SAMPEL PERCUMA

Trial STPM 2021 Fizik Semester 1 SMJK Yu Hua, Selangor

Set penuh: Kertas Percubaan STPM

Sem 1 · Fizik

Sampel ini: 8 muka surat. Set penuh ada:

- 3 fail PDF
- 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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SMJK Yu Hua, Kajang, Selangor
STPM Trial Examination
Februari 2021
Physics Paper 1

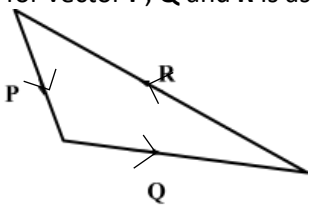
Form : 6BS1 Prepared by : Pn. Rosmaya Mokhtar
Date : 17th Februari 2021 (Wednesday) Verified by : Pn. Dayang Setiah
Time : (8:35 – 10:05) am, 1 ½ h
Number of printed pages : 6

Name:…….

SECTION A. (15 marks)
Answer all questions.

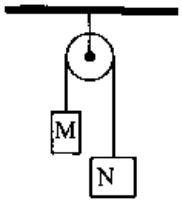
1. A student uses the symbols L, M, T, N and θ for dimensions of length, mass, time, amount of substance and t emperature. Using these symbols, what are the dimensions of R in the equation $PV_m = nRT$?
   A. $ML^2T^{-1}\theta^{-1}$ B. $M^2L^2T^{-2}\theta^{-1}$ C. $ML^2T^{-2}N^{-1}\theta^{-1}$ D. $MLT^{-2}N^{-3}$

2. The vector triangle for vector **P**, **Q** and **R** is as shown in the diagram.



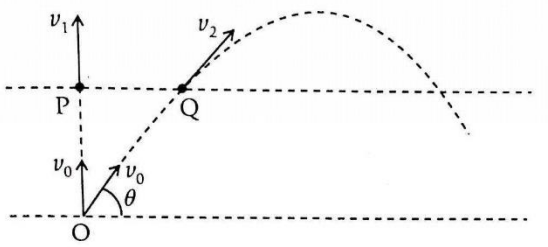
   Which of the following is the correct representation of **R** in terms of **P** and **Q**?
   A. **R = P + Q** B. **R = Q - P** C. **R = P -Q** D. **R=-(P+Q)**

3. Two blocks M and N of masses 10.0 kg and 20.0 kg respectively are joined by a light string which passes over a light frictionless pulley is shown in the diagram.



   What is the acceleration of the blocks the instant block N is released?
   A. 3.3 ms^{-2} B. 6.5 ms^{-2} C. 9.8 ms^{-2} D. 14.7 ms^{-2}

4. The diagram shows two bodies with the same mass being launched from point O with a velocity of v_o. The firts body is launched vertically whereas the second body is launched at an angle θ with the horizontal. v_1 is the velocity of the first bodyt P and v_2 is the velocity of the second body at Q. P and Q are at the same height.



   Which of the following statements is correct regarding the velocities of the two bodies?

   A. $v_1 > v_2$ because the kinetic energy of the body at P is greater than the kinetic energy of the body at Q.

   B. $v_1 > v_2$ because the angle of launch for the first body is greater than the angle of launch for the second body.

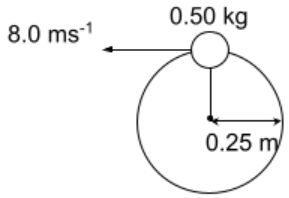
   C. $v_1 = v_2$ because the height of P and Q is the same.

   D. $v_1 < v_2$ because the path OP is less than the path OQ.

5. A ball is projected horizontally from the top of a cliff with a speed of 40.0 ms^{-1}. What is the speed of the ball 3.0 seconds later? (assume that air resistance is negligible

A. 29.4 ms^{-1} B. 49.7 ms^{-1} C. 53.5 ms^{-1} D. 69.4 ms^{-1}

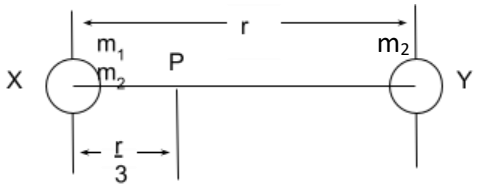
6. The diagram shows a ball of mass 0.50 kg attached to a string and swung in a vertical circle of radius 0.25 m.



