Name: Answer Key

Advanced General Science
Secondary IV

Exam Review Package

December 20th 2017

10:55 a.m.—2:25 p.m.

11:25

Topics

- Ecotoxicology
- Forces
- Energy
- Electricity

Bring to the Exam:

- Multiple pencils
- Eraser
- Calculator or 2
- Ruler
- Kleenex
- Cough drops
- Water bottle

Review Advanced General Science December 2017

Earth	X
$m = 10.\ kg$	$m = 10.\ kg$
	$F_g = 40.\ N$
	$g = ?$
	$\frac{F_g}{m} = \frac{mg}{m} = \frac{40.\ N}{10.\ kg} = 4.0 \frac{m}{s^2}$

1)

On the surface of planet *X*, a body with a mass of 10. kilograms weighs 40. newtons. The magnitude of the acceleration due to gravity on the surface of planet *X* is

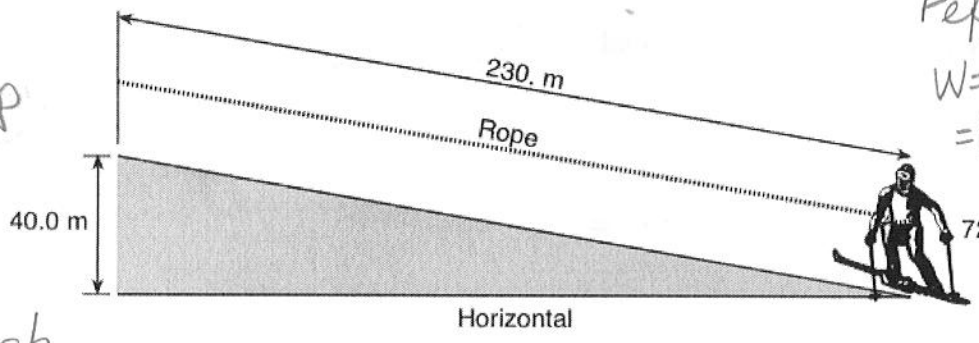
(1) 4.0×10^3 m/s^2
(2) 4.0×10^2 m/s^2
(3) 9.8 m/s^2
(4) 4.0 m/s^2

2)

As represented in the diagram, a ski area rope-tow pulls a 72.0-kilogram skier from the bottom to the top of a 40.0-meter-high hill. The rope-tow exerts a force of magnitude 158 newtons to move the skier a total distance of 230. meters up the side of the hill at constant speed.

$F_{eff} = 158\ N$

$W = F \times d$
$= (158\ N)(230.\ m)$
$= 3.63 \times 10^4\ J$



workup

$E_P = mgh$
$= (72.0\ kg)(9.8 \frac{m}{s^2})(40.0\ m) = 2.82 \times 10^4\ J$ = work directly up

FRICTION
so more than E_P straight up

66 Determine the total amount of work done by the rope on the skier. [1]

$= 3.63 \times 10^4\ J$

should become

67–68 Calculate the total amount of gravitational potential energy gained by the skier while moving up the hill. [Show all work, including the equation and substitution with units] [2]

$= 2.82 \times 10^4\ J$

X 69 Describe what happens to the internal energy of the skier-hill system as the skier is pulled up the hill. [1]

X 70 Describe what happens to the total mechanical energy of the skier-hill system as the skier is pulled up the hill. [1]

3)

What is the weight of a 2.00-kilogram object on the surface of Earth?

(1) 4.91 N
(2) 2.00 N
(3) 9.81 N
(4) 19.6 N

$F_g = mg$
$= (2.00\ kg)(9.8 \frac{m}{s^2})$
$= 19.6\ N$

4)

The gravitational potential energy, with respect to Earth, that is possessed by an object is dependent on the object's

(1) acceleration
(2) momentum
(3) position
(4) speed

5)

An operating 100.-watt lamp is connected to a 120-volt outlet. What is the total electrical energy used by the lamp in 60. seconds?

