科目： 293006
知能類： K1.03 [2.4/2.5]
序號： B925 (P1921)

Refer to the drawing of a centrifugal pump operating curve (see figure below).
Which one of the following determines the general shape of the curve from point D to point B?

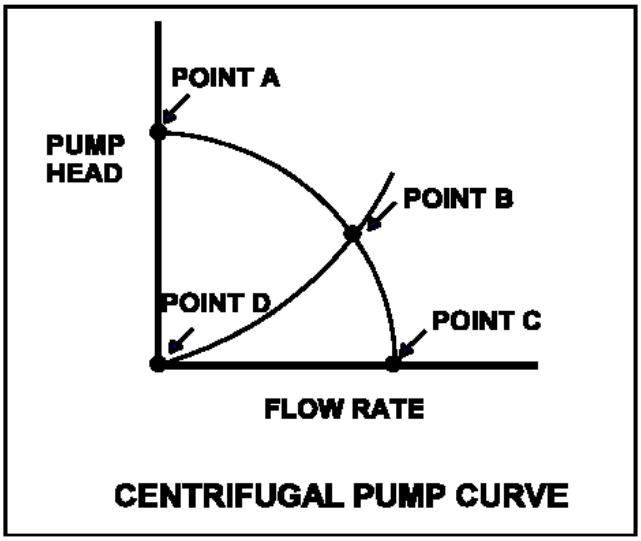
A. Pump flow losses due to the decrease in available net positive suction head as the system flow rate increases
B. Pump flow losses due to back leakage through the clearances between the pump impeller and casing as the D/P across the pump increases
C. The frictional and throttling losses in the piping system as the system flow rate increases
D. The frictional losses between the pump impeller and its casing as the differential pressure (D/P) across the pump increases

ANSWER: C

參考離心泵運轉曲線圖示（見下圖）。下列何者決定了從D到B的曲線形狀？

A. 當系統流量增加時，可用的淨正吸水頭減小，而導致泵流量損失
B. 當泵差壓增加時，在泵葉輪與外殼間隙之反向洩漏所導致泵流量損失
C. 當系統流量增加時，管路系統之摩擦與節流損失
D. 當泵差壓增加時，在泵葉輪與外殼間的摩擦損失

答案： C.



科目： 293006
知能類： K1.03 [2.4/2.5]
序號： B979

Head loss is the...
A. reduction in discharge pressure experienced by a real pump due to slippage.
B. reduction in discharge pressure experienced by a real pump due to mechanical friction.
C. conversion of system fluid pressure and velocity to heat energy as a result of friction.
D. decrease in static pressure in a piping system resulting from decreases in elevation.
ANSWER: C

水頭損失是
A. 泵因為滑移所生之出口壓力減小
B. 泵因為機械摩擦所生之出口壓力減小
C. 因為摩擦而使系統流體壓力與速度轉換成熱能
D. 管路系統中因為高度降低而導致之靜壓減小
答案： C.

科目： 293006
知能類： K1.05 [3.2/3.3]
序號： B79 (P80)

If a valve closure suddenly stops fluid flow, the resulting piping system pressure change is referred to as...
A. cavitation.
B. shutoff head.
C. water hammer.
D. valve chatter.
ANSWER: C

若一閥突然關閉而使流體停止流動，則所導致之管路系統壓力變化稱之為
A. 孔蝕作用
B. 關斷水頭
C. 水錘
D. 閥顫振（chatter）
答案： C.

科目： 293006
知能類： K1.05 [3.2/3.3]
序號： B148 (P2279)

Which one of the following operating practices minimizes the possibility of water hammer?
A. Change valve position as rapidly as possible.
B. Start a centrifugal pump with the discharge valve throttled.
C. Start a positive displacement pump with the discharge valve closed.
D. Vent a system only after initiating system flow.
ANSWER: B

下列何項運轉程序能降低產生水錘現象的可能性？
A. 儘速改變閥位
B. 在出口閥節流情況下啟動離心泵
C. 在出口閥關閉情況下啟動一正排量泵(positive displacement pump)?
D. 只在啟動系統流之後才使系統通氣
答案： B.

科目： 293006
知能類： K1.05 [3.2/3.3]
序號： B279 (P679)

A sudden stop of fluid flow in a piping system, due to rapid closure of an isolation valve, will most likely result in...
A. check valve slamming.
B. pump runout.
C. piping hanger damage.
D. pressurized thermal shock.
ANSWER: C

在一管路系統中，因為一隔離閥的快速關閉而導致流體流動突然停止，最可能導致
A. 止回閥關閉
B. 泵偏轉(runout)
C. 管路吊桿受損
D. 壓力熱震(pressurized thermal shock)
答案： C.

科目： 293006
知能類： K1.05 [3.2/3.3]
序號： B380 (P381)

The major concern with starting a main feedwater pump with downstream fluid in a saturated condition is...
A. cavitation.
B. water hammer.
C. thermal shock.
D. positive reactivity addition.
ANSWER: B

在下游液體處於飽和狀況下啟動一主飼水泵，需要注意
A. 孔蝕作用
B. 水錘現象
C. 熱震現象
D. 正反應度增加
答案： B.

科目： 293006
知能類： K1.05 [3.2/3.3]
序號： B1180 (P2480)

Which one of the following will increase the possibility of water hammer?
A. Opening and closing system valves very slowly
B. Venting liquid systems only after initiating system flow
C. Starting centrifugal pumps with the discharge valve closed
D. Starting positive displacement pumps with the discharge valve open
ANSWER: B

下列何者會增加水錘現象可能性？
A. 非常緩慢地開啟或關閉系統閥門
B. 在液體系統啟動後才進行管路通氣
C. 在出口閥關閉情況下啟動離心泵
D. 在出口閥開啟情況下啟動正排量泵
答案： B.

科目： 293006
知能類： K1.05 [3.2/3.3]
序號： B2081 (P2079)

Which one of the following will minimize the possibility of water hammer?
A. Draining the discharge line of a centrifugal pump after shutdown
B. Draining condensate out of steam lines before and after initiating flow
C. Starting a centrifugal pump with its discharge valve fully open
D. Starting a positive displacement pump with its discharge valve partially closed
ANSWER: B

下列何者將水錘現象可能性降至最低？
A. 在停機之後將離心泵的出口管路內水份排盡
B. 在蒸汽開始流動的前後，將蒸汽管路內凝結水排盡
C. 在出口閥全開情況下啟動一離心泵
D. 在出口閥部分關閉情況下啟動一正排量泵
答案： B.

科目： 293006
知能類： K1.05 [3.2/3.3]
序號： B2679 (P2279)

Which one of the following operating practices minimizes the possibility of water hammer?
A. Change valve positions as rapidly as possible.
B. Start centrifugal pumps with the discharge valve throttled.
C. Start positive displacement pumps with the discharge valve closed.
D. Vent systems only after initiating system flow.
ANSWER: B

下列何種運轉程序能將水錘現象可能性降至最低？
A. 儘速改變閥位
B. 在出口閥節流情況下啟動離心泵
C. 在出口閥關閉情況下啟動正置換閥
D. 只有在開始系統流動後才使系統通氣
答案： B.

科目： 293006
知能類： K1.05 [3.2/3.3]
序號： B2779 (P1879)

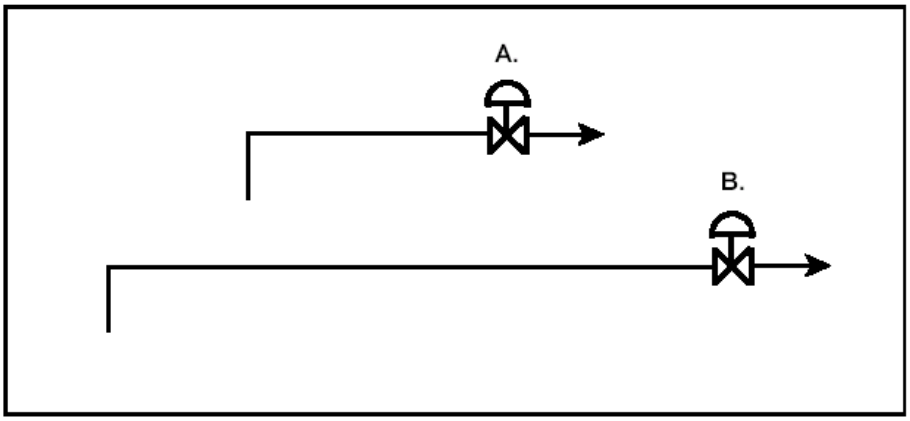
Which one of the following describes why large steam lines are gradually warmed instead of suddenly admitting full steam flow?
A. To minimize the possibility of stress corrosion cracking of the steam lines
B. To minimize the total thermal expansion of the steam lines
C. To minimize the potential for water hammer in the steam lines
D. To minimize the heat loss from the steam lines
ANSWER: C

下列何者描述了為何大型蒸汽管路要漸漸加熱，而非突然增加至全蒸汽流量？
A. 為了使蒸汽管路的應力腐蝕破裂的可能性降至最低
B. 為了使蒸汽管路的總熱膨脹降至最低
C. 為了使蒸汽管路發生水錘的可能性降至最低
D. 為了使蒸汽管路的熱損降至最低
答案： C.

科目： 293006
知能類： K1.05 [3.2/3.3]
序號： B4041 (P4042)

Refer to the drawing of two lengths of 6-inch piping, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing water at 65°F is flowing at 1,000 gpm through each pipe. If the isolation valves suddenly and simultaneously close, valve A and its associated piping will experience a maximum pressure that is _____ the maximum pressure experienced by valve B and its associated piping. The pressure spike will dissipate quicker in the _____ length of pipe.
A. equal to; shorter
B. equal to; longer
C. less than; shorter
D less than; longer
ANSWER: A

參考兩個6英吋管路圖示，兩者均具有相同之自動隔離閥。實際的管路長度正比於其在圖示中之符號。65°F的水以1000gpm流過兩管路。若隔離閥突然且同時關閉，閥A與其附屬管路所生之最大壓力將會____閥B與其附屬管路所生之最大壓力。而管路越____壓力峰值(pressure spike)消散越快。
A. 等於；短
B. 等於；長
C. 小於；短
D. 小於；長
答案： A.



科目： 293006
知能類： K1.06 [2.5/2.6]
序號： B1480

Which one of the following components of a centrifugal pump has the specific primary function of converting the kinetic energy of a fluid into pressure?
A. Volute
B. Impeller
C. Pump shaft
D. Discharge nozzle
ANSWER: A

一離心泵中，下列何者具有將液體動能轉換成為壓力的特定功能？
A. 渦卷(volute)
B. 葉輪(impeller)
C. 泵軸(pump shaft)
D. 出口噴嘴(discharge nozzle)
答案： A.