The speed of the ball at the top of the circle is 8.0 $ms^{-1.}$
What is the tension in the string at this moment?

A. 119.2 N B. 120.8 N C. 123.1 N D. 125.4 N

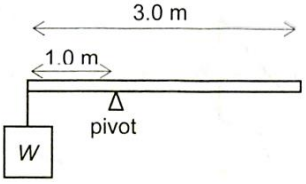
7. The diagram shows two stars X and Y of masses m_1 and m_2 respectively and separated by a distance r.



If the gravitational field strength at point P at distance $\frac{r}{3}$ from X is zero, the ratio of m_1 to m_2 is

A. 1:4 B. 1:2 C. 2:1 D. 4:1

8. A uniform beam of weight 40 N is 3.0 m long and is supported on a pivot situated 1.0 m from one end. A load of weight W is hung from that end and the beam is in equilibrium, as shown in the diagram below.



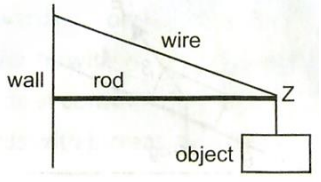
What is the value of W?

A 20 N B 40 N C 60 N D 80N

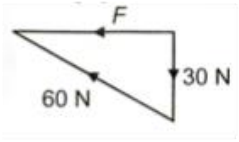
9. A spring of force constant 400N/m is placed on a smooth horizontal table. The spring is then compressed a distance of 0.05 m against wall. A ball of mass 0.20 kg is placed at the free end of the spring. The spring is then released. What is the velocity of the ball when it leaves the spring?

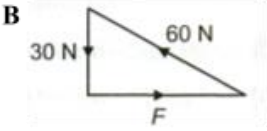
A. 2.2 m/s B. 3.2 m/s C. 5.0 m/s D. 10.0 m/s

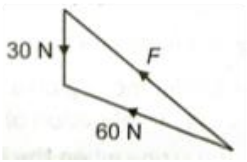
10. An object of weight 30 N is suspended from a rod which is attached to a wall is shown in the diagram below.

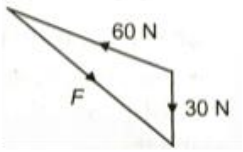


The rod is kept in equilibrium by a wire attached at point Z of the rod. The force exerted by the rod at point Z is F , and the tension in the wire is 60 N . Which diagram represents the three forces acting at point Z?

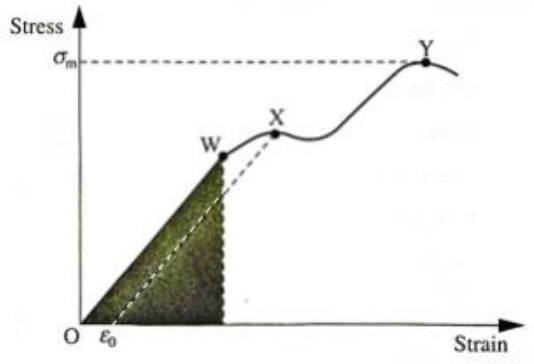
A 

B 

C 

D 

11. The behaviour of a wire when it is extended by a tensile force is represented by the graph of stress against strain as shown below.



Which of the following deductions from the graph above is **not** true?

A. The shaded area below the straight line OW is the same as strain energy.
B. Young modulus for the material of the wire is the same as the gradient of the straight line OW.
C. A permanent deformation ε_o is produced when the stress exerted on the wire at the point X is removed.
D. When a maximum stress σ_m is applied, the wire begins to become thinner non-uniformly.

12. Which of the following influence the degree of freedom of a gas molecule?
    A. The mass of the gas molecule and the pressure of the gas.
    B. The mass of the gas molecule and the temperature of the gas.
    C. The rms speed of the gas molecule and the pressure of the gas.
    D. The number of atoms per molecule and the temperature of the gas.

