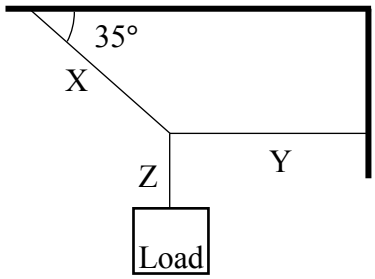
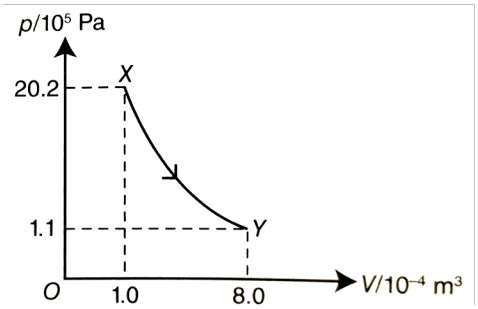
12. A wire system made of similar wires is suspended from the ceiling and the wall and attached to a variable load as shown.



If the diameter of the wires is 0.40 mm and the tensile stress of the wire is 210 MPa, which wire snaps first and what is the maximum weight of the load before it snaps?

A Z, 26 N **B** Y, 38 N **C** X, 46 N **D** Z, 110 N

13. The graph shows the variation of pressure, p with volume, V for 0.040 mol of a diatomic gas. The gas expands adiabatically from state X to state Y. The internal energy change in the process XY is



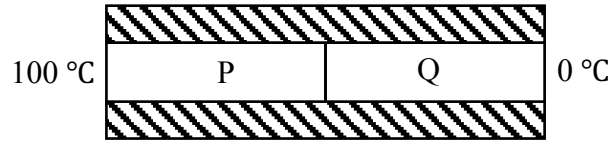
A -7130 J **B** -4280 J **C** -285 J **D** -171 J

14. A gas of one mole quantity is heated at a constant pressure, P. The volume of the gas is changed by ΔV and the temperature is changed by ΔT. The heat supplied to the gas is

A $P\Delta V$ **C** $C_{P,m}\Delta T - P\Delta V$

B $C_{V,m}\Delta T$ **D** $C_{V,m}\Delta T + P\Delta V$

15. The diagram shows two well-lagged uniform metal rods having their ends in good thermal contact. Both rods have the same length and diameter. One end of the composite rod is kept at 100 ℃ and another at 0 ℃.



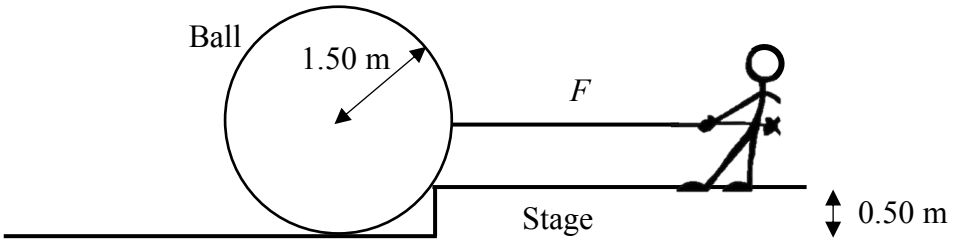
The thermal conductivity of P is three times that of Q. What is the temperature at the PQ junction?

A 25 ℃
B 33 ℃
C 67 ℃
D 75 ℃

Section B (*15 marks*)

Answer **all** *questions in this section.*

16. Diagram below shows a student tries to pull a ball of weight *W* onto a stage using a rope.



The sphere is 1.5 m in radius and the stage is 0.50 m high. Assume that the edge of the stage is smooth.

(a) Label all the forces experienced by the ball in the diagram above. [2 marks]

(b) Calculate the minimum force, *F*, in term of *W*, just sufficient to move the ball. [3 marks]

(c) If the student pulls the same ball up a higher smooth stage using the same method, what is the change to the value of *F*? Explain your answer. [2 marks]

_____

_____

_____

(d) State one assumption in the scenario in 16(c). [1 mark]

_____

_____

17. (a) Define stress and strain for a stretched wire. [2 marks]

_____

_____

_____

_____

(b) A uniform copper wire and a uniform steel wire each of length 1.00 m and of the same diameter are joined end to end to form a vertical composite wire of length 2.00 m long. A load is hung at the lower end of the composite wire until its length becomes 2.01 m. Calculate the ratio of the extension of copper wire to that of the steel wire.
(Youngs moduli for copper = 1.2×10^{11} Pa; steel = 2.0×10^{11} Pa.). [4 marks]

(c) State one assumption that is made in 17(b). [1 mark]

_____

_____

Section C [30 *marks*]