(1) 0.60 J
(2) 1.7 J
(3) 6.0×10^3 J
(4) 7.2×10^3 J

$E = Pt$
$= (100.\,W)(60.\,s)$
$= 6000\,J = 6.0 \times 10^3\,J$

6)

As a ball falls freely toward the ground, its total mechanical energy

1) increases
2) decreases
3) stays the same
4) inverts

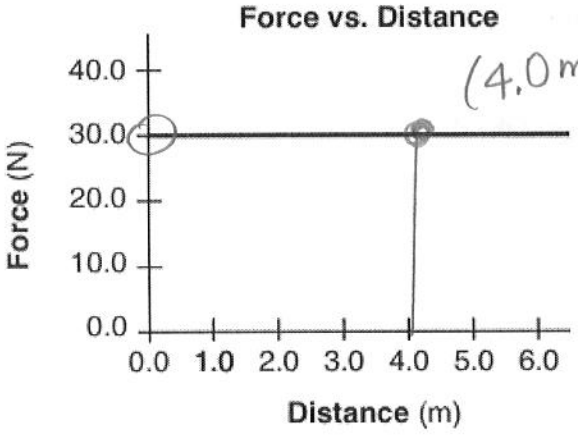
$TME = Ep + Ek$

TME at A = TME at B etc

Ek↑
Ep↓

7)

A boy pushes his wagon at constant speed along a level sidewalk. The graph below represents the relationship between the horizontal force exerted by the boy and the distance the wagon moves.



(4.0 m, 30.0 N)

$W = Fd$
$= (30.0\,N)(4.0\,m)$
$= 120\,J = Nm$

25)

41 What is the total work done by the boy in pushing the wagon 4.0 meters?

(1) 5.0 J
(2) 7.5 J
(3) 120 J
(4) 180 J

4)

The gravitational potential energy, with respect to Earth, that is possessed by an object is dependent on the object's

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(2) momentum
(3) position
(4) speed

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$TME = Ep + Ek$

TME at A = TME at B etc

$Ek \uparrow$
$Ep \downarrow$

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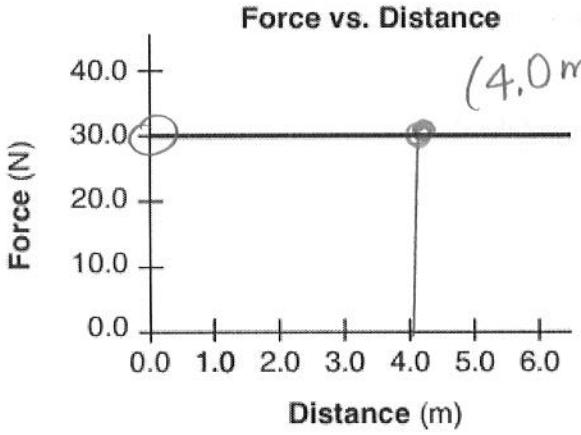

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25

41 What is the total work done by the boy in pushing the wagon 4.0 meters?

(1) 5.0 J
(2) 7.5 J
(3) 120 J
(4) 180 J

8) $-F_g$

A person weighing 785 newtons on the surface of Earth would weigh 298 newtons on the surface of Mars. What is the magnitude of the gravitational field strength on the surface of Mars?

(1) 2.63 N/kg
(2) 3.72 N/kg
(3) 6.09 N/kg
(4) 9.81 N/kg

Earth	Mars
$F_g = 785\,N$	$F_g = 298\,N$
$g = 9.8\,\frac{m}{s^2}$	$g = ?$
$m = ?$	$m = 80.1\,kg$

Mars is smaller than Earth

$F_g = mg$

$\frac{F_g}{g} = \frac{mg}{g}$

$\frac{785\,N}{9.8\,\frac{m}{s^2}} = 80.1\,kg = m$

mass never changes, F_g or weight changes depending on the planet.

$\frac{F_g}{m} = \frac{mg}{m}$

$\frac{298\,N}{80.1\,kg} = 3.72\,\frac{m}{s^2}$

9) Which is an SI unit for work done on an object?

(1) $\frac{kg \cdot m^2}{s^2}$
(2) $\frac{kg \cdot m^2}{s}$
(3) $\frac{kg \cdot m}{s}$
(4) $\frac{kg \cdot m}{s^2}$

$W = F \times d$

$= N \times m$

$= \frac{kgm}{s^2} \cdot m$

10) $W = E_p = mgh = kg \cdot \frac{m}{s^2} \cdot m = \frac{kgm^2}{s^2}$

A 3.0-ohm resistor and a 6.0-ohm resistor are connected in series in an operating electric circuit. If the current through the 3.0-ohm resistor is 4.0 amperes, what is the potential difference across the 6.0-ohm resistor?