13. The specific heat capacity at constant volume for an ideal gas is 2.4×10^2 $Jkg^{-1}K^{-1}$. The change in the internal energy of 5.0×10^{-3} kg of the gas when the temperature of the gas when the temperature of the gas is increased from 27° C to 327°C is
    A. 32 J B. 49 J C. 180 J D. 360 J

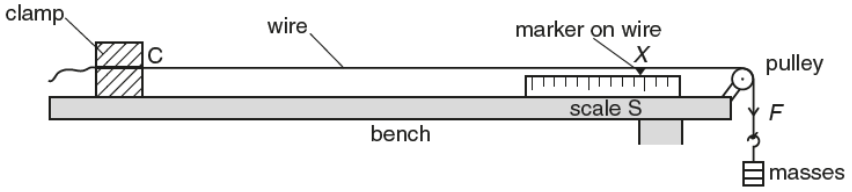
14. The work done to adiabatically compress one mole of a diatomic gas is 50 J. What is the temperature rise of the gas?
    A. 0 K B. 1.72 K C. 2.41 K D. 4.10 K

15. A refrigerator door is 120.0 cm high, 75.0 cm wide, and 5.5 cm thick. The temperature of the inner and outer surface of the door are 0°C and 32°C respectively. What is the heat flow through the door in one minute? (thermal conductivity of door is $0.21 Wm^{-1}K^{-1}$)
    A. 4.80×10^3 J B. 5.00×10^3 J C. 5.81×10^3 J D. 6.60×10^3 J

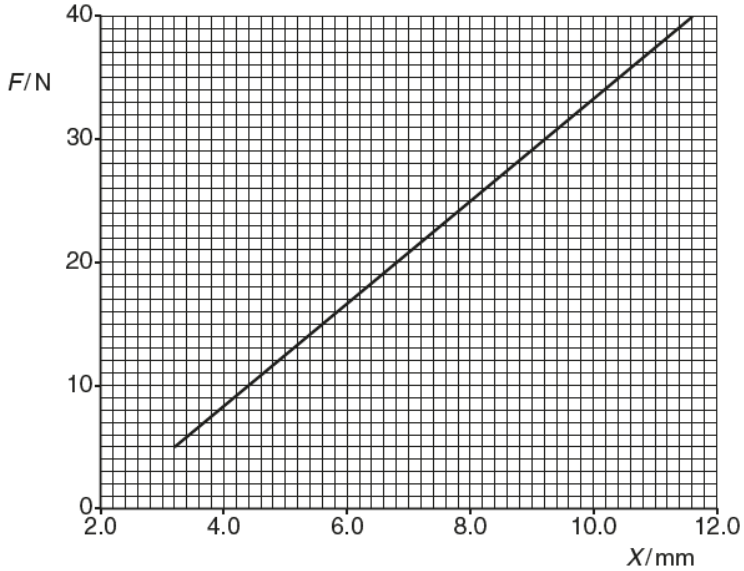
Section B. [15 marks]
Answer all questions.

16. a) Explain what is meant by stress and strain in a wire. Hence define Young modulus of the wire. [3 marks]

b) The Young modulus of the material of a wire can be determined using the apparatus shown in the diagram below.



One end of the wire is clamped at C and a marker is attached to the wire above a scale S. A force to extend the wire is applied by attaching masses to the other end of the wire.
The reading X of the marker on the scale S is determined for different forces F applied to the end of the wire.
The variation with X of F is shown in the graph below.



The length of the wire from C to the marker for $F = 0$ is 3.50 m. The diameter of the wire is 0.38 mm. Use the gradient of the line in the graph to determine the Young modulus E of the material of the wire. [4 marks]

c) The experiment is repeated with a thicker wire of the same material and length.
State how the range of the force F must be changed to obtain the same range of extension scale readings as in the graph above. [1 mark]

17. a)What is the basic principle used in the first law of thermodynamics? [1 mark]

b)State the first law of thermodynamics. [1 mark]

c)An insulated cylinder is fitted with a frictionless light piston which contains 0.22 mol of diatomic ideal gas. The gas expands from $4.0\times10^{-3}m^3$ to $4.2\times10^{-3}m^3$ with an initial pressure of $2.0\times10^{5}Pa$.

i) Name the thermodynamic process. [1 mark]

ii)Calculate the final pressure of the gas. [2 marks]

iii) Calculate the work done by the gas. [2 marks]

Section C. [30 marks]

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

18. a) Define power. [1 mark]