Answer any **two** *questions in this section.*

18. A hitter in a baseball game hits a ball to launch the ball into a projectile. The ball is then caught by a catcher 25.0 m away 4.0 seconds later. Assume that the ball was hit and caught at the same height and air resistance is negligible.
    (a) What is the initial speed of the baseball? [4 marks]
    (b) What is the angle of the initial velocity to the horizontal? [2 marks]
    (c) Find the maximum height achieved by the ball. Given the height of the hitting point from the ground is 1.50 m. [2 marks]
    (d) If air resistance is not negligible, sketch a *y*-*x* graph to show the difference between the projectiles with and without effect of air resistance. [2 marks]
    (e) If the hitter wishes to hit the ball to a further distance but he could only hit the ball with the same power, what should he do? Explain your answer. [2 marks]
    (f) If the players played the same match on the moon, what is the difference of the projectile of the baseball compared to in 18(d)? Explain your answer. [3 marks]

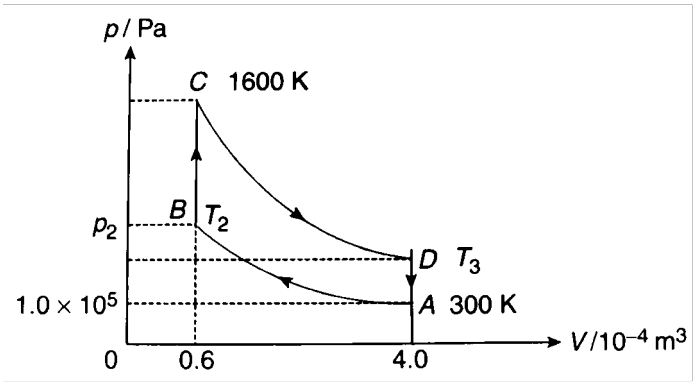
    Take acceleration due to gravity as 10.0 m s^{-2}.

19. (a) (i) State Newton's law of gravitation. [2 marks]
    (ii) Sketch the graph of gravitational field strength against distance from the centre of the Earth. Assume that the Earth is a sphere with uniform density. [2 marks]
    (iii) In terms of the acceleration of gravity at the surface of the Earth, *g* and the Earth's radius *R*, determine the escape velocity of a body from the surface of the Earth. [2 marks]
    (iv) Calculate the minimum speed required by a 5000 kg spacecraft to escape from the surface of the Earth. [1 mark]

    (b) A satellite of mass 500 kg is launched from a site on the Equator into an orbit at 200 km above Earth's surface. If the orbit is circular,
    (i) What is the satellite's speed in orbit? [3 marks]
    (ii) What is the minimum energy necessary to launch the satellite into its orbit, assuming no air friction? [2 marks]

    (c) An object of mass 10.0 kg is launched vertically upwards from the surface of the Earth at speed 9.0 km s^{-1}. When it reaches a point X at a height which is equal to one half the radius of the Earth, its speed becomes 4.4 km s^{-1}. Determine the amount of energy dissipated due to air resistance. [3 marks]

20. The diagram below shows an indicator diagram of a fixed mass of air in a petrol engine.



The air starts at A with a volume of 4.0×10^{-4} m^3, at a temperature of 300 K and a pressure of 1.0×10^5 Pa.

(a) Find the number of moles of the gas. [2 marks]

(b) If the air is considered to be diatomic, determine the ratio of the molar heat capacities γ. [2 marks]

(c) In the change from A to B, the air is compressed adiabatically to a volume of 0.60×10^{-4} m^3. Determine

i. its new pressure p_2, [2 marks]

ii. its new temperature T_2. [2 marks]

(d) In the change from B to C, heat is supplied to the air so that its temperature rises to 1600 K.

i. What is the work done by the gas? [1 mark]

ii. Calculate the heat supplied to the gas. [3 marks]

(e) In the change from C to D, the gas expands adiabatically to its original volume. Determine the change to the internal energy of the gas. [3 marks]

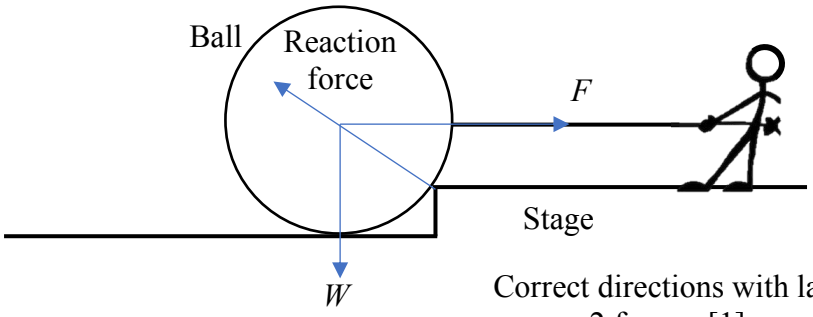
STPM 2024 Trial Exam
Physics Paper 1
Answer scheme