(1) 8.0 V
(2) 2.0 V
(3) 12 V
(4) 24 V

$V = IR$

3.0 Ω, 4.0 A — 6.0 Ω, 4.0 A

$\therefore$ 24 V

11) A roller coaster car has a mass of 290. kilograms. Starting from rest, the car acquires 3.13×10^5 joules of kinetic energy as it descends to the bottom of a hill in 5.3 seconds.

$V = 0$

$\approx E_K$

t?

a) Calculate the height of the hill. [Neglect friction.] [Show all work, including the equation and substitution with units.] [2]

$E_{p\,top} = E_{k\,bottom}$

b) Calculate the speed of the roller coaster car at the bottom of the hill. [Show all work, including the equation and substitution with units.] [2]

12) a) $TME = E_p + E_k$ (Ø) top $\quad TME = E_p$ (Ø) $+ E_k$ bottom

b) $v = \sqrt{\frac{2E_K}{m}}$

$= \sqrt{\frac{2(3.13 \times 10^5\,J)}{290.\,kg}}$

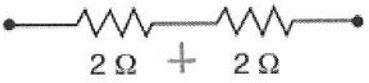
$v = 46.5\,\frac{m}{s}$

$E_{p\,top} = E_{k\,bottom}$

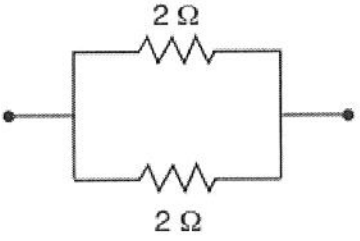
$\frac{mgh}{mg} = \frac{E_K}{mg}$

$h = \frac{3.13 \times 10^5\,J}{(290.\,kg)(9.8\,\frac{m}{s^2})} = 110.\,m = h$

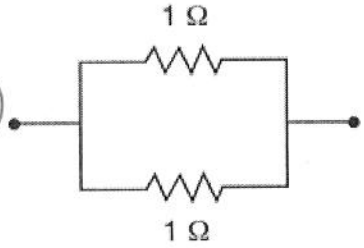
Which combination of resistors has the *smallest* equivalent resistance?

Series (1) 

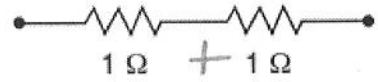
$= 4\Omega$

(2) 

$\frac{1}{R_T} = \frac{1}{2\Omega} + \frac{1}{2\Omega} = \frac{2}{2\Omega} = \frac{2\Omega}{2} = 1\Omega$

(3) 

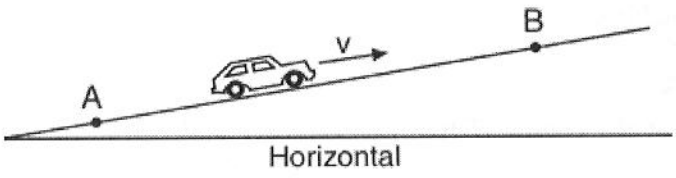
$\frac{1}{R_T} = \frac{1}{1\Omega} + \frac{1}{1\Omega} = \frac{2}{1\Omega} = \frac{1\Omega}{2} = 0.5\Omega$

Series (4) 

$= 2\Omega$

13)

18 A car travels at constant speed v up a hill from point A to point B, as shown in the diagram below.



As the car travels from A to B, its gravitational potential energy

(1) increases and its kinetic energy decreases

(2) increases and its kinetic energy remains the same

(3) remains the same and its kinetic energy decreases

(4) remains the same and its kinetic energy remains the same

same speed → $E_K = \frac{1}{2}mv^2$ ↑ also not changing! not changing ∴ no change in E_K

14)

What is the maximum amount of work that a 6000.-watt motor can do in 10. seconds?