科目： 293006
知能類： K1.07 [2.5/2.6]
序號： B479

If the discharge valve of an operating ideal positive displacement pump is repositioned from fully open to 75% open, pump head will _____ and pump flow rate will _____.
A. increase; remain the same
B. increase; decrease
C. remain the same; remain the same
D. remain the same; decrease
ANSWER: A

若運轉中之理想正排量泵之出口閥從全開重新定位至75%開啟，則泵水頭將會_____，而泵流量將會_____。
A. 增加；維持不變
B. 增加；減小
C. 維持不變；維持不變
D. 維持不變；減小
答案： A.

科目： 293006
知能類： K1.07 [2.5/2.6]
序號： B1280

Which one of the following describes pump head?
A. The energy added by a pump to increase fluid pressure or velocity
B. The energy added by a pump in excess of shutoff head
C. The fluid energy required to ensure a pump does not cavitate
D. The fluid energy contained at the inlet of a pump
ANSWER: A

下列何者描述了泵水頭？
A. 由泵所加入的能量，用以增加流體壓力或速度
B. 由泵所加入，超過關斷水頭的能量
C. 確保泵不發生孔蝕所需要的液體能量
D. 在泵入口所具有的液體能量
答案： A.

科目： 293006
知能類： K1.07 [2.5/2.6]
序號： B1680 (P3525)

An ideal positive displacement pump is pumping to a system operating at 100 psig. Assume pump speed is constant, zero pump slip, and pump backpressure remains within normal pump operating limits. If system pressure increases to 200 psig, the pump head will _____ and pump flow rate will _____.
A. increase; remain the same
B. increase; decrease
C. remain the same; remain the same
D. remain the same; decrease
ANSWER: A

一理想正排量泵在100psig下運轉。假設泵速度固定，泵滑移為零，而泵背壓維持在正常泵運轉限制內。若系統壓力增加至200psig，則泵水頭將會_____，而泵流量將會_____。
A. 增加；維持不變
B. 增加；減小
C. 維持不變；維持不變
D. 維持不變；減小
答案： A.

科目： 293006
知能類： K1.08 [2.5/2.6]
序號： B198

Which one of the following statements describes application of centrifugal pump laws?
A. Pump head is directly proportional to speed.
B. Power varies as the square of the speed.
C. Pump head varies as the square of the speed.
D. Capacity varies as the cube of the speed.
ANSWER: C

下列何者描述了離心泵的使用定則？
A. 泵水頭與速度成正比
B. 功率隨著速度的平方而變
C. 泵水頭隨著速度的平方而變
D. 容量隨著速度的三次方而變
答案： C.

科目： 293006
知能類： K1.08 [2.5/2.6]
序號： B322 (P325)

Increasing the flow rate from a centrifugal pump by throttling open the discharge valve will cause pump head to...
A. increase and stabilize at a higher value.
B. decrease and stabilize at a lower value.
C. remain constant because pump head is a design parameter.
D increase, then decrease following the pump's efficiency curve.
ANSWER:B

藉由逐漸開大出口閥來增加離心泵的流量，將會導致泵水頭
A. 增加，並在一較高值達到穩定
B. 減小，並在一較低值達到穩定
C. 維持不變，因為泵水頭是設計參數
D. 增加，然後沿著泵的效率曲線而減小
答案： B.

科目： 293006
知能類： K1.08 [2.5/2.6]
序號： B2579

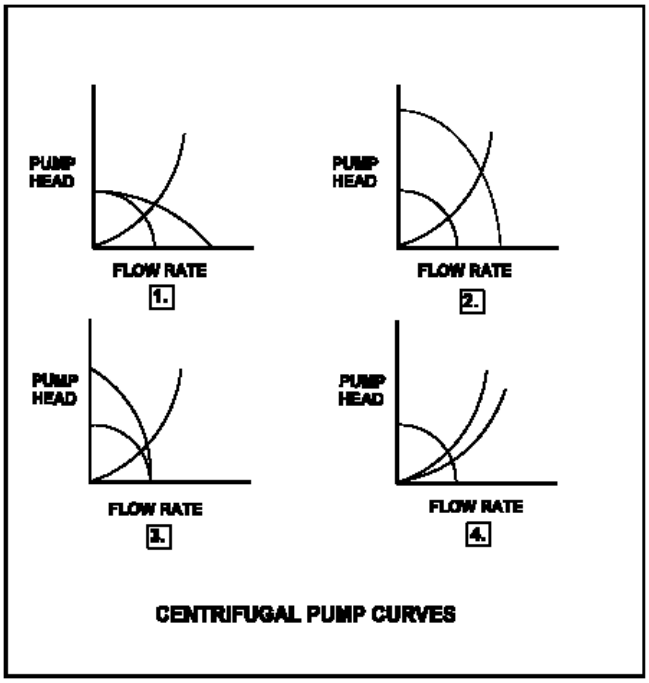
Decreasing the flow rate from a centrifugal pump by throttling the pump discharge valve will cause pump head to...
A. increase and stabilize at a higher value.
B. decrease and stabilize at a lower value.
C. remain constant because pump head is a design parameter.
D. decrease, then increase following the pump's efficiency curve.
ANSWER:A

藉由逐漸關小出口閥來減小離心泵的流量，將會導致泵水頭
A. 增加，並在一較高值達到穩定
B. 減小，並在一較低值達到穩定
C. 維持不變，因為泵水頭是設計參數
D. 減小，然後沿著泵的效率曲線而增加
答案： A.

科目： 293006
知能類： K1.08 [2.5/2.6]
序號： B3579 (P2923)

Refer to the drawing of four centrifugal pump operating curves (see figure below). A two-speed centrifugal pump is operating at fast speed in a cooling water system and discharging through a heat exchanger. The pump is then switched to slow speed. Which set of curves illustrates the initial and final pump operating conditions?
A. 1.
B. 2.
C. 3.
D. 4.
ANSWER: B

參考四條離心泵運轉曲線之圖示（見下圖）。一雙速離心泵在一冷卻水系統中以高速運轉，其出口是接到一熱交換器。然後此泵轉成低速。下列何曲線說明了初始與最終之泵運轉狀況？
A. 1.
B. 2.
C. 3.
D. 4.
答案： B.



科目： 293006
知能類： K1.09 [2.8/2.9]
序號： B80 (P382)

The condition that could cause cavitation of an operating pump is...
A. lowering the suction temperature.
B. throttling the pump suction valve.
C. throttling the pump discharge valve.
D. decreasing the pump speed.
ANSWER: B

會導致運轉中泵發生孔蝕作用的是
A. 降低進水溫度
B. 節流泵進口閥
C. 節流泵出口閥
D. 降低泵速度
答案： B.

科目： 293006
知能類： K1.09 [2.8/2.9]
序號： B280 (P2680)

Cavitation is the formation of vapor bubbles in the _____ pressure area of a pump followed by the _____ of these bubbles within the pump casing.
A. low; expansion
B. low; collapse
C. high; expansion
D. high; collapse
ANSWER: B

孔蝕作用是汽泡在一泵的_____壓區形成，其後這些氣泡會在泵的外殼_____。
A. 低；擴張（expansion）
B. 低；塌陷（collapse）
C. 高；擴張
D. 高；塌陷
答案： B.

科目： 293006
知能類： K1.09 [2.8/2.9]
序號： B1880

Complete the following statement. Pump cavitation occurs when vapor bubbles are formed at the eye of a pump impeller...

A. because the localized flow velocity exceeds sonic velocity for the existing fluid temperature.
B. because the localized pressure exceeds the vapor pressure for the existing fluid temperature.
C. and enter a high pressure region of the pump where they collapse causing damaging pressure pulsations.
D. and are discharged from the pump where they expand into larger bubbles causing damaging pressure pulsations.

ANSWER: C

泵孔蝕發生乃是當汽泡在泵葉輪眼（eye of a pump impeller）形成

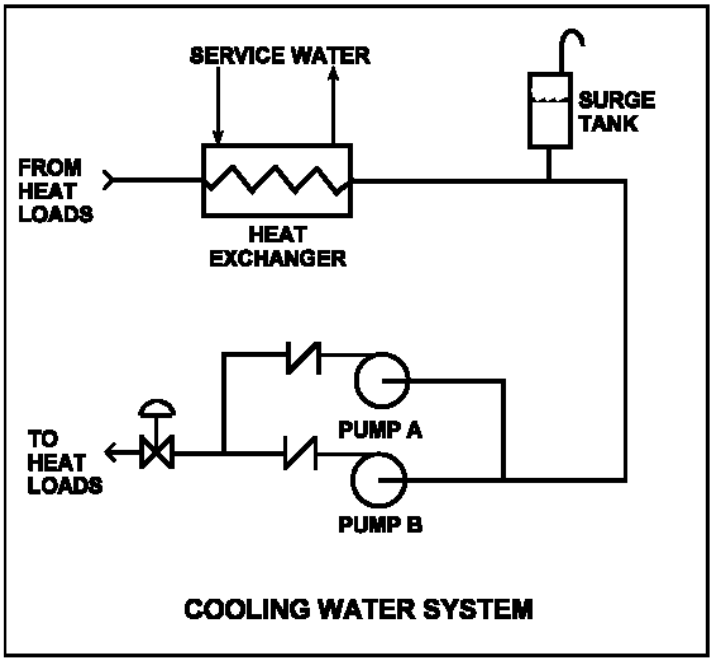
A. 因為在目前液體溫度下，區域流速超過了音速
B. 因為在目前液體溫度下，區域壓力超過了蒸汽壓力
C. 同時進入泵之高壓區域，在此處這些氣泡崩塌(collapse)而導致損害性的壓力脈波(pressure pulsations)
D. 同時被從泵中排放出去，在此處這些氣泡擴張成為較大氣泡而導致損害性的壓力脈波

答案： C.

科目： 293006
知能類： K1.09 [2.8/2.9]
序號： B2680 (P1582)

Refer to the drawing of a cooling water system in which only pump A is operating and the pump discharge valve is currently 50% open (see figure below). If pump A is cavitating, which one of the following will reduce or eliminate cavitation in pump`A?
A. Starting pump B
B. Positioning the discharge valve to 75% open
C. Raising the water level in the surge tank by 2 feet
D. Decreasing heat exchanger service water flow rate by 10%
ANSWER: C

參考冷卻水系統圖示，其中只有泵A正在運轉，而泵出口閥目前為50%開啟（見下圖）。
若泵A發生孔蝕，則下列何者將會降低或消除泵A之孔蝕作用？
A. 啟動泵B
B. 將出口閥位置調整至75%開啟
C. 將湧槽（surge tank）水位提高2英呎
D. 降低熱交換器廠用水流量10%
答案： C.



