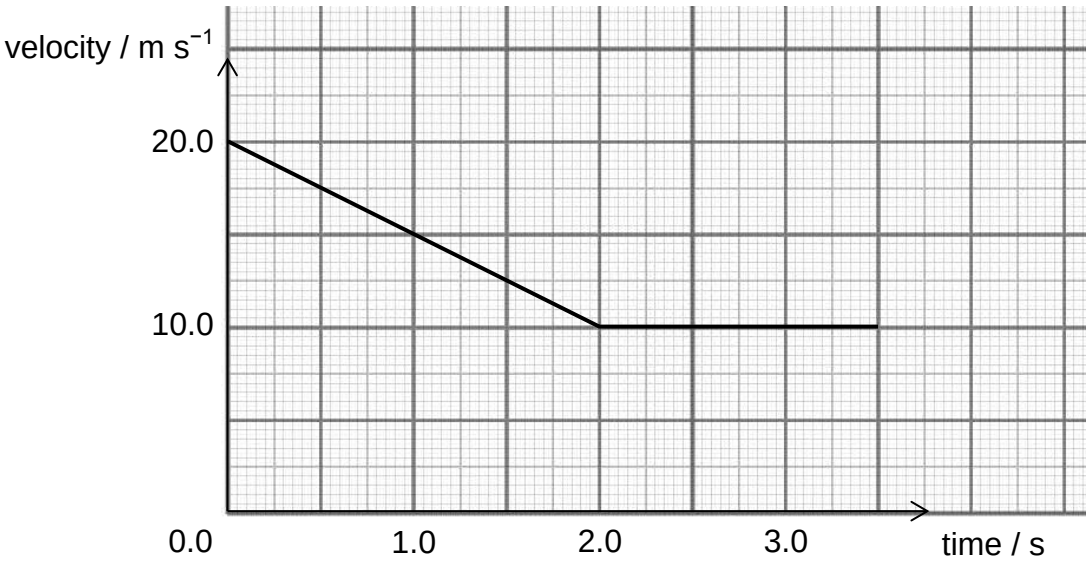

Fig. 11.1

(c) Calculate the deceleration of the cars while they are braking.

deceleration = …… [2]

(d) Calculate the minimum value of the initial separation *d* if the cars are **not** to collide.

minimum *d* = …… [3]

(e) If the cars are initially 15 m apart, state the final value of *d* after Y slows down to 10 m s^{-1}.

final *d* = …… [1]

11 OR

A submarine lays stationary on the seabed as shown Fig. 11.2.

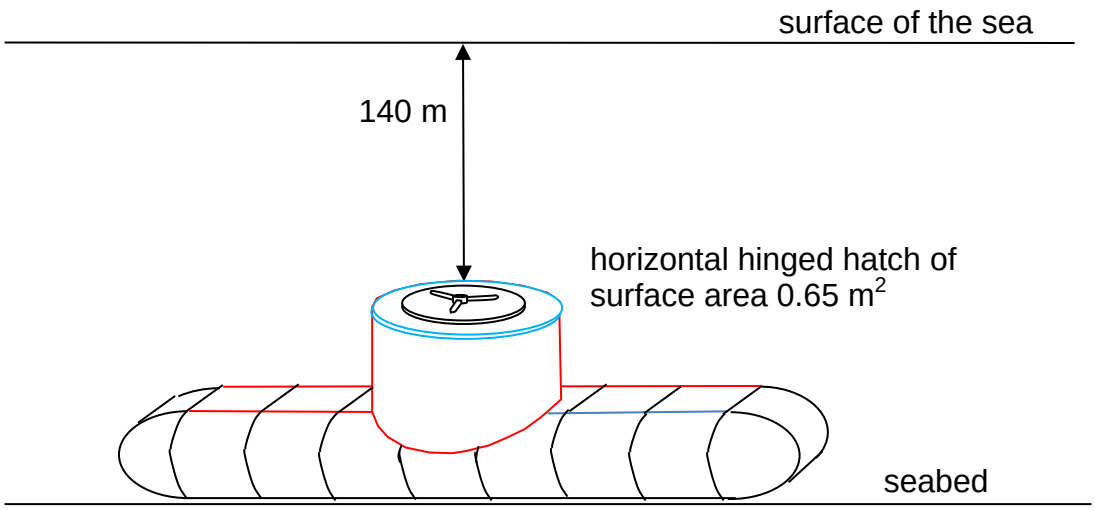

Fig. 11.2

(a) If the density of sea water is 1000 kg m^{-3} and the atmospheric pressure is 100 000 Pa, calculate the pressure at the depth of 140 m in pascals.

pressure = ……..[2]

(b) The submarine has a horizontal hinged hatch of surface area 0.65 m^2 on top of the submarine.

(i) Calculate the downward force acting on the surface of the hatch.

force = ……..[1]

(ii) State **two** reasons why the force needed to lift the hatch is different from the value calculated in **(b)(i)**.

……

……

……

……..[2]

(c) The hull of a submarine must be very strong as the pressure due to the water is extremely high. An experimental submarine with a volume 15 m^3 has an internal pressure of 1.1 atm. If the pressure of the ocean required to break the submarine is 200 atm, calculate the volume of the gas released when the submarine breaks.

volume = ……..[1]

(d) State and explain, in molecular terms, what happens to the bubbles of air as it rises to the surface.

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……..[4]

End of Paper

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