(1) 6.0×10^1 J
(2) 6.0×10^2 J
(3) 6.0×10^3 J
(4) 6.0×10^4 J

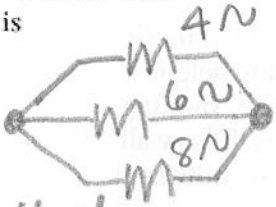
P t work = energy

$E = Pt$
$= (6000.\,W)(10.\,s)$
$= 60000\,J$
$= 6.0 \times 10^4\,J$ = work
↑ 2sf

15)

Three resistors, 4 ohms, 6 ohms, and 8 ohms, are connected in parallel in an electric circuit. The equivalent resistance of the circuit is

(1) less than 4 Ω
(2) between 4 Ω and 8 Ω
(3) between 10. Ω and 18 Ω
(4) 18 Ω



in ∥ R_T < smallest R !

$\frac{1}{R_T} = \frac{1\times6}{4\Omega\times6} + \frac{1\times4}{6\Omega\times4} + \frac{1\times3}{8\Omega\times3}$

$\frac{1}{R_T} = \frac{13}{24\Omega}$ $\quad \frac{R_T}{1} = \frac{24\Omega}{13}$

$R_T = 1.85\Omega$
< 4Ω

16)

The mass of a paper clip is approximately

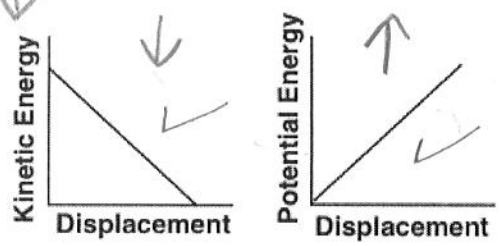
(1) 1×10^6 kg
(2) 1×10^3 kg
(3) 1×10^{-3} kg = 1g
(4) 1×10^{-6} kg

$1\times10^{-3}\,kg \times \frac{1000\,g}{1\,kg} = 1\,g \sim$ 1 pinkie fingernail

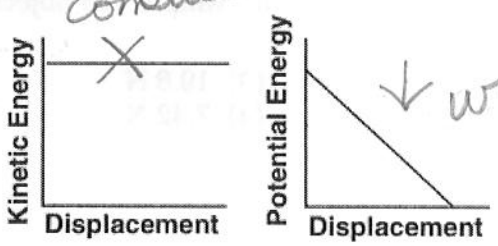
17)

An object is thrown vertically upward. Which pair of graphs best represents the object's kinetic energy and gravitational potential energy as functions of its displacement while it rises?

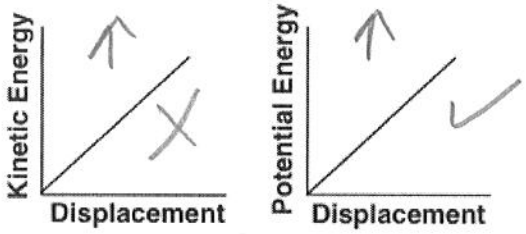
rise: E_P↑ E_K↓



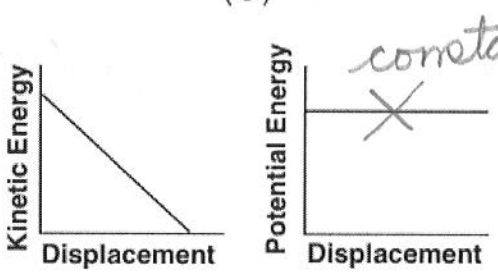
(1)



(3) ↓ wrong = E_P↑ as goes higher



(2)



(4)

$E = VIt$ ($J = VAs$)

18)

An electric drill operating at 120. volts draws a current of 3.00 amperes. What is the total amount of electrical energy used by the drill during 1.00 minute of operation?

(1) 2.16×10^4 J
(2) 2.40×10^3 J
(3) 3.60×10^2 J
(4) 4.00×10^1 J

$E = VIt = (120.\,V)(3.00A)(1.00\,min \times \frac{60s}{1\,min}) = 21600\,J$

19)

A 65-kilogram pole vaulter wishes to vault to a height of 5.5 meters.