科目： 293006
知能類： K1.10 [2.7/2.8]
序號： B82

Net positive suction head is the...
A. difference between pump suction pressure and the saturation pressure of the fluid being pumped.
B. difference between the total suction head and the pressure at the eye of the pump.
C. amount of suction pressure required to prevent cavitation.
D. difference between the pump suction pressure and the pump discharge pressure.
ANSWER: A

淨正吸水頭是
A. 泵進口壓力與泵送液體之飽和壓力之差值
B. 總吸水頭與泵眼之壓力之差值
C. 防止孔蝕作用所需之進口壓力
D. 泵進口壓力與泵出口壓力之差值
答案： A.

科目： 293006
知能類： K1.10 [2.7/2.8]
序號： B281

The available net positive suction head of a centrifugal pump...
A. decreases with increased subcooling to the pump.
B. decreases with an increase in pump flow rate.
C. increases as the suction temperature increases.
D. decreases as pump discharge pressure increases.
ANSWER: B

離心泵之可用的淨正吸水頭
A. 隨著泵次冷度增加而減小
B. 隨著泵流量增加而減小
C. 當進水溫度增加時增加
D. 當泵出口壓力增加時減小
答案： B.

科目： 293006
知能類： K1.10 [2.7/2.8]
序號： B1381

Which one of the following sets of parameters directly affects available net positive suction head for the recirculation pumps?
A. Feed water temperature, reactor power, and reactor water level
B. Feed water temperature, reactor pressure, and reactor water level
C. Reactor water level, feed water flow rate, and reactor power
D. Reactor pressure, reactor power, and feed water flow rate
ANSWER: B

對於再循環泵，下列何組參數直接影響到可用的淨正吸水頭？
A. 飼水溫度，反應爐功率，與反應爐水位
B. 飼水溫度，反應爐壓力，與反應爐水位
C. 反應爐水位，飼水流量，與反應爐功率
D. 反應爐壓力，反應爐功率，與飼水流量
答案： B.

科目： 293006
知能類： K1.11 [2.4/2.5]
序號： B381

A single stage centrifugal pump is operating in an open system. Which one of the following is the force caused by subjecting the pump impeller to the unequal pressures that exist at the suction and the discharge of the pump?
A. Axial thrust
B. Radial thrust
C. Kingsbury thrust
D. Journal thrust
ANSWER: A

一單級離心泵在一開放系統中運轉。下列何者是使泵葉輪產生進口與出口間不相等壓力的力？
A. 軸向推力
B. 徑向推力
C. 金氏（Kingsbury）推力
D. Journal（Journal）推力
答案： A.

科目： 293006
知能類： K1.11 [2.4/2.5]
序號： B680

An ac motor-driven centrifugal pump is operating at rated flow and pressure in a cooling water system. A break occurs in the pump discharge piping resulting in a loss of pump backpressure. As a result of the break, the pump will operate at a _____ flow rate and the pump motor will draw _____ electrical power.
A. higher; more
B. higher; less
C. lower; more
D. lower; less
ANSWER: A

一交流馬達驅動離心泵在一冷卻水系統中於額定流量與壓力下運轉。泵出口管路產生破裂，導致泵背壓喪失。由於此破裂，泵將會在一_____流量下運轉，而泵馬達將會吸取_____的電功率。
A. 較高；較多
B. 較高；較少
C. 較低；較多
D. 較低；較少
答案： A.

科目： 293006
知能類： K1.12 [2.9/2.9]
序號： B143 (P279)

A centrifugal water pump is being returned to service after maintenance. However, the operator fails to vent the pump. Compared to normal operations, after the pump is started, the operator will see _____ flow rate and _____ discharge head.
A. higher; lower
B. higher; higher
C. lower; lower
D. lower; higher

一離心水泵在維修之後準備重新運轉。然而，運轉員並未完成泵通氣。與正常運轉相比較，在泵啟動之後，運轉員將會看到_____流量與_____的出口水頭。
A. 較高；較低
B. 較高；較高
C. 較低；較低
D. 較低；較高
答案： C.

科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B22

Which one of the following items is not a characteristic of centrifugal pumps operating in series?

A. The available net positive suction head (NPSH) of the second pump in the series is greater than the NPSH in a single-pump system.
B. The capacity for two pumps operating in series is limited by the capacity of the first pump in the series.
C. The total head for two pumps operating in series is approximately twice the head for a single pump supplying the same capacity.
D. The power required to supply two centrifugal pumps operating in series is less than twice the power required for each of the individual pumps.

ANSWER: D

下列何者並非是串聯運轉之離心泵的特徵？

A. 串聯中之第二泵的可用的淨正吸水頭大於單一泵系統之可用的淨正吸水頭
B. 串聯運轉之兩泵其容量受限於串聯中第一泵的容量
C. 串聯運轉之兩泵之總水頭，大約是同樣容量之單一泵水頭的兩倍
D. 串聯運轉之兩泵所需要之功率小於個別泵的兩倍功率

答案： D.

科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B283

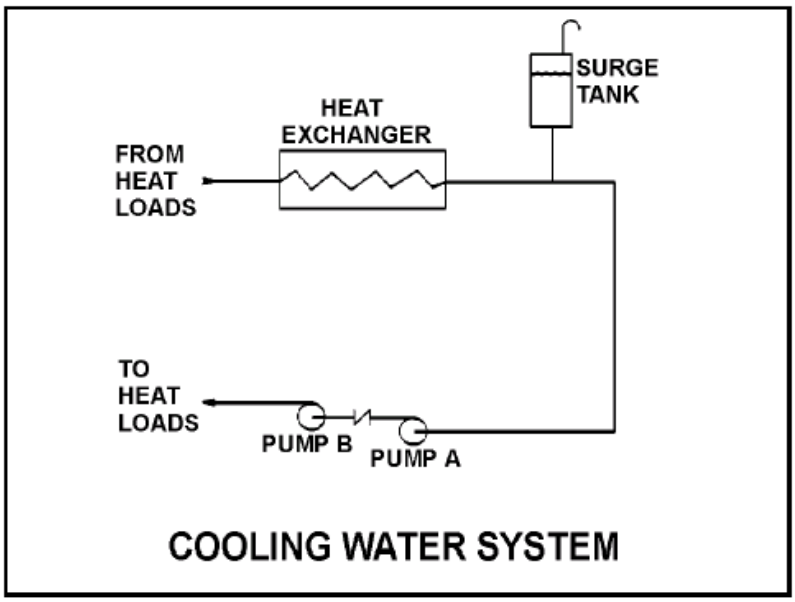
A single-speed centrifugal pump, A, is operating in a closed system. An identical centrifugal pump, B, is started in parallel with pump A. The major effect of operating pump B in parallel with pump A is...
A. increased system pressure.
B. increased system flow rate.
C. decreased system pressure.
D. decreased system flow rate.
ANSWER: B

單速離心泵A正在封閉系統中運轉。一相同之離心泵B與A並聯啟動。泵B與泵A並聯使用的主要效果是
A. 增加系統的壓力
B. 增加系統的流量
C. 降低系統的壓力
D. 降低系統的流量
答案： B.

科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B880

Refer to the drawing of a cooling water system (see figure below). Pumps A and B are identical single-speed centrifugal pumps, but only pump A is operating. Assume real (non-ideal) system and pump operating characteristics. If pump B is started, system flow rate will _____ and the total pump head will _____.
A. increase; increase
B. increase; remain the same
C. remain the same; increase
D. remain the same; remain the same
ANSWER: A

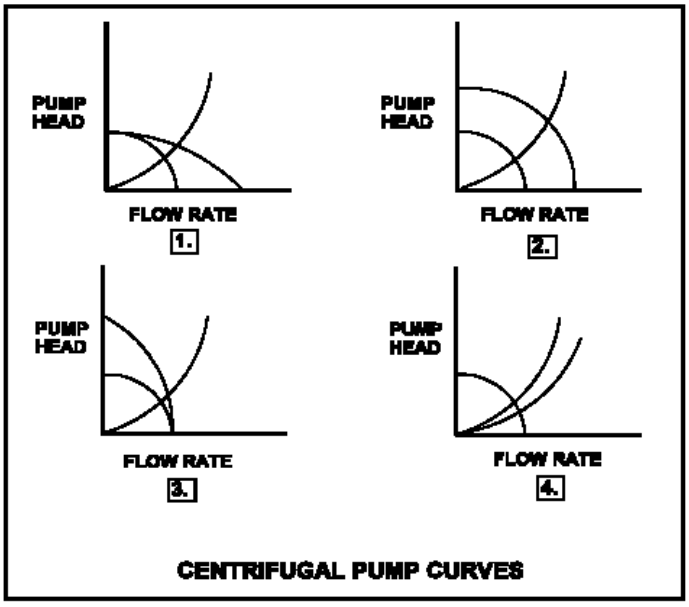
參考一冷卻水系統圖示（見下圖）。泵A與B乃相同之單速離心泵，但是只有泵A在運轉中。假設真實（非理想）系統與泵運轉特徵。若泵B啟動，則系統流量將會_____，而總泵水頭將會_____。
A. 增加；增加
B. 增加；維持不變
C. 維持不變；增加
D. 維持不變；維持不變
答案： A.



科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B1578 (P926)

Refer to the drawing of four sets of centrifugal pump operating curves (see figure below). Each set of curves shows the results of a change in pump/system operating conditions. Two identical constant-speed centrifugal pumps are operating in series in an open system when one pump trips. Which set of operating curves depicts the "before" and "after" conditions described above?
A. 1.
B. 2.
C. 3.
D. 4.
ANSWER: C

參考四組離心泵運轉曲線的圖示（見下圖）。每組曲線顯示了泵/系統運轉狀況的結果。兩相同之定速離心泵在一開放系統中串聯運轉，此時一台泵跳脫。下列何組曲線描述了上述狀況之「前」與「後」的情況？
A. 1.
B. 2.
C. 3.
D. 4.
答案： C.



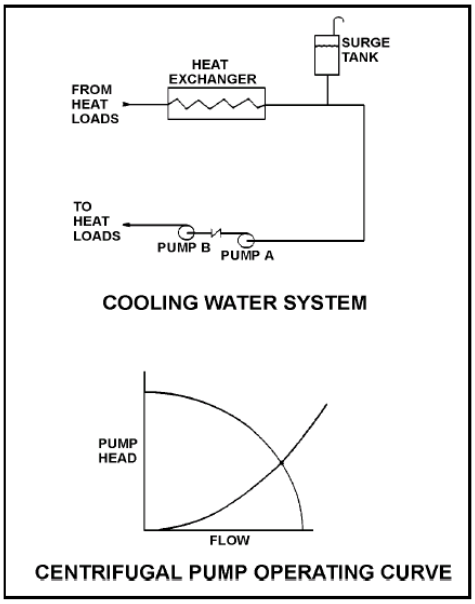
科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B1678

Refer to the drawing of a cooling water system and the associated centrifugal pump operating curve showing two-pump operation (see figure below). Pumps A and B are identical single-speed centrifugal pumps and both pumps are operating. If pump B trips, system flow rate will _____ and common pump discharge pressure will _____.