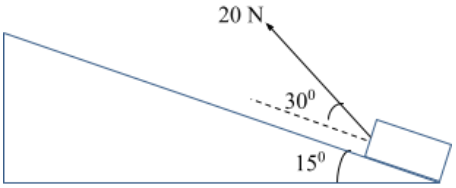
b) Starting with an expression for work done, derive a relation for the constant power P required to move against a constant force F at speed v . [2 marks]

c) The maximum power delivered by the engine of a car of mass 1 200 kg is 90.0 kW.

i) Assuming that the power delivered by the engine of the car is always at the maximum calculate the time which the car takes to accelerate from rest to 30.0 ms^{-1}. [2 marks]

ii) If it is assumed that the engine only delivers the maximum power when its speed is 30.0 ms^{-1} and the force is constant, what is the time taken by the car to accelerate from rest? [2 marks]

d) A block of mass 2.0 kg is at rest on a rough plane inclined at 15° to the horizontal as shown in the diagram below.



At the instant time, t = 0, a 20 N force acts on the object. The coefficient of kinetic friction between the object and the plane is 0.20.

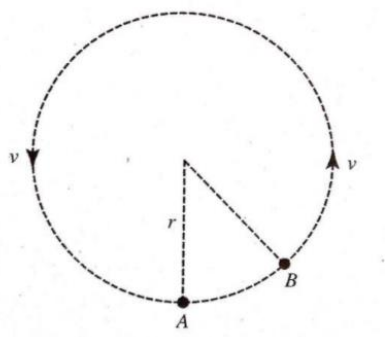
i)What is meant by coefficient of static friction?. [1 marks]

ii)Sketch all the forces on the block when it is at P. [2 marks]

iii)Determine the speed of the object at the instant t = 3.0 s. [5 marks]

19. a) Derive a relationship between linear velocity, v and angular velocity, ω for an object moving in a circle of radius, r. [3 marks]

b) A particle moves from position A to position B in a circular path of radius r with constant speed, v in time Δt is shown in the diagram below.



i)Draw a vector diagram for the change in velocity Δv. [1 mark]

ii)Show that the angle between the velocity vectors at A and B is $\frac{v\Delta t}{r}$. [2 marks]

iii)Derive the expression for the centripetal acceleration a in terms of v and r. [2 marks]

Answer :

1. C

$$R = \frac{pV_m}{T}$$

$$p = \frac{\text{force}}{\text{area}}$$

$$\text{Dimensions } p = \frac{MLT^{-2}}{L^2}$$

$$= MT^{-2}L^{-1}$$

$$V_m = \frac{\text{volume}}{\text{mole}} = \frac{\text{volume}}{\text{amount}}$$

$$= \frac{L^3}{N}$$

$$= L^3 N^{-1}$$

$$T = \theta$$

$$R = \frac{[MT^{-2}L^{-1}][L^3 N^{-1}]}{\theta}$$

$$= MT^{-2}L^2 N^{-1}\theta^{-1}$$

2. D
3. A
4. C

Using the principle of conservation of energy

$$\frac{1}{2}mv_1^2 + mgh = \frac{1}{2}mv_2^2 + mgh$$

P and Q are at the same height, $\therefore v_1 = v_2$.

5. B
6. C
7. A
8. A
9. A

$$\frac{1}{2}mv^2 = \frac{1}{2}kx^2$$

$$v = \sqrt{\frac{(400)(0.05)^2}{0.20}}\ \text{m s}^{-1}$$

$$= 2.2\ \text{m s}^{-1}$$

10. B
11. A
12. D
13. D

Since ΔV=0, W = pΔV = 0

ΔQ = ΔU + W

ΔQ = ΔU = m CVΔT

= 360 J

14. C

W= ΔU = 5/2 R (ΔT)

ΔT = 2W/5R = 2.41 K

15. D

$$\frac{dQ}{dt} = kA\frac{d\theta}{dx} = \frac{-(0.21)(1.2 \times 0.75)(0-32)}{0.055}\ \text{J s}^{-1}$$

$$= 109.96\ \text{J s}^{-1}$$

Heat flow in one minute

$= 109.96 \times 60$ J

$= 6.60 \times 10^3$ J

16. a) Stress = Tension/Force per unit cross-sectional area of the wire

Strain = extension per unit original length of the wire

Young Modulus, E = stress/strain

b) .