53 Calculate the *minimum* amount of kinetic energy the vaulter needs to reach this height if air friction is neglected and all the vaulting energy is derived from kinetic energy. [Show all work, including the equation and substitution with units.] [2]

$35000\,J = E_p$

all EP here → 5.5 m → $E_p = mgh = (65\,kg)(9.8\frac{m}{s^2})(5.5$

$E_p = 35000\,J = E_K$

$V = ?$ ← ø m

all E_K here

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

$V = \sqrt{\frac{2E_K}{m}} = \sqrt{\frac{2(35000\,J)}{65\,kg}} = 33\frac{m}{s}$

Calculate the speed the vaulter must attain to have the necessary kinetic energy. [Show all work, including the equation and substitution with units.] [2]

$V = 33\frac{m}{s}$ WOW!

20)

A 2.00-kilogram object weighs 19.6 newtons on Earth. If the acceleration due to gravity on Mars is 3.71 meters per second^2, what is the object's mass on Mars?

(1) 2.64 kg
(2) 2.00 kg
(3) 19.6 N
(4) 7.42 N

no calculations necessary! $m = m$!

21)

Which quantity is a measure of the rate at which work is done?

(1) energy
(2) power
(3) momentum
(4) velocity

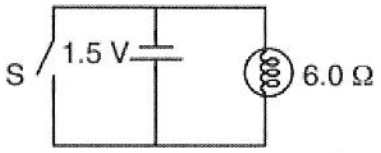
work is energy

$P = \frac{E}{t}$ = rate = E used or produced per unit time

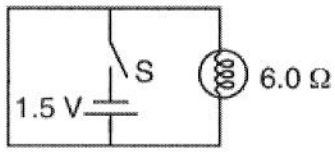
22) V I

A 6.0-ohm lamp requires 0.25 ampere of current to operate. In which circuit below would the lamp operate correctly when switch S is closed?

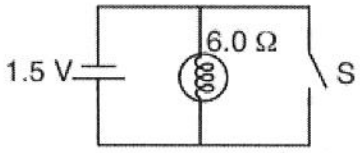
(1)



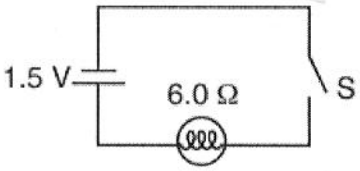
(2)



(3)



(4)



23)

Which row in the chart below correctly pairs a human activity with its impact on the environment?

Row	Human Activity	Impact
(1)	decrease in the use of pesticides	erosion of rock in the soil
(2)	increase in housing developments	improvement in air quality
(3)	increase in human population	reduction in water usage
(4)	decrease in recycling	reduction in amount of available resources

24)

For centuries, humans have used resources from coastal areas and open ocean waters. An example of an activity that would promote the conservation of coastal areas and ocean resources is

(1) harvesting large numbers of different fish species
(2) allowing all-terrain vehicles access to beach areas
(3) creating protected zones of natural grasses and shrubs in beach areas
(4) encouraging the construction of factories along the ocean shoreline

prevents erosion + absorbs pollutants

25)

Some states require shoppers to pay a deposit on certain beverage containers made of plastic and glass. When shoppers return the containers, their deposits are returned to them. How is this system intended to help the environment?

(1) It encourages people to buy products that do not have a deposit.
(2) It reduces the amount of money shoppers actually spend.
(3) It reduces the amount of plastics and glass put into landfills.
(4) It forces manufacturers to reduce air pollution when they are making the containers.

26)

In 2011 and 2012, scientists working on the Banana River in Florida recorded a dramatic increase in the number of manatee deaths. Over the past 50 years, this area has also seen the human population increase by more than 500,000 people. It is believed that pollution from numerous sewage tanks leaked into the water, eliminating the manatees' food source, replacing it with an alga that is toxic to the manatee. This is an example of

(1) a natural cycle in an ecosystem
(2) the effect of increased biodiversity on an ecosystem
(3) direct harvesting in an ecosystem
(4) human actions altering ecosystems with serious consequences

27)

A student performed an experiment to see if water temperature affects the level of activity in aquatic snails. The student set up four tanks with five snails in each tank. All four of the setups were identical in every way, except for the temperature of the water. In order to make the conclusions more valid, the student could

change 1 variable at a time

(1) alter the pH of the water
(2) change the size of the tank
(3) carry out the experiment for a shorter period of time
(4) use a larger number of snails

28)

A broad body of evidence, subject to revisions, supported by different kinds of scientific investigations and often involving the contributions of scientists from different disciplines is necessary to develop

(1) an inference
(2) a fact
(3) a theory
(4) a prediction

29)

A student wanted to investigate the effect of light on the rate of ripening of tomatoes. She set up four pots of the same size with identical amounts of soil, water, and type of tomato plants. Each plant was exposed to a different intensity of light as shown in the table below.