A. remain the same; decrease
B. decrease; remain the same
C. remain the same; remain the same
D. decrease; decrease
ANSWER: D

參考一顯示兩泵運轉之冷卻水系統與相關之離心泵運轉曲線圖示（見下圖）。泵A與B乃相同之單速離心泵，同時兩泵均在運轉中。若泵B跳脫，系統流量將會_____，而共同泵排放壓力將會_____。

A. 維持不變；減小
B. 減小；維持不變
C. 維持不變；維持不變
D. 減小；減小
答案： D.



科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B1725 (P1784)

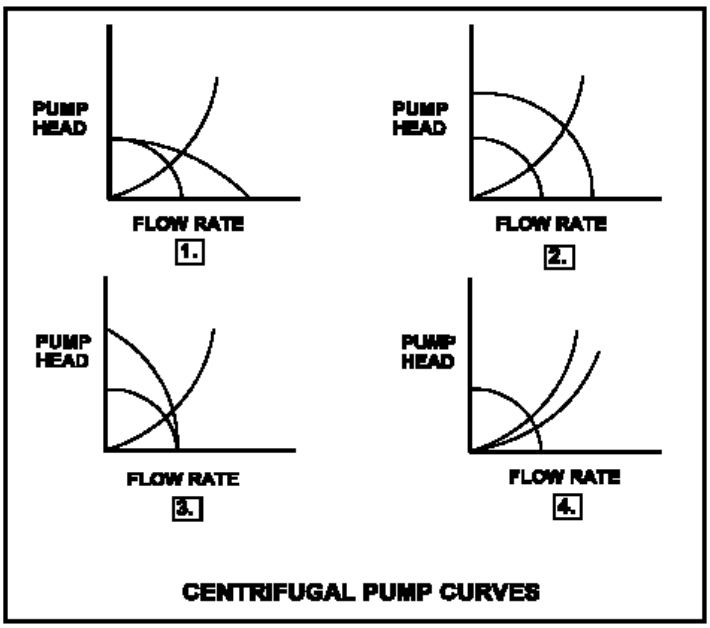
Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1000 psig.
Given the following information:
Centrifugal Pumps
Shutoff head: 1500 psig
Maximum design pressure: 2000 psig
Positive Displacement Pumps
Maximum design pressure: 2000 psig
Which one of the following pump configurations will supply the lowest makeup flow rate to the system if system pressure is at 1700 psig?
A. Two CPs in series
B. Two CPs in parallel
C. One PDP and one CP in series (CP supplying PDP)
D. One PDP and one CP in parallel
ANSWER: B

兩相同之離心泵與兩相同之正排量泵在一通氣儲水槽取水，並且提供補給水給一冷卻水系統。這些泵能夠交互連結提供多重組態。在單一泵排列（alignment）中，每一泵將會在系統壓力1000psig下提供100gpm。根據下列資料：
離心泵
關斷水頭: 1500 psig
最大設計壓力: 2000 psig
正排量泵
最大設計壓力: 2000 psig
若系統壓力為1700psig，則下列何種泵組態將會提供最低的補給水流量?
A. 兩離心泵串聯
B. 兩離心泵併聯
C. 一正排量泵與一離心泵串聯（離心泵供水至正排量泵）
D. 一正排量泵與一離心泵併聯
答案： B.

科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B1780 (P1724)

Refer to the drawing of four centrifugal pump operating curves (see figure below). A centrifugal pump is operating in a closed water system and discharging through a heat exchanger. A second heat exchanger, in parallel with the first, is then placed in service.
Which set of curves illustrates the initial and final operating conditions?
A. 1.
B. 2.
C. 3.
D. 4.
ANSWER: D

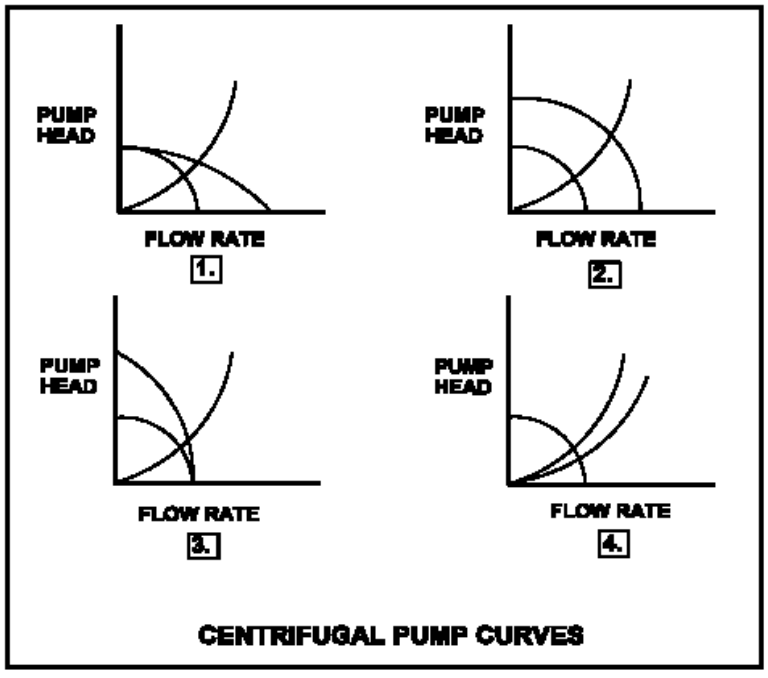
參考四離心泵運轉曲線圖示（見下圖）。一離心泵正在封閉水系統中運轉，其出口是接到一熱交換器。與第一熱交換器併聯之第二熱交換器隨後開始置入使用。下列何曲線代表了初始與最終之運轉狀態？
A. 1.
B. 2.
C. 3.
D. 4.
答案： D.



科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B1878 (P1324)

Refer to the drawing of four centrifugal pump operating curves (see figure below). A centrifugal pump is operating in a cooling water system. Another identical centrifugal pump is started in series with the first. Which set of curves illustrates the resulting change in system parameters?
A. 1.
B. 2.
C. 3.
D. 4.
ANSWER: C

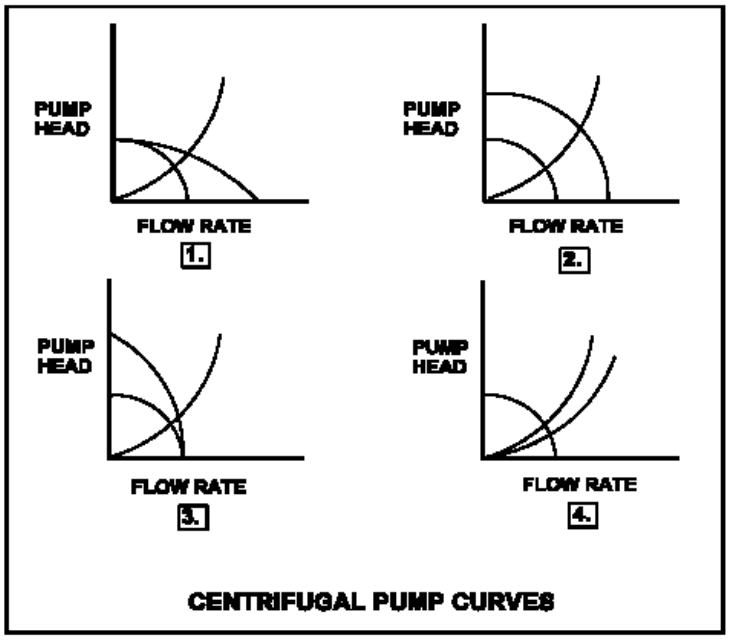
參考四組離心泵運轉曲線圖示（見下圖）。一離心泵正在一冷卻水系統中運轉。另一相同之離心泵接著啟動與第一台泵串聯使用。下列何曲線說明了系統參數所產生的變化？
A. 1.
B. 2.
C. 3.
D. 4.
答案： C.



科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B2279 (P1524)

Refer to the drawing of four sets of centrifugal pump operating curves (see figure below). Each set of curves shows the results of a change in pump/system operating conditions.Two identical constant-speed centrifugal pumps are operating in parallel in an open system when one pump trips. Which set of operating curves depicts the "before" and "after" conditions described above?
A. 1.
B. 2.
C. 3.
D. 4.
ANSWER: A

參考四組離心泵運轉曲線的圖示（見下圖）。每組曲線顯示了泵/系統運轉狀況的變化。兩相同之定速離心泵在一開放系統中並聯運轉，此時發生一台泵跳脫。下列何組曲線描述了上述狀況之「前」與「後」的情況？
A. 1.
B. 2.
C. 3.
D. 4.
答案： A.



科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B2324 (P2383)

Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1200 psig.
Given the following information:
Centrifugal Pumps
Shutoff head: 1500 psig
Maximum design pressure: 2000 psig
Positive Displacement Pumps
Maximum design pressure: 2000 psig
Which one of the following pump configurations will supply the highest makeup flow rate to the system if system pressure is at 500 psig?
A. Two CPs in series
B. Two CPs in parallel
C. Two PDPs in parallel
D. One PDP and one CP in series (CP supplying PDP)
ANSWER: B

兩相同之離心泵與兩相同之正排量泵在一通氣儲水槽取水，並且提供補給水給一冷卻水系統。這些泵能夠交互連結提供多重組態。在單一泵排列（alignment）中，每一台泵將會在系統壓力1200psig下提供100gpm。根據下列資料：
離心泵
關斷水頭: 1500 psig
最大設計壓力: 2000 psig
正排量泵
最大設計壓力: 2000 psig
若系統壓力為500psig，則下列何種泵組態將會提供最高的補給水流量?
A. 兩離心泵串聯
B. 兩離心泵併聯
C. 兩正排量泵併聯
D. 一正排量泵與一離心泵串聯 (離心泵供水至正排量泵)
答案： B.