Section A (*15 marks*)

1	C	**6**	A	**11**	C
2	D	**7**	B	**12**	C
3	B	**8**	D	**13**	C
4	C	**9**	A	**14**	D
5	B	**10**	A	**15**	D

Section B (*15 marks*)

16. (a)



Correct directions with labels
- 2 forces [1]
- 3 forces [+1]

(b) $r_w = \sqrt{1.5^2 - (1.5 - 0.50)^2} = 1.118\ \text{m}$ [1]

$r_w W = r_F F$ [1]

$F = \frac{1.118}{1.0} \cdot W = 1.12W$ [1]

(c) The magnitude of the force increases. [1] the ratio of $\frac{r_w}{r_F}$ increases [1]

(d) The height of the stage is lower than the radius of the ball. [1]

17. (a) Stress is the ratio of longitudinal force applied to the cross sectional area of the wire. [1]
Strain is the ratio of the extension to the original length of the wire. [1]

(b)

$$\text{stress}_{\text{Cu}} = \text{stress}_{\text{Steel}} \quad [1]$$

$$E_{\text{Cu}} \cdot e_{\text{Cu}} = E_{\text{Steel}} \cdot e_{\text{Steel}} \quad [1]$$

$$\frac{e_{\text{Cu}}}{e_{\text{Steel}}} = \frac{E_{\text{Steel}}}{E_{\text{Cu}}} = 1.7$$ Correct substitution[1]. Correct answer [1]

(c) The limits of proportionality of the wires are not exceeded. [1]

Section C (*30 marks*)

18. (a) $u_x = 6.25$ m s^{-1} [1] $u_y = \frac{4.0}{2} \cdot g = 20$ m s^{-1} [1]

$$u = \sqrt{{u_x}^2 + {u_y}^2} \quad [1] \qquad = 21 \text{ m s}^{-1} \quad [1]$$

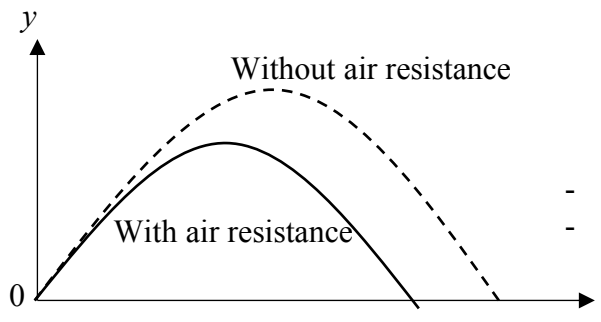
(b)

$$\theta = \tan^{-1}\frac{u_y}{u_x} \quad [1] \quad = 73° \quad [1]$$

(c) $H = \frac{1}{2}g\left(\frac{T}{2}\right)^2$ [1] $= 20$ m

$H' = 21.5$ m [1]

(d)



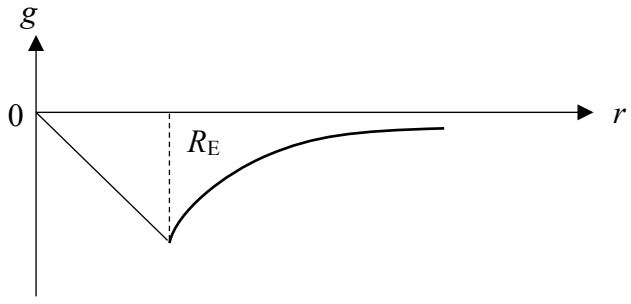
- Smaller H [1]
- Smaller range [1]

(e) He should hit the ball at a smaller angle but not lower than 17° . [1]
The range is proportional to sin 2θ. [1]

(f) The ball will go higher and further. [1] The acceleration due to gravity is smaller. [1]
There is no air friction. [1]

19. (a) (i) Newton's law of gravitation states that the gravitational force of attraction between two particles of masses M and m separated by a distance r is directly proportional to the product of the masses and inversely proportional to r^2. [2]

(ii)



- Correct shape [1]
- Labels [1]

(iii) $\frac{1}{2}m{v_e}^2 = \frac{GMm}{R} = mgR$ [1] $v_e = \sqrt{2gR}$ [1]

Suka sampel ini?

Kertas Percubaan STPM

Sem 1 · Fizik

- Semester 1: kertas percubaan (trial) negeri, subjek yang dipilih + skema
- Blueprint 30 hari Semester 1 (setiap subjek)
- Semester 3: percubaan 2024, 10 subjek, banyak negeri, soalan + skema dalam satu fail

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