Plant	Light Intensity (lumens)	
1	0	
2	1000	
3	5000	
4	10,000	

To report the final results, which label would be most appropriate for the third column of the data table?

(1) Height of Tomato Plants (cm)
(2) Average Ripening Time (days)
(3) Average Weight of Tomatoes per Plant (grams)
(4) Acidity of Tomatoes (pH)

The independent variable in this experiment is the

(1) type of tomato plant
(2) amount of soil provided
(3) color of tomatoes
(4) light intensity

30)

The units of specific heat are_____?

- J/C
- J/g
- J/g*C
- g/J

31)

What does specific heat measure?

- How much energy it takes to raise 1-g of matter by 1-degrees C.
- How much energy it takes to raise the temperature of matter by 50-degrees.
- How much the temperature goes up.
- How much energy it takes to raise 1-g of matter by 10-degrees C.

32)

A student must use 225 mL of hot water in a lab procedure. Calculate the amount of heat required to raise the temperature of 225 mL of water from 20.0 °C to 100.0 °C.

density of water

$225\,mL\ water \times \frac{1\,g}{1\,mL} = 225\,g$

$Q = mc\Delta T$

$= (225\,g)\left(4.19\frac{J}{g\cdot C}\right)(100.0^\circ C - 20.0^\circ C)$

$Q = 75400\,J$

33)

A 40.0 g sample of ethanol releases 2952 J as it cools from 50.0 °C. Calculate the final temperature of the ethanol.

always solve for ΔT first then do $\Delta T = T_f - T_i$ + rearrange on paper NOT in your head

google cal ethanol $2.46\frac{J}{g\cdot C}$

T↓ — loses E when cools

$\frac{Q}{mc} = \frac{mc\Delta T}{mc} = \frac{2952\,J}{(40.0\,g)\left(2.46\frac{J}{g\cdot C}\right)}$

$\Delta T = 30.0^\circ C$

$\Delta T = T_f - T_i + T_i$

$+T_i$

$-30.0^\circ C = T_f = 20.0^\circ C$

$+50.0^\circ C$

33)

A 40.0 g sample of ethanol releases 2952 J as it cools from 50.0 °C. Calculate the final temperature of the ethanol.

34)

2. **What form of transportation do the <u>members of your household</u> usually take from your Kings County home to their place of employment / school?** *(If no one in your household commutes to work or school, go to question 5)*

Vehicle Type	Member 1	Member 2	Member 3	Member 4	Member 5	Member 6
a) Car / van / truck (1)	○1a	○2a	○3a	○4a	○5a	○6a
b) Car / van / truck (2)	○1b	○2b	○3b	○4b	○5b	○6b
c) School bus	○1c	○2c	○3c	○4c	○5c	○6c
d) Public Transit	○1d	○2d	○3d	○4d	○5d	○6d
e) Taxi	○1e	○2e	○3e	○4e	○5e	○6e
f) Motorcycle	○1f	○2f	○3f	○4f	○5f	○6f
g) Bicycle	○1g	○2g	○3g	○4g	○5g	○6g
h) Walk	○1h	○2h	○3h	○4h	○5h	○6h
i) Other (specify) _____	○1i	○2i	○3i	○4i	○5i	○6i

What is the above table a part of? Explain. = ecological footprint calculation = how much of the Earth's resources your family is using

35)

look up answers in your book

Where does wastewater come from? houses, fact.

How do treatment plants protect our water?

How does a wastewater treatment plant work?

What is sludge?

Who operates treatment plants?

Are there any special challenges in treating wastewater?

What can I do to help?

Where does wastewater come from?

How do treatment plants protect our water?