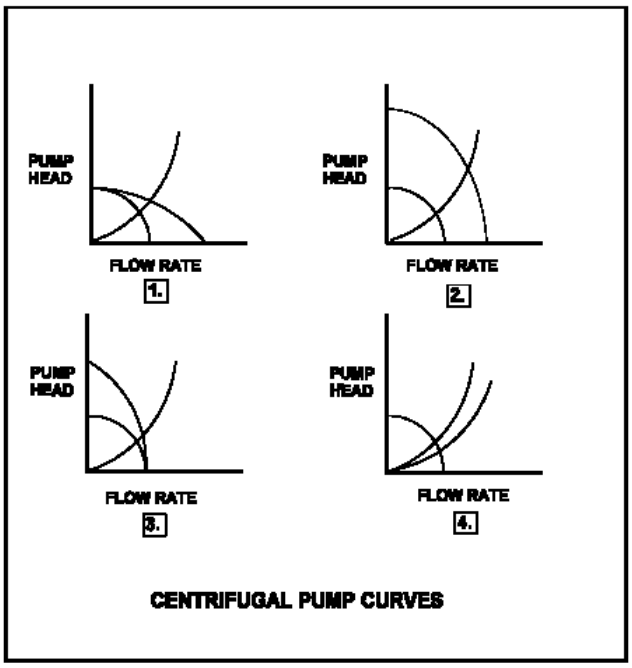
科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B2723 (P2783)
Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1200 psig.
Given the following information:
Centrifugal Pumps
Shutoff head: 1500 psig
Maximum design pressure: 2000 psig
Flow rate with no backpressure: 180 gpm
Positive Displacement Pumps
Maximum design pressure: 2000 psig
Which one of the following pump configurations will supply the highest makeup flow rate to the cooling water system if system pressure is at 1700 psig?
A. Two CPs in series
B. Two CPs in parallel
C. Two PDPs in parallel
D. One PDP and one CP in series (CP supplying PDP)
ANSWER: C

兩相同之離心泵與兩相同之正排量泵從一通氣儲水槽取水，並且提供補給水給一冷卻水系統。這些泵能夠交互連結提供多重組態。在單一泵排列(alignment)中，每一台泵將會在系統壓力1200psig下提供100gpm。根據下列資料：
離心泵
關斷水頭: 1500 psig
最大設計壓力: 2000 psig
無背壓之流量：180gpm
正排量泵
最大設計壓力: 2000 psig
若系統壓力為1700psig，則下列何種泵組態將會提供最高的補給水流量?
A. 兩離心泵串聯
B. 兩離心泵併聯
C. 兩正排量泵併聯
D. 一正排量泵與一離心泵串聯(離心泵供水至正排量泵)
答案： C.

科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B2879 (P2823)

Refer to the drawing of four centrifugal pump operating curves (see figure below).
A two-speed centrifugal pump is operating in low speed in a cooling water system and discharging through a heat exchanger. The pump is then switched to high speed.
Which set of curves illustrates the initial and final operating conditions?
A. 1.
B. 2.
C. 3.
D. 4.
ANSWER: B

參考四組離心泵運轉曲線之圖示（見下圖）。一雙速離心泵正在一冷卻水系統中以低速運轉，其出口是接到一熱交換器。其後此泵調整成高速。下列何組曲線說明初始與最終的運轉狀況？
A. 1.
B. 2.
C. 3.
D. 4.
答案： B.



科目： 293006
知能類： K1.13 [2.6/2.7]
序號： B3681 (P3683)
Two identical single-speed centrifugal pumps (CPs) and two identical single-speed positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,200 psig. Given the following information:
Centrifugal Pumps
Discharge pressure at shutoff head: 1,500 psig
Maximum design pressure: 2,000 psig
Flow rate with no backpressure: 180 gpm
Positive Displacement Pumps
Maximum design pressure: 2,000 psig
Which one of the following makeup water pump configurations will supply the highest initial
flow rate to a cooling water system that is drained and depressurized?
A. Two CPs in series
B. Two CPs in parallel
C. Two PDPs in parallel
D. One PDP and one CP in series (CP supplying PDP)
兩相同之單速離心泵與兩相同之單速正排量泵從一通氣儲水槽取水，並且提供補給水給一冷卻水系統。這些泵能夠交互連結提供多重組態。在單一泵排列中，每一台泵將會在系統壓力1200psig下提供100gpm。根據下列資料：
離心泵
關斷水頭: 1500 psig
最大設計壓力: 2000 psig
無背壓之流量：180gpm
正排量泵
最大設計壓力: 2000 psig
則下列何種補給水泵組態將會提供最高的初始補給水流量給一已減壓洩水的冷卻水系統?
A. 兩離心泵串聯
B. 兩離心泵併聯
C. 兩正排量泵併聯
D. 一正排量泵與一離心泵串聯(離心泵供水至正排量泵)
答案： B.

科目： 293006
知能類： K1.19 [2.7/2.9]
序號： B1181 (P1222)

A nuclear power plant is operating at full power when a 200 gpm reactor coolant leak occurs, which results in a reactor scram and initiation of emergency coolant injection. Reactor vessel pressure stabilizes at 900 psia and all centrifugal injection pumps are operating with all pump miniflow paths isolated. The shutoff heads for the pumps are as follows:
High pressure coolant injection (HPCI) pumps: 1,200 psia
Low pressure coolant injection (LPCI) pumps: 200 psia
Which pumps are currently threatened for operability and why?
A. LPCI pumps due to pump overheating
B. LPCI pumps due to motor overheating
C. HPCI pumps due to pump overheating
D. HPCI pumps due to motor overheating
ANSWER: A

一核能電廠正以全功率運轉，此時反應爐冷卻水發生200gpm的洩漏，因而導致反應爐急停，並引發緊急注水。反應爐槽壓力穩定於900psia，而所有的離心注水泵在所有最小流量旁通管路(miniflow paths)隔離情況下運轉。此泵的關斷水頭如下：
高壓注水（HPCI）泵：1200psia
低壓注水（LPCI）泵：200psia
下列何泵目前會有運轉性的問題，理由為何？
A. LPCI泵，因為泵過熱
B. LPCI泵，因為馬達過熱
C. HPCI泵，因為泵過熱
D. HPCI泵，因為馬達過熱
答案： A.

科目： 293006
知能類： K1.19 [2.7/2.9]
序號： B3281 (N/A)

A nuclear power plant is operating at full power when a 200 gpm reactor coolant leak occurs, which results in a reactor scram and initiation of emergency coolant injection. Reactor vessel pressure stabilizes at 900 psia and all injection pumps are operating with all pump miniflow paths isolated. The shutoff heads for the pumps are as follows:
High pressure coolant injection (HPCI) pumps: 800 psia
Low pressure coolant injection (LPCI) pumps: 200 psia
Which pumps are currently threatened for operability and why?
A. Only the LPCI pumps due to pump overheating
B. All LPCI and HPCI pumps due to pump overheating
C. Only the HPCI pumps due to motor overheating
D. All LPCI and HPCI pumps due to motor overheating
ANSWER: B

一核能電廠正以全功率運轉，此時反應爐冷卻水發生200gpm的洩漏，因而導致反應爐急停，並引發緊急注水。反應爐槽壓力穩定於900psia，而所有的離心注水泵在所有最小流量旁通管路(miniflow paths)隔離情況下運轉。此泵的關斷水頭如下：
高壓注水（HPCI）泵：800psia
低壓注水（LPCI）泵：200psia
下列何泵目前會有運轉性的問題，理由為何？
A. 只有LPCI，因為泵過熱
B. 所有的LPCI與HPCI，因為泵過熱
C. 只有HPCI，因為馬達過熱
D. 所有的LPCI與HPCI，因為馬達過熱
答案： B.

科目： 293006
知能類： K1.21 [2.4/2.6]
序號： B1980 (N/A)

A reactor heatup is in progress. Which one of the following reactor temperatures will result in a main steam line pressure of approximately 530 psig?
A. 462^{o}F
B. 468^{o}F
C. 476^{o}F
D. 484^{o}F
ANSWER: C

一反應爐在升溫過程中，下列何反應爐溫度將會導致主蒸汽管路壓力達到約530psig？
A. 462^{o}F
B. 468^{o}F
C. 476^{o}F
D. 484^{o}F
答案： C.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B383 (P380)

An 85 gpm leak to atmosphere has developed from a cooling water system that is operating at 100 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 50 psig?
A. 33.3 gpm
B. 42.5 gpm
C. 51.7 gpm
D. 60.1 gpm
ANSWER: D

一於100psig下運轉之冷卻水系統發生洩漏至大氣，洩漏率為85gpm。當系統壓力降低至50psig時，洩漏率約為多少？
A. 33.3 gpm
B. 42.5 gpm
C. 51.7 gpm
D. 60.1 gpm
答案： D.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B681 (P680)

A 55 gpm leak to atmosphere has developed from a cooling water system that is operating at 100psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 50 psig?
A. 27.5 gpm
B. 31.8 gpm
C. 38.9 gpm
D. 43.4 gpm
ANSWER: C

一於100psig下運轉之冷卻水系統發生洩漏至大氣，洩漏率為55gpm。當系統壓力降低至50psig時，洩漏率約為多少？
A. 27.5 gpm
B. 31.8 gpm
C. 38.9 gpm
D. 43.4 gpm
答案： C.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B1783 (P1779)

A 100 gpm leak to atmosphere has developed from a cooling water system that is operating at 45 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 30 psig?
A. 25 gpm
B. 50 gpm
C. 67 gpm
D. 82 gpm
ANSWER: D

一於45psig下運轉之冷卻水系統發生洩漏至大氣，洩漏率為100gpm。當系統壓力降低至30psig時，洩漏率約為多少？
A. 25 gpm
B. 50 gpm
C. 67 gpm
D. 82 gpm
答案： D.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B1979 (P1580)

A 60 gpm leak to atmosphere has developed from a cooling water system that is operating at 150 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 75 psig?
A. 15 gpm
B. 30 gpm
C. 42 gpm
D. 53 gpm
ANSWER: C

一於150psig下運轉之冷卻水系統發生洩漏至大氣，洩漏率為60gpm。當系統壓力降低至75psig時，洩漏率約為多少？
A. 15 gpm
B. 30 gpm
C. 42 gpm
D. 53 gpm
答案： C.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B2080 (P2080)

An 80 gpm leak to atmosphere has developed from in a cooling water system that is operating at 100 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 75 psig?
A. 69 gpm
B. 60 gpm
C. 51 gpm
D. 40 gpm
ANSWER: A

一於100psig下運轉之冷卻水系統發生洩漏至大氣，洩漏率為80gpm。當系統壓力降低至75psig時，洩漏率約為多少？
A. 69 gpm
B. 60 gpm
C. 51 gpm
D. 40 gpm
答案： A.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B2281 (P2282)

Water at 90^{o}F and 50 psig is flowing through a 10-inch diameter pipe at 100 lbm/sec. The pipe then splits into two pipes, a 4-inch diameter pipe and an 8-inch diameter pipe. Disregarding any flow restrictions other than pipe size, which one of the following lists the approximate flow rates through the 4-inch and 8-inch diameter pipes?