$= [\text{gradient} \times 3.5] / [\pi \times (0.19 \times 10^{-3})^2]$

e.g. $E = [\{(40 - 5) / ([11.6 - 3.2] \times 10^{-3})\} \times 3.5] / [\pi \times (0.19 \times 10^{-3})^2]$

or

$[4170 \times 3.5] / [\pi \times (0.19 \times 10^{-3})^2]$

$E = 1.3 \times 10^{11}$ Pa

c) A larger range of F is required or F must be larger than 35 N

17. a) Principle of conservation of energy

b) $Q = \Delta U + W$

c) i) Adiabatic process

ii) $P_2V_2^{\gamma} = P_1V_1^{\gamma}$

$P_2(4.2\times10^{-3})^{1.4} = (2.0\times10^{5})(4.0\times10^{-3})^{1.4}$

$P_2 = 1.9\times10^{5}$ Pa

iii) $W = [1/(\gamma-1)][P_1V_1 - P_2V_2]$

$= [1/(1.4-1)][(2.0\times10^{5})(4.0\times10^{-3}) - (1.9\times10^{5})(4.2\times10^{-3})]$

$=5.0$ J

18. a) rate of doing work

b).

If the force F on a body is constant,

Work done, $W = Fs$ s = displacement

Power $P = \frac{dW}{dt}$ .....

$= \frac{d}{dt}(Fs)$

$= F\frac{ds}{dt}$ $\frac{ds}{dt} = v$

$\boldsymbol{P = Fv}$ ..

c) i) Since the power of the engine is constant,

work done by engine = Pt

t = time taken

By the principle of conservation of energy.

Work done = Gain in kinetic energy

$Pt = \frac{1}{2}mv^2$

$t = \frac{1}{2} \times \frac{12200(30^2)}{90\times10^3}$

$= 6.0$ s

(c)(ii) $P = Fv$

$F = \frac{90000}{30}$

$= 3000N$ (Constant force)

Using $F = ma$

$a = \frac{F}{m}$

$= \frac{3000}{1200}$ .....

$= 2.5\ ms^{-2}$ Using $v = u + at$

$t = \frac{v-u}{a}$

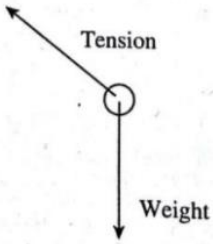
$= 12.0$ s .....

(iii) $a = \frac{\Delta v}{\Delta t} = \frac{v\theta}{\Delta t}$

$= \frac{v^2 \Delta t}{\Delta t r}$

$= \frac{v^2}{r}$

c) (i)



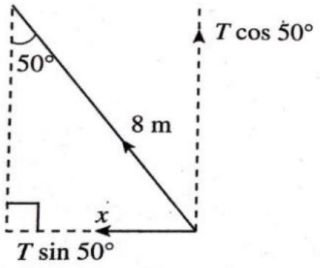
(ii) $T \cos 50° = mg$

$T = \frac{mg}{\cos 50°}$

$= \frac{70(9.81)}{\cos 50°}$

$= 1068 \text{ N}$

iii)



$\sin 50° = \frac{x}{8}$

$x = 6.128 \text{ m}$

$T \sin 50° = \frac{mv^2}{r}$

$1068 \sin 50° = \frac{70v^2}{11.128}$

$v = 11.4 \text{ m s}^{-1}$

20. a)i) The degree of freedom of a gas molecule is the number of independent ways by which energy is absorbed by the gas molecule.

ii) At 30 K it has translational kinetic energy only
At 300 K it has translational and rotational kinetic energy
At 3000 K it has translational, rotational and vibrational kinetic energy.

b)i) The Law of equipartition of energy states that the average kinetic energy of molecules is distributed equally among all the effective degrees of freedom and the energy associated with each degree of freedom is ½ kT

ii) Mean kinetic energy of 1 molecule $= \frac{f}{2}kT$

Mean kinetic energy of 1 mole of gas $= N_A(\frac{f}{2}kT) = N_A\frac{f}{2}(\frac{R}{N_A})T = \frac{f}{2}RT$

Internal energy U for n moles of ideal gas $= \frac{f}{2}nRT$

TAMAT SAMPEL

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

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