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Are there any special challenges in treating wastewater?

What can I do to help?

36)

Definitions of in your notes!

i) Contaminant

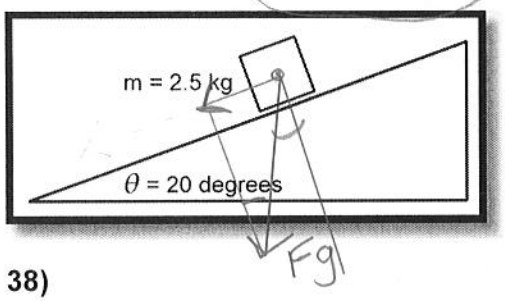
ii) Bioaccumulation

iii) Bioconcentration

iv) Toxicity Threshold

= $F_{\perp}$ = F_{eff} on the ramp = Opp side

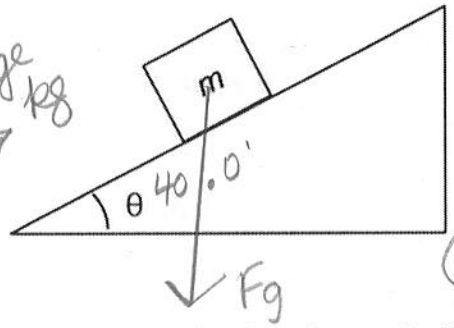
37) What is the horizontal force responsible for pulling the block down the incline?



$F_g = mg$
$= (2.5\,kg)(9.8\frac{m}{s^2})$
$= 25\,N$

SOH
$\sin\theta = \frac{O}{H}$
$H\sin\theta = O$
$(25N)\sin(20°) = O$
$O = 8.6N = F_{eff}$

38)

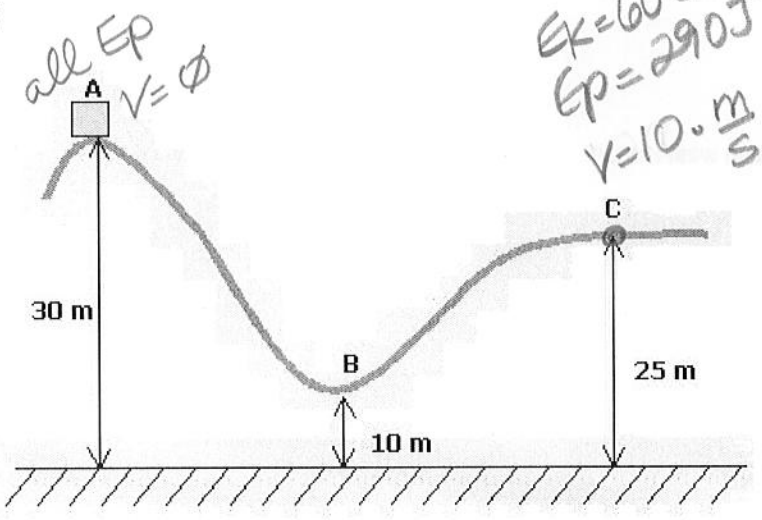


change kg
g →

$H\sin\theta = O$
$F_g\sin\theta = O$
$mg\sin\theta = O$
$(20.0g)(\frac{1kg}{1000g})(9.8\frac{m}{s^2})\sin 40.0° = opp$
$= 0.126N$

A 20.0 g object is placed on an inclined plane at a 40.0 ° angle. What force would be necessary to push the object up the incline at a constant velocity?

39)



all EP
V = Ø

$E_K = 60\,J$
$E_P = 290\,J$
$V = 10.\frac{m}{s}$ at C

$V = \sqrt{\frac{2E_K}{m}} = \sqrt{\frac{2(60}{1.2}}$
$V = 1($ m/s
↑
so $E_K = 60\,J$ at C

What would be the speed of the 1200 g cart at C if it started at rest from A?

↳ 1.2 kg

A) $E_P = mgh$
$= (1.2kg)(9.8\frac{m}{s^2})(30.m)$
$E_P = 350\,J$

C) $E_P = mgh = (1.2kg)(9.8\frac{m}{s^2})(2$ n

$= 290\,J$

$TME = E_P + E_K - E_P$
$-E_P$