4-inch Pipe (lbm/sec)	8-inch Pipe (lbm/sec)
A. 20	80
B. 25	75
C. 30	70
D. 33	67

ANSWER: A

溫度及壓力分別為90^{o}F及50psig的水，以100lbm/sec流量流經一10英吋直徑管路。此管路分流至兩條管路，一條直徑4英吋，一條直徑8英吋。除了管路大小之外，任何會限制水流的因素均不用考慮，下列何者約為4英吋與8英吋直徑管路的流量？

4英吋管路 (lbm/sec)	8英吋管路 (lbm/sec)
A. 20	80
B. 25	75
C. 30	70
D. 33	67

答案： A.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B2381 (P2379)

A 60 gpm leak to atmosphere has developed from a cooling water system that is operating at 150 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 100 psig?
A. 27 gpm
B. 35 gpm
C. 40 gpm
D. 49 gpm
ANSWER: D

一於150psig下運轉之冷卻水系統發生洩漏至大氣，洩漏率為60gpm。當系統壓力降低至100psig時，洩漏率約為多少？
A. 27 gpm
B. 35 gpm
C. 40 gpm
D. 49 gpm
答案： D.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B2479 (P2481)

Water at 90EF and 50 psig is flowing through a 10-inch diameter pipe at 100 lbm/sec. The pipe then splits into two pipes, a 3-inch diameter pipe and a 6-inch diameter pipe. Disregarding any flow restrictions other than pipe size, which one of the following lists the approximate flow rates through the 3-inch and 6-inch diameter pipes? (Assume fluid velocity is the same in each pipe.)

3-inch Pipe (lbm/sec)	6-inch Pipe (lbm/sec)
A. 10	90
B. 20	80
C. 25	75
D. 33	67

ANSWER: B

溫度及壓力分別為90^{o}F及50psig的水，以100lbm/sec流量流經一10英吋直徑管路。此管路分流至兩條管路，一條直徑3英吋，一條直徑6英吋。除了管路大小之外，任何會限制水流的因素均不用考慮，下列何者約為3英吋與6英吋直徑管路的流量（假設每一條管路的流體速度相同）？

3英吋管路 (lbm/sec)	6英吋管路 (lbm/sec)
A. 10	90
B. 20	80
C. 25	75
D. 33	67

答案： B.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B2581 (P2582)

Water at 90EF and 50 psig is flowing through a 10-inch diameter pipe at 100 lbm/sec. The pipe then splits into two pipes, a 6-inch diameter pipe and an 8-inch diameter pipe. Disregarding any flow restrictions other than pipe size, which one of the following lists the approximate flow rates through the 6-inch and 8-inch diameter pipes? (Assume fluid velocity is the same in each pipe.)

6-inch Pipe (lbm/sec)	8-inch Pipe (lbm/sec)
A. 24	76
B. 32	68
C. 36	64
D. 40	60

ANSWER: C

溫度及壓力分別為90^{o}F及50psig的水，以100lbm/sec流量流經一10英吋直徑管路。此管路分流至兩條管路，一條直徑6英吋，一條直徑8英吋。除了管路大小之外，不論任何流體限制，下列何者約為6英吋與8英吋直徑管路的流量（假設每一條管路的流體速度相同）？

6英吋管路 (lbm/sec)	8英吋管路 (lbm/sec)
A. 24	76
B. 32	68
C. 36	64
D. 40	60

答案： C.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B2781 (P2779)

An 80 gpm leak to atmosphere has developed in a cooling water system that is operating at 150 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 75 psig?
A. 20 gpm
B. 40 gpm
C. 49 gpm
D. 57 gpm
ANSWER: D

一於150psig下運轉之冷卻水系統發生洩漏至大氣，洩漏率為80gpm。當系統壓力降低至75psig時，洩漏率約為多少？
A. 20 gpm
B. 40 gpm
C. 49 gpm
D. 57 gpm
答案： D.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B2981 (P1679)

A 100 gpm leak to atmosphere has developed from a cooling water system that is operating at 60 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 20 psig?
A. 33.3 gpm
B. 53.0 gpm
C. 57.7 gpm
D. 70.7 gpm
ANSWER: C

一於60psig下運轉之冷卻水系統發生洩漏至大氣，洩漏率為100gpm。當系統壓力降低至20psig時，洩漏率約為多少？
A. 33.3 gpm
B. 53.0 gpm
C. 57.7 gpm
D. 70.7 gpm
答案： C.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B3181 (P3080)

A 75 gpm leak to atmosphere has developed from a cooling water system that is operating at 100 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 80 psig?
A. 26.5 gpm
B. 38.9 gpm
C. 56.4 gpm
D. 67.1 gpm
ANSWER: D

一於100psig下運轉之冷卻水系統發生洩漏至大氣，洩漏率為75gpm。當系統壓力降低至80psig時，洩漏率約為多少？
A. 26.5 gpm
B. 38.9 gpm
C. 56.4 gpm
D. 67.1 gpm
答案： D.

科目： 293006
知能類： K1.29 [2.6/2.7]
序號： B3581

A reactor shutdown has been performed because of leakage from the main condenser cooling water system into the main condenser through a tube leak.
Given the following initial conditions:
Main condenser pressure is 1.0 psia.
Main condenser cooling water system pressure is 10 psig.
Main condenser cooling water inlet temperature is 60^{o}F.
Cooling water leak rate into the main condenser is 100 gpm.
If the main condenser is brought to atmospheric pressure, with no changes to the main condenser cooling water system parameters, what will be the approximate rate of cooling water leakage into the main condenser?
A. 17 gpm
B. 28 gpm
C. 42 gpm
D. 65 gpm
ANSWER: D

一反應爐發生停機，原因為主冷凝器冷卻水系統管路洩漏至主冷凝器。根據如下初始狀況：
主冷凝器壓力為1.0psia
主冷凝器冷卻水系統壓力為10psig
主冷凝器冷卻水進口溫度為60^{o}F
進入主冷凝器的冷卻水洩漏率為100gpm
若主冷凝器之壓力為大氣壓力時，在不改變主冷凝器冷卻水系統參數的情況下，冷卻水洩漏至主冷凝器的洩漏率大約為多少？
A. 17 gpm
B. 28 gpm
C. 42 gpm
D. 65 gpm
答案： D.

科目/題號：293006/1 (2016新增)
知能類：K1.05 [3.2/3.3]
序號：B6241 (P6242)

Refer to the drawing of two lengths of 16-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing.
Water is flowing at 10,000 gpm through each pipe when both isolation valves instantly close.
Consider two cases:

Case 1: The water temperature upstream of both valves is 65°F.
Case 2: The water temperature is 65°F upstream of valve A, and 85°F upstream of valve B.

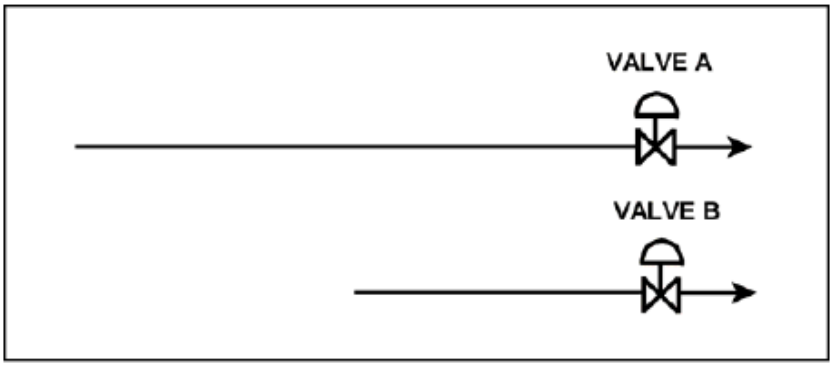
For which case(s), if any, will valve A experience a pressure spike that is greater than the pressure spike at valve B?
A. Case 1 only
B. Case 2 only
C. Both cases
D. Neither case
ANSWER: B.

參考圖示兩段直徑為16英寸的管路，各具有相同的自動隔離閥。管路實際長度與圖示成正比。
當瞬間關閉這兩個隔離閥時，各段管路皆有水以10,000gpm流過，考慮以下兩種狀況：

狀況1：這兩個閥上游的水溫是65°F
狀況2：閥A上游的水溫是65°F，閥B上游的水溫是85°F

在何狀況下閥A會承受比閥B更高的壓力突波？
A.僅狀況1
B.僅狀況2
C.兩者都會
D.兩者都不會

答案： B



科目/題號：293006/2 (2016 新增)
知能類：K1.05 [3.2/3.3]
序號：B6741 (P6742)

Refer to the drawing of two lengths of 16-inch diameter pipe, each containing an identical automatic isolation valve. The actual pipe lengths are proportional to their symbols in the drawing.
Water is flowing at 10,000 gpm through each pipe when both isolation valves instantly close.
Consider two cases:

Case 1: The water temperature upstream of both valves is 65°F.

Case 2: The water temperature is 85°F upstream of valve A, and 65°F upstream of valve B.

For which case(s), if any, will valve A experience a pressure spike that is greater than the pressure spike at valve B?
A. Case 1 only
B. Case 2 only
C. Both cases
D. Neither case
ANSWER: D.

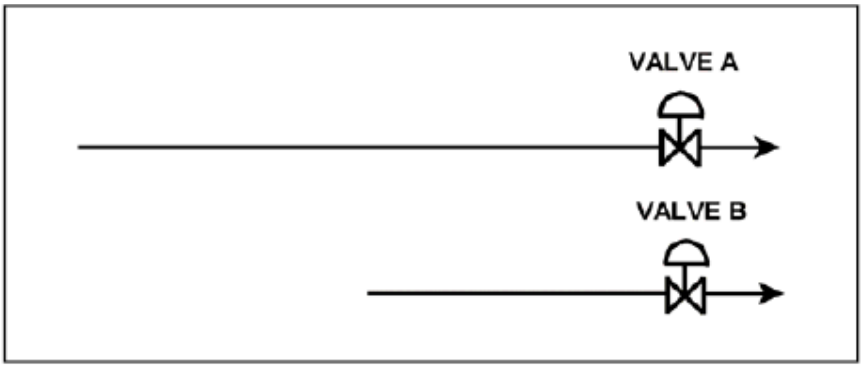
參考圖示兩段直徑為16英寸的管路，各具有相同的自動隔離閥。管路實際長度與圖示成正比。
當瞬間關閉這兩個隔離閥時，各段管路皆有水以10,000gpm流過，考慮以下兩種狀況：

狀況1：這兩個閥上游的水溫是65°F

狀況2：閥A上游的水溫是85°F，閥B上游的水溫是65°F

在何狀況下閥A會承受比閥B更高的壓力突波？
A.僅狀況1
B.僅狀況2
C.兩者都會
D.兩者都不會

答案： D



科目/題號：293006/3 (2016 新增)
知能類：K1.05 [3.2/3.3]
序號：B7620 (P7620)

Which one of the following will result in a higher probability and/or severity of water hammer in a flowing water system?
A. Gradual pipe bends rather than sharp pipe bends.
B. Shorter pipe lengths rather than longer pipe lengths.
C. Lower initial flow rates rather than higher initial flow rates.
D. Shorter valve stroke times rather than longer valve stroke times.
ANSWER: D.

下面何者會導致一流體系統有較高可能性與/或嚴重性的水錘效應？
A.平緩的彎管，而不是急劇的彎管
B.長度較短的管，而不是長度較長的管
C.初始流量率較低者，而不是初始流量率較高者
D.閥行程時間較短者，而不是閥行程時間較長者

答案： D

科目/題號：293006/4 (2016 新增)
知能類：K1.13 [2.6/2.7]
序號：B4342 (P4343)

Two identical single-speed centrifugal pumps (CPs) and two identical single-speed positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1,200 psig. Given the following information:

Centrifugal Pumps
Discharge pressure at shutoff head = 1,500 psig
Maximum design pressure = 2,000 psig
Flow rate with no backpressure = 180 gpm
Positive Displacement Pumps
Maximum design pressure = 2,000 psig

Which one of the following pump configurations will supply the lowest initial flow rate of makeup water to a cooling water system that is drained and depressurized?
A. Two CPs in series
B. Two CPs in parallel
C. Two PDPs in parallel
D. One CP and one PDP in series (CP supplying PDP)
ANSWER: D.

兩台相同單速離心泵(CP)和兩台相同單速正排量泵(PDP)，從排氣儲水槽取水，並提供補水至冷卻水系統。這些泵也能夠被交叉連接並提供多樣配置。以單泵列置時，每台泵可在系統1,200psia壓力下提供100gpm流量率。
已知以下參數：

離心泵：
關斷水頭的出口壓力=1,500 psig
最大設計壓力=2,000 psig
無背壓流量率=180 gpm
正排量泵：
最大設計壓力=2,000 psig

以下何者泵配置可以最低的初始流量率提供補水至一個洩水、洩壓的冷卻水系統？
A.兩台CP串聯
B.兩台CP並聯
C.兩台PDPs並聯
D.一台CP與一台PDP串聯(CP供水至PDP)

答案： D

科目/題號：293006/5 (2016 新增)
知能類：K1.21 [2.4/2.6]
序號：B7649 (P7649)

If the quality of a flowing steam-water mixture is known, what additional information, if any, is needed to determine the percent moisture content of the steam-water mixture?
A. The mass flow rate of the mixture.
B. The specific volume of the mixture.
C. The pressure and/or temperature of the mixture.
D. No additional information is needed.
ANSWER: D.

如果已知一流動的蒸汽-水混合物的乾度，若還有需要是什麼額外資訊，以確定蒸汽-水混合物中的水份含量？
A.混合物的質量流量率
B.混合物的比容
C.混合物的溫度和/或壓力
D.不需要其他資訊

答案： D

科目/題號：293006/6 (2016 新增)
知能類：K1.21 [2.4/2.6]
序號：B7690

A nuclear power plant is initially operating at steady-state 100 percent power. If an unplanned load rejection causes the main generator load to rapidly decrease to 90 percent, the voids in the two-phase flow in the reactor core will initially _____; which causes indicated reactor vessel water level (measured in the downcomer) to initially _____.
A. shrink; decrease
B. shrink; increase
C. expand; decrease
D. expand; increase
ANSWER: A.

核能電廠初始穩定運轉在功率100％。如果一非計劃性棄載導致主發電機負載迅速降低至90％時，則反應器爐心雙相流中的空泡將開始_____；這將導致反應器水位指示（在降流區量測）開始_____。
A.收縮；降低
B.收縮；昇高
C.膨脹；降低
D.膨脹；昇高

答案： A

科目/題號：293006/7 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B4242 (P4243)

Refer to the drawing of a venturi in a main steam line (see figure below). The venturi inlet and outlet pipe diameters are equal.
A main steam line break downstream of the venturi causes the main steam mass flow rate through the venturi to increase. Soon, the steam reaches sonic velocity in the throat of the venturi.
How will the main steam mass flow rate through the venturi be affected as the steam pressure downstream of the venturi continues to decrease?

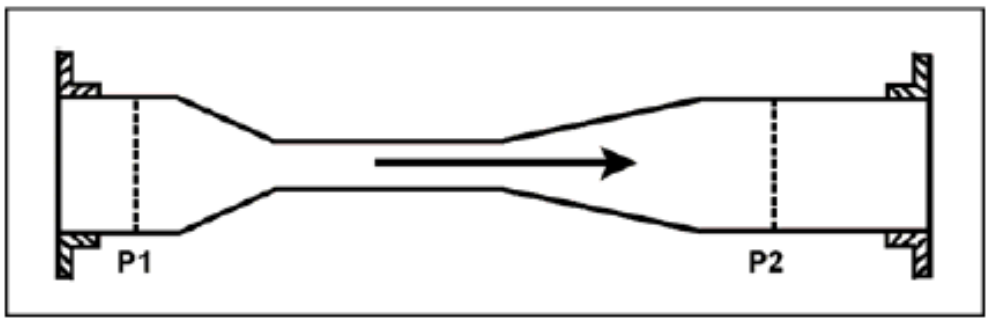
A. It will continue to increase at a rate that is dependent on the steam velocity in the throat of the venturi.
B. It will continue to increase at a rate that is dependent on the differential pressure (P1 - P2) across the venturi.
C. It will not continue to increase because the steam velocity cannot increase above sonic velocity in the throat of the venturi.
D. It will not continue to increase because the differential pressure (P1 - P2) across the venturi cannot increase further once the steam reaches sonic velocity in the throat of the venturi.

ANSWER: C.

參考主蒸汽管路中的文氏管圖(見下圖)。文氏管的入口和出口管徑是相等的。
當文氏管下游的主蒸汽管路破裂會使經過文氏管主蒸汽質量流量率增加，並會迅速讓文氏管喉部蒸汽流速達到音速。
當文氏管下游蒸汽壓力繼續下降時，通過文氏管的主蒸汽質量流量率將會受到如何的影響？

A.它會依據文氏管喉部的蒸汽速率繼續增加
B.它將依據文氏管前後的壓差(P1 - P2)率繼續增加
C.它不會繼續增加，因為文氏管喉部的蒸汽速度不能增加到高於音速
D.它不會繼續增加，因為一旦文氏管喉部的蒸汽流速達到音速，文氏管前後的壓差(P1- P2)就無法進一步增加

答案： C



科目/題號：293006/8 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B4542 (P4543)

Refer to the drawing of a main water header that splits into two parallel headers (see figure below).
Header A has a 2-inch diameter and header B has a 3-inch diameter. The velocity of the water in both headers is the same.
If the main water header has a flow rate of 500 gpm, what is the approximate flow rate in each of the parallel headers?

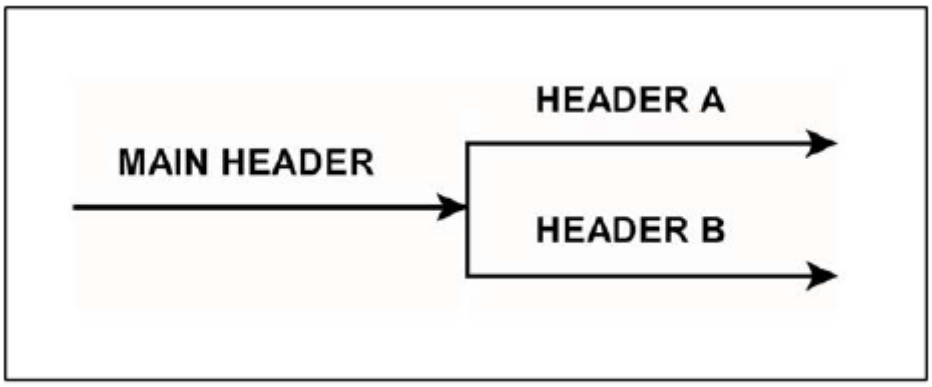
	Header A (gpm)	Header B (gpm)
A.	125	375
B.	154	346
C.	200	300
D.	222	278

ANSWER: B.

參考一主水集管分成兩個平行集管圖(見下圖)。集管A直徑為2-inch且集管B直徑為3-inch。兩個集管中水的速度是相同的。
如果主集管流量率為500gpm，則兩個平行集管的流量率各約為多少？

	集管A (gpm)	集管B (gpm)
A.	125	375
B.	154	346
C.	200	300
D.	222	278

答案： B



科目/題號：293006/9 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B4642 (P4643)

A length of pipe in a cooling water system uses a reducer fitting to decrease the pipe diameter from 6 inches to 4 inches. The flow rate in the 6-inch diameter section of pipe is 200 gpm. What is the flow rate in the 4-inch diameter section of pipe?
A. 133 gpm
B. 200 gpm
C. 300 gpm
D. 450 gpm
ANSWER: B.

在一冷卻水系統的某段管，安裝一漸縮管使管徑從6-inch減到4-inch。在6-inch管段的流量率為200 gpm。則在4-inch管段的流量率為多少？
A. 133 gpm
B. 200 gpm
C. 300 gpm
D. 450 gpm

答案： B

科目/題號：293006/10 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B5342 (P5342)

A heat exchanger has the following initial cooling water inlet temperature and differential pressure (ΔP) parameters:
Inlet Temperature = 70°F
Heat Exchanger ΔP = 10 psi
Six hours later, the current heat exchanger cooling water parameters are:
Inlet Temperature = 85°F
Heat Exchanger ΔP = 10 psi
In comparison to the initial cooling water mass flow rate, the current mass flow rate is...
A. lower, because the density of the cooling water has decreased.
B. higher, because the velocity of the cooling water has increased.
C. the same, because the changes in cooling water velocity and density offset.
D. the same, because the heat exchanger cooling water ΔP is the same.
ANSWER: A.

熱交換器其初始冷卻水入口溫度和壓力差（ΔP）參數如下：
進口溫度=70°F
熱交換器壓差ΔP= 10psi
6 小時後，該熱交換器的冷卻水的參數為：
進口溫度=85°F
熱交換器壓差ΔP= 10psi
相較於初始冷卻水的質量流率，目前的質量流量率為何？
A.較低，因為冷卻水的密度已降低
B.較高，因為冷卻水的流速已提高
C.相同，因為冷卻水的流速與密度的變化相互抵消
D.相同，因為熱交換器冷卻水的壓差ΔP相同

答案： A

科目/題號：293006/11 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B5542 (P5543)

A vented water storage tank contains 60 feet of water at 70°F. A cracked weld at the bottom of the tank results in a leak rate of 12 gpm. If makeup water flow rate is 5 gpm, at what water level will the tank stabilize?
A. 38.7 feet
B. 25.0 feet
C. 10.4 feet
D. 0.0 feet
ANSWER: C.

一個排氣儲水槽內有70°F，60 feet高的水。在水槽底部有一銲道裂縫造成12gpm的洩漏率。假設補水流量率為5gpm，則水槽會穩定在何水位？
A. 38.7 feet
B. 25.0 feet
C. 10.4 feet
D. 0.0 feet

答案： C

科目/題號：293006/12 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B5942 (P5943)

A vented water storage tank contains 64 feet of water at 70°F. A cracked weld at the bottom of the tank results in a leak rate of 12 gpm. At what water level will the leak rate be 3 gpm?
A. 48 feet
B. 32 feet
C. 16 feet
D. 4 feet
ANSWER: D.

一個排氣儲水槽內有70°F，64 feet高的水，在水槽底部有一銲道裂縫造成12gpm的洩漏率。在何水位時其洩漏率會減為3gpm？
A. 48 feet
B. 32 feet
C. 16 feet
D. 4 feet

答案： D

科目/題號：293006/13 (2016新增)
知能類：K1.29 [2.6/2.7]
序號：B6142 (P6143)

A plant shutdown will be performed because of leakage from the main condenser cooling water system into the main condenser via a tube leak.
Given the following initial conditions:
- Main condenser pressure is 1.7 psia.
- Atmospheric pressure is 14.7 psia
- Main condenser cooling water pressure at the location of the tube leak is 18 psig.
- Cooling water leak rate into the main condenser is 80 gpm.

If the main condenser is brought to atmospheric pressure, with no changes to the main condenser cooling water system parameters, what will be the approximate rate of cooling water leakage into the main condenser?
A. 36 gpm
B. 52 gpm
C. 61 gpm
D. 72 gpm
ANSWER: C.

因主冷凝器冷凝管洩漏造成冷卻水進入主冷凝器，電廠將執行停機。若已知下面的初始條件：
- 主冷凝器壓力1.7 psia.
- 大氣壓力14.7 psia.
- 在管束洩漏處的主冷凝器冷卻水壓力為18 psig
- 冷卻水洩漏到主冷凝器的洩漏率為80 gpm

如果主冷凝器壓力上升到大氣壓力，在不改變主冷凝器冷卻水系統的參數下，冷卻水洩漏到主冷凝器的流量率約為多少？
A. 36 gpm
B. 52 gpm
C. 61 gpm
D. 72 gpm

答案： C

科目/題號：293006/14 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B6542 (P6543)

An ideal positive displacement pump is operating in an open system with the following initial parameters:

Suction pressure = 10 psig
Discharge pressure = 25 psig
Flow rate = 100 gpm

If the pump discharge pressure increases to 40 psig, the pump flow rate will...

A. remain constant.
B. decrease in direct proportion to the change in pump differential pressure.
C. decrease in direct proportion to the square of the change in pump differential pressure.
D. decrease in direct proportion to the square root of the change in pump differential pressure.

ANSWER: A.

一台理想的正排量泵運轉於一開放系統中，初始參數如下：

進口壓力= 10 psig
出口壓力= 25psig
流量率= 100 gpm

如果泵的出口壓力升高到40psig，則泵的流量率將會是多少？

A.保持固定
B.依泵壓差變化成正比減少
C.依泵壓差變化的平方成正比減少
D.依泵壓差變化的平方根成正比減少

答案： A

科目/題號：293006/15 (2016新增)
知能類：K1.29 [2.6/2.7]
序號：B6742 (P6743)

A centrifugal pump is operating at a constant speed in a closed system with the following initial parameters:

Suction pressure = 10 psig
Discharge pressure = 25 psig
Pump flow rate = 500 gpm

If the pump discharge flow control valve is throttled such that the pump discharge pressure increases to 40 psig, the change in pump flow rate will be...

A. directly proportional to the square of the change in pump differential pressure.
B. directly proportional to the square root of the change in pump differential pressure.
C. inversely proportional to the square root of the change in pump differential pressure.
D. .impossible to determine from the provided information

ANSWER: D.

一定速離心泵運轉於一封閉系統中，初始參數如下：

進口壓力= 10 psig
出口壓力= 25 psig
泵流量率=500 gpm

如果泵的出口流量受控制閥節流，使得泵的出口壓力升高到40 psig，則泵流量率的變化將會是…？

A.與泵壓差變化的平方成正比
B.與泵壓差變化的平方根成正比
C.與泵壓差變化的平方根成反比
D.無法從所提供的資訊來決定

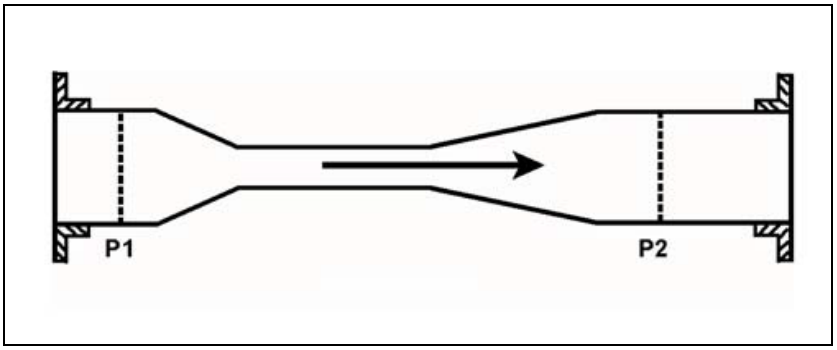
答案： D

科目/題號：293006/16 (2016新增)
知能類：K1.29 [2.6/2.7]
序號：B6842 (P6843)

Refer to the drawing of a venturi in a steam line (see figure below). The venturi inlet and outlet pipe diameters at P1 and P2 are equal.
Currently, steam is flowing through the venturi, reaching sonic velocity in the throat of the venturi. If the steam inlet pressure (P1) remains constant while the downstream pressure (P2) decreases, the mass flow rate of the steam will _____; and the velocity of the steam at the venturi outlet will _____.
A. increase; increase
B. increase; remain the same
C. remain the same; increase
D. remain the same; remain the same
ANSWER: C.

參考蒸汽管路內的文氏管圖(見下圖)。文氏管的進口和出口在 P1 和 P2 的管徑相同。目前蒸汽流經文氏管時，在文氏管喉部的流速達到音速。如果下游壓力(P2)減小時，其蒸汽進口壓力(P1)仍維持不變，則蒸汽的質量流量率將會_____；而文氏管出口處的蒸汽流速將會_____。
A.增加；增加
B.增加；維持不變
C.維持不變；增加
D.維持不變；維持不變

答案： C



科目/題號：293006/17 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B7142

The following are current parameter values for an operating nuclear power plant:
Reactor vessel (RV) pressure = 1,000 psia
Main feed pump (MFP) discharge pressure = 1,220 psia
If RV pressure does not change, which one of the following MFP discharge pressures will increase main feedwater mass flow rate by 10 percent? (Assume MFP inlet temperature remains the same. Also, assume all valves/components that contribute to head loss downstream of the MFP remain in their current configuration.)
A. 1,242 psia
B. 1,266 psia
C. 1,293 psia
D. 1,342 psia
ANSWER: B.

以下是核能電廠目前運轉的參數值：
反應爐槽(RV)壓力=1000 psia
主飼水泵(MFP)出口壓力=1,220 psia
如果反應爐槽的壓力不變，以下何者MFP出口壓力，將增加主飼水10%的質量流量率？(假設MFP進口溫度維持不變。同時假設所有影響MFP下游水頭損失的閥/組件，均維持在目前的配置。)
A. 1,242 psia
B. 1,266 psia
C. 1,293 psia
D. 1,342 psia

答案： B

科目/題號：293006/18 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B7342 (P7342)

An 80 gpm leak to atmosphere has developed from a cooling water system that is operating at 150 psig. Which one of the following will be the approximate leak rate when system pressure has decreased to 100 psig?
A. 70 gpm
B. 65 gpm
C. 53 gpm
D. 47 gpm
ANSWER: B.

一冷卻水系統以150 psig運轉，發生80 gpm洩漏到大氣中。當系統壓力下降至100psig時，下列何者為洩漏率的近似值？
A. 70 gpm
B. 65 gpm
C. 53 gpm
D. 47 gpm

答案： B

科目/題號：293006/19 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B7542 (P7543)

Which one of the following will increase the head loss occurring in an operating cooling water system?

A. Shifting two heat exchangers from parallel to series operation.
B. Increasing the flow rate in the system by throttling open a flow control valve.
C. Replacing a 20 foot section of 10-inch diameter pipe with a 10 foot section of 10-inch diameter pipe.
D. Replacing a 20 foot section of 10-inch diameter pipe with a 20 foot section of 12-inch diameter pipe.

ANSWER: A.

下面何者將會增加冷卻水系統運轉中的水頭損失？
A.將兩個並聯的熱交換器更換成串聯運轉
B.節流開啟流量控制閥，以增加系統流量率
C.將20feet長10- inch管徑的管路，更換為10feet長10 -inch管徑的管路
D.將20feet長10- inch管徑的管路，更換為 20feet長12-inch管徑的管路

答案： A

科目/題號：293006/20 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B7660 (P7660)

Which one of the following will decrease the head loss occurring in an operating cooling water system?
A. Shifting two heat exchangers from parallel to series operation.
B. Increasing the flow rate in the system by positioning a flow control valve more open.
C. Replacing a 10 foot length of 10-inch diameter pipe with a 20 foot length of 10-inch diameter pipe.
D. Replacing a 20 foot length of 12-inch diameter pipe with a 20 foot length of 10-inch diameter pipe.
ANSWER: B.

下面何者將會減少冷卻水系統運轉中的水頭損失？
A.將兩個並聯的熱交換器更換成串聯運轉
B.節流開啟流量控制閥，以增加系統流量率
C.將10feet長10-inch管徑的管路，更換為20feet長10-inch管徑的管路
D.將20feet長12-inch管徑的管路，更換為20feet長10-inch管徑的管路

答案： B

科目/題號：293006/21 (2016 新增)
知能類：K1.29 [2.6/2.7]
序號：B7669 (P7669)

Refer to the drawing of a main water header that splits into two parallel headers (see figure below).
Header A has a 2-inch diameter and header B has a 4-inch diameter. The velocity of the water in both headers is the same.
If the main water header has a flow rate of 500 gpm, what is the approximate flow rate in each of the parallel headers?

	Header A (gpm)	Header B (gpm)
A.	100	400
B.	125	375
C.	167	333
D.	200	300

ANSWER: A.

參考主水集管分成兩個平行的集管圖(見下圖)。集管A管徑為2-inch且集管B管徑為4-inch，兩個集管內水的流速相同。
如果主集管的流量率是500gpm，則每個平行集管的流量率各約為多少？

	集管A (gpm)	集管B (gpm)
A.	100	400
B.	125	375
C.	167	333
D.	200	300

